

### Canadian Society of Plastic Surgeons Société Canadienne des Chirugiens Plasticiens

Abstracts presented at the  
66th Annual Meeting / 66<sup>e</sup> Réunion annuelle  
June 5–9, 2012, Toronto, Ontario

**Dr Patricia Bortoluzzi:** President / Présidente

**Dr Douglas Ross:** Vice-President / Vice-Président, Chair, Scientific Program / Président, Programme scientifique

**Dimitri Anastakis:** Chair, Local Organizing Committee / Président, Intendance générale

#### EYE-OPENER SESSION

##### 01A

##### MY FACELIFT JOURNEY – THEN AND NOW

**I Carlsen**

The presenter will discuss the evolution of his facelift practice. Fit the operation to the patient is the basic premise.

The concept of dealing with the deep layered support will be discussed and representative results will be shown.

Unsatisfactory results and complications will be addressed. Helpful techniques learned from performing almost 5000 facelifts will be shown.

##### Learning Objectives:

- The presenter will review facial rejuvenation techniques as they have evolved over the past 40 years.
- Participants will be able to evaluate scar placement, compare the various techniques to fit the operation to the patient and understand the management of complications.

##### 01

##### MEASURING QUALITY OF LIFE IN FACIAL AESTHETIC PATIENTS: FIELD-TESTING OF A NEW MODULAR SYSTEM (THE FACE-Q)

**A Scott, S Cano, A Klassen, R Warren, N VanLaeken, A Pusic**

**PURPOSE:** In aesthetic surgery, the assessment of patient-reported outcomes (PRO) is especially pertinent to clinicians as patient satisfaction and quality of life are the predominant considerations determining success. In order to measure the impact of these procedures, well-developed and validated questionnaires are needed. The purpose of this study was to develop a new PRO measure to evaluate patient satisfaction and quality of life following facial cosmetic procedures. The main scale: 'Satisfaction with face overall' will be presented.

**METHOD:** Field-testing was performed at 3 centers. Preoperative patients were >18 years and scheduled to undergo a facial cosmetic procedure. Postoperative patients had undergone a facial cosmetic procedure within 5 years. Patients received a questionnaire with standard incentives and reminders. Rasch analysis was used for item reduction and scale development (RUMM2030<sup>®</sup>), each scale and item were examined according to 7 measurement criteria (clinical meaning, thresholds for item response options, item fit, item locations, DIF, standardized residuals, person separation index).

**RESULTS:** 344 facial cosmetic patients (preoperative n=79, postoperative n=265) participated. Scales were constructed for each area defined as important to patients by the qualitative data. This was achieved by choosing sets of items hypothesized to constitute a scale, analyzing the data against measurement criteria and making decisions on item retention. The scale fulfilled Rasch and traditional psychometric criteria (including Person Separation index 0.94; Cronbach's alpha 0.95).

**CONCLUSION:** The FACE-Q is a new PRO measure that will provide information about the impact and effectiveness of facial aesthetic procedures from the patients' perspective. It is conceptually grounded in patient perceptions and fulfills criteria for rigorous measurement. It will support multi-center studies, while also being clinically useful.

##### Learning Objectives:

- Participants will be able to describe the psychometric criteria necessary for rating scale development and construction.
- Participants will have a better understanding of the role PRO data can have in aesthetic surgery.

##### 02

##### TECHNICAL CONSIDERATIONS IN SECONDARY RECONSTRUCTIVE RHINOPLASTY

**J Fialkov**

Reconstructive rhinoplasty for traumatic, iatrogenic or congenital deformities of the nose can be technically challenging. Surgeons undertaking these procedures require an armamentarium of techniques to address particular deformities such as short nose, saddle nose and cleft nasal deformity. Caveats, lessons learned, soft tissue considerations and grafting techniques including spreader, septal extension, dorsal, rim and batten grafts will be discussed using intra-operative photographs and based on a twelve year clinical experience treating patients with these deformities. In addition, long term results will be shown to represent surgical outcomes and limitations using these techniques.

##### Learning Objectives:

**After this presentation, audience participants should:**

- be able to identify and list specific conditions and deformities associated with secondary reconstructive rhinoplasty.
- be able to identify the technical challenges faced in secondary reconstructive rhinoplasty.
- be able to identify specific technical manoeuvres in secondary reconstructive rhinoplasty and understand how they are applied to particular nasal deformities.

##### 03

##### COMPLICATIONS IN BROW LIFT TECHNIQUES: A SYSTEMATIC REVIEW

**S Byun, I Mukovozov, F Farrokhyar, A Thoma**

**PURPOSE:** The purpose of this study is to systematically review the literature, to determine the complication rates for a variety of techniques in surgical brow elevation.

**METHODS:** The databases: MEDLINE, EMBASE, CINAHL, LILACS, Web of Science, Cochrane Libraries, controlled-trials.com and clinicaltrials.gov, were searched using the terms: "Brow" OR "Forehead", AND "Surgery". From 7920 articles, after deleting duplicates and reviewing abstracts and full-texts by two independent assessors, 80 case-series reporting complications on endoscopic or open brow lift techniques were included. Assuming between-study heterogeneity due to the limitations and biases inherent to case-series, a random effects model (DerSimonian-Laird method) was used for calculation of weighted proportions (StatsDirect software). Weighted proportions with 95% confidence intervals were reported.

**RESULTS:** Regardless of the approach, both open and endoscopic procedures are associated with a range of complications. Scar revision and paresthesia are the most commonly reported across techniques. Anterior hairline incision with subcutaneous dissection reports alopecia (8.5%), paresthesia (5.4%), scar revision (2.1%) and skin necrosis

(1.8%). Coronal incision with subperiosteal dissection is associated with nerve injury (6.4%), scar revision (2.5%) and hematoma (1.0%). Endoscopic techniques with subperiosteal dissection have the highest number of complications overall, with asymmetry (3.6%), lagophthalmos (2.7%) and recurrence (2.4%) occurring amongst other complications.

**CONCLUSIONS:** The literature on brow elevation demonstrates that complication rates vary depending on incision site and plane of dissection. The findings should be interpreted with caution due to the limitations inherent to case-series. A well-designed comparative study is needed to evaluate the complications of surgical brow lift techniques.

**Learning Objectives:**

**Learners will:**

- become aware of the various types of cosmetic brow lift techniques;
- be able to identify the complication rates in cosmetic brow lift techniques;
- be in position to inform patients of these complications.

04

## CANADIAN EXPERT PRESENTATION

### FILLERS AND FAT IN AESTHETIC SURGERY – IS THERE ANYTHING NEW?

**T Born**

The use of fillers and fat for facial and body contouring are an essential component of an Aesthetic and Reconstructive Practice.

The safe use and excellent results requires precision, a thorough understanding of the products used and the possible risks.

The goals of the patient and the plan for their treatment over the long term should be considered for good patient retention and practice building.

**Learning Objectives:**

- Safety – 3 points to consider
- Which fillers, where?
- Basic techniques of fat grafting

05

### THE BODY-Q: A NEW PATIENT-REPORTED OUTCOME (PRO) MEASURE FOR BODY CONTOURING PATIENTS

**A Price, A Pusic, S Cano, N Van Laeken, J Johnson, A Klassen**

**PURPOSE:** Body contouring is a growing area of plastic surgery in part due to the increasing numbers of patients with massive weight loss following bariatric surgery. Body contouring following bariatric surgery can improve a patient's body image and quality of life (QOL). The aim of this study was to develop a new PRO measure for the unique outcomes of bariatric and body contouring patients. Phase I item generation of BODY-Q development will be presented.

**METHODS:** In Phase I, a conceptual framework and pool of items is generated to ensure essential areas are captured by the PRO measure. We conducted a systematic literature review and interviews with 59 patients at different stages of bariatric and body contouring surgery from 5 centers in the US and Canada. Patient interviews were audio-recorded, transcribed, coded line-by-line, and analyzed thematically to identify concepts and domains of importance to this patient group. We used this information to develop a framework and questionnaire items to measure outcomes deemed important to patients.

**RESULTS:** Issues of importance to bariatric and body contouring patients were categorized into the following 7 concepts: (1) Satisfaction with appearance; (2) Physical, (3) Sexual, (4) Psychological and (5) Social well-being; (6) Satisfaction with care and (7) Recovery. These concepts formed the organizational structure for the preliminary questionnaire, under which preliminary scales were grouped.

**CONCLUSIONS:** It is imperative that the growing field of bariatric surgery and body contouring be guided by high-level evidence. Once completed, the BODY-Q will provide the data necessary to lead an informed outcomes discussion, thus advance surgical techniques, evidence-based practice and patient advocacy.

**Learning Objectives:**

- After this presentation, the learner will be able to describe Phase I PRO measure development.
- After this presentation, the learner will be able to describe Phase I development of BODY-Q.

06

### BREAST EXPANDER-IMPLANT CAPSULES: OBSERVATION AND ANALYSIS TECHNOLOGIES IN SCANNING ELECTRON MICROSCOPY

**JO Tétreault-Paquin, L Paek, S St-Jacques, M Nelea, A Danino**

**PURPOSE:** Scanning electron microscopy (SEM) is a powerful analytical tool functioning under the principle of interactions between electrons and substances. Previous studies have employed SEM to characterize relief and biofilm in breast implant capsules. An update of the latest technologies in SEM and their applications to the study of breast periprosthetic capsules will be presented. Principal study parameters derived from such recent technological advancements will equally be discussed.

**METHODS:** Our pilot study group prospectively included 10 patients for a total of 12 breast expanders. Twelve 1 cm<sup>2</sup> periprosthetic capsule specimens were sampled during expander to permanent implant exchange. All samples were analyzed under SEM using both traditional High Vacuum (HiVac) and newer Environmental (ESEM) modes. Energy dispersive X-ray (EDX) studies were conducted in combination with SEM. Observations were charted in order to tally and objectivise the principal microscopic findings.

**RESULTS:** HiVac mode was found to be superior to ESEM, providing better capsule definition and three-dimensional architectural visualization. Furthermore, the EDX microanalysis allows detection of atypical chemical elements (silicium, calcium, phosphorus) and compound (talc, apatite) present in the capsular tissue. The use of SEM technologies permits a better appreciation of the implant/capsule interface; the identification of a multitude of cells, including echinocytes (red blood cells with a modified cellular membrane); and the visualization of bacteriological biofilm.

**CONCLUSIONS:** SEM analyses provide an important modality for further understanding of periprosthetic capsule formation and evolution. Furthermore, they may provide the foundation for clinical correlation to recognized pathologies related to such implant materials. Our analysis methods may be applicable to all forms of explanted prosthetic devices.

**Learning Objectives:**

- Participants will be able to appreciate recent developments in scanning electron microscopy technology and their applications to research in plastic surgery
- Participants will gain a better understanding of breast periprosthetic capsule characteristics and formation

07

### TRANSAXILLARY SUBPECTORAL BREAST AUGMENTATION WITH SALINE IMPLANTS: A REVIEW OF 474 CONSECUTIVE PATIENTS

**P Carter, S Aflaki, A Khan, J Ahmad, F Lista**

**GOALS/PURPOSE:** Transaxillary subpectoral augmentation mammoplasty (TSAM) is not widely performed due to criticisms of lack of pocket visualization, blunt dissection, risk of bleeding and subsequent risk of postoperative complications. In the early 1990s, endoscopic assisted TSAM was developed to address these perceived shortcomings, with improvements in capsular contracture and malposition reoperation rates. This study investigates the outcomes of TSAM with smooth, round, saline implants in a consecutive series by a single surgeon.

**METHODS/TECHNIQUE:** A retrospective chart review was performed identifying all patients who underwent TSAM with saline implants from 2009 to 2010. Patient demographics, clinical characteristics, all complications and reoperations were examined.

**RESULTS/COMPLICATIONS:** Between 2009 and 2010, 474 consecutive patients were identified. The average patient age at the time of surgery was 32 years old and the average body mass index was 24.8 kg/m<sup>2</sup>. The average implant volume was 365 cc (range 200 to 650 cc). 6.1% of patients experienced a complication and 2.7% required reoperation. The risk of a complication increased with increasing implant size ( $P(x^2)=0.0036$ ). The most frequent indication for reoperation was capsular contracture (1.8% of patients). 0.6% patients developed a hematoma requiring evacuation. 0.8% patients had malposition of an implant, and 0.4% required reoperation to correct this. The implant deflation rate was 0.2%.

**CONCLUSION:** Given the benefit of low complications rates and an inconspicuous scar, this is a worthwhile option to explore when counseling for breast augmentation.

#### Learning Objectives:

- Participants will appreciate the option of non-endoscopic transaxillary subpectoral breast augmentation in terms of indications, technique, pros and cons
- Participants will describe the range of complications associated with this technique
- Participants will have tips and pearls on how to optimize outcomes

## 08

### OUTCOME ANALYSIS OF AN ACADEMIC TRAINING PROGRAM AESTHETIC CLINIC: A FIVE-YEAR REVIEW

**I Alrasheed, T Bell, A Freiberg**

**INTRODUCTION:** Aesthetic surgery is an important part of the core curriculum of plastic surgery. However, the problems in teaching aesthetic surgery, as opposed to other types of reconstructive surgical procedures, are numerous and have been well described in the literature. To address these problems, an academic training program (ATP) aesthetic clinic was founded in 1986 in one of the University of Toronto's teaching hospitals. This program has evolved over the last 23 years. The ATP clinic is run by a senior plastic surgery resident as well as a fellow under the supervision of an attending plastic surgeon. **AIM:** 5 years retrospective outcome analysis of the University of Toronto's Academic training program (ATP) aesthetic clinic.

**METHODS:** An Institutional Review Board approved retrospective chart review of all patients who were seen at the UofT ATP aesthetic clinic over a 5-year span from 2007 to 2012 was done. All procedures were viewed as independent events. The cosmetic procedures were subdivided into surgical and non-surgical. The non-surgical procedures mainly included injectables and fillers performed by senior residents and/or fellows. All procedures were evaluated for adverse events and revisions. Adverse events were divided into major and minor complications.

**RESULTS:** A total of 305 charts were reviewed. Sixteen charts were excluded because of inadequate records. A total of 289 patients underwent 219 cosmetic procedures in a 5-year span. 131 surgical procedures were performed. There were no major complications for any of the procedures. Overall minor complication rate was 14% and the revision rate was 10%. Because many cosmetic patients desire secondary touch up procedures, a rate of 10% in this cohort is neither unexpected nor unacceptable.

**CONCLUSION:** The University of Toronto's Academic Training program aesthetic clinic provides senior residents and fellows a unique exposure to aesthetic surgery with the opportunity to gain "hands-on" operative experience under supervision, while providing a safe and expectedly desirable result for their patients.

#### Learning Objectives:

- At the end of this lecture, the participant will be able to recognize the value of having an aesthetic teaching clinic run by senior plastic surgery residents and fellows during their training that is able to deliver safe and reasonable aesthetic outcomes.

## 09

### GROWTH FACTOR EXPRESSION IN THE MURINE SPINAL CORD FOLLOWING SCIATIC NERVE LACERATION

**AA Roy, AM Pion, E Beaumont, J Lin**

**PURPOSE:** The molecular mechanisms involved in guiding peripheral nerve regeneration have not been fully elucidated. Growth factors such as Hepatocyte Growth Factor (HGF), c-met, Ciliary Neurotrophic Factor (CNTF) and Cardiotrophin-like Cytokine/Cytokine-like Factor 1 (CLC/CLF1) have been shown to be potent survival factors for motor neurons in embryonic development. We hypothesize that these developmentally important factors for nerve tissue may also be important in guiding adult nerve regeneration following injury. However, their role in peripheral nerve regeneration has not yet been studied.

**METHODS:** Twenty-four adult C57BL/6 mice were divided into 2 groups. The first group (n=12) underwent complete sciatic nerve laceration, while the second group (n=12) were subjected to sham surgery only. Spinal cords were harvested at 1, 3, 7 and 14 days post-axotomy. In situ hybridization was used to determine the expression of candidate growth factors and their receptors (HGF, c-met, CNTF, CLC/CLF) at each timepoint and compared to spinal cords from mice that did not undergo surgery. BDNF and trkB have previously been shown to be upregulated in spinal motor neurons following axotomy, and were used as positive controls.

**RESULTS AND CONCLUSIONS:** Our preliminary results show that trkB expression is upregulated in mouse spinal cord following sciatic nerve axotomy. The in situ hybridization experiments for the other growth factors is ongoing and results will be presented. The identification of neurotrophic factors involved in nerve regeneration will provide crucial information on underlying nerve repair mechanisms, which may one day lead to new therapeutic interventions targeting these factors to improve patients' neurological recovery.

#### Learning Objectives:

- At the end of this presentation, the participant will be able to identify candidate growth factors in peripheral nerve regeneration following nerve laceration and understand their expression patterns in mouse spinal cords following axotomy.

## 10

### A NOVEL TECHNIQUE FOR LOCALIZATION OF THE CUTANEOUS PERFORATORS OF THE LEG

**A Martin, MB Bissell, S Morris**

**PURPOSE:** Lower leg reconstruction is challenging, requiring an accurate knowledge of the cutaneous vascular anatomy in lower limb skin perforator flap donor site regions. Results of past anatomical studies are not useful in the design of local perforator-based flaps. The purpose of this study is to comprehensively document the three-dimensional anatomy of each cutaneous perforator vessel of the lower limb in human cadavers.

**METHOD:** Cadavers underwent whole body lead oxide injection. CT angiography and 3-D reconstructions of the lower limb using MIMICS software were completed for 5 lead oxide-injected cadavers. Cutaneous perforators arising from the anterior tibial artery, the peroneal artery and the posterior tibial artery were identified. Perforator diameter, course and location relative to leg length were subject to cluster analysis to evaluate the consistency of perforator locations across individuals when standardized for leg length.

**RESULTS:** The anterior tibial artery had the greatest number of perforator vessels ( $19 \pm 2$ ), which clustered into three groups centered at:  $0.83\% \pm 0.06$  (percent of tibial height  $\pm$  95% confidence interval),  $0.59\% \pm 0.07$ , and  $0.28\% \pm 0.09$ . Peroneal artery perforators ( $10.6 \pm 0.5$ ) were clustered in two groups centered at  $0.61\% \pm 0.09$  and  $0.27\% \pm 0.11$ . The posterior tibial artery perforators could also be divided into two groups, however a wider confidence interval in the two groups suggests that perforators arising from this vessel are more evenly spaced.

**CONCLUSIONS:** Statistical analysis demonstrated that the major perforator vessels of the tibial trunk are conserved across individuals,



and can be reliably dissected using the cluster's 95% confidence interval. Results of this study will allow for better planning of local flaps without the need for preoperative CT scanning.

**Learning Objectives:**

- Describe the anatomical distribution of the vessels of the tibial trunk.
- Understand cluster analysis as a method for characterizing perforator vessel distribution.
- Demonstrate the benefits of CT angiograms in clinical and research use

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## CANADIAN EXPERT PRESENTATION

### DUPUYTREN'S DISEASE: KNIFE OR NEEDLE?

**M Morhart**

**Learning Objectives:**

- To review the pathophysiology of Dupuytren's disease
- To understand and become familiar with the needle aponeurotomy procedure

12

### HAND OUTCOMES IN OPERATIVE MANAGEMENT OF COMPLETE OBSTETRICAL BRACHIAL PLEXUS Palsy

**I Harvey, E Ho, H Clarke**

A retrospective review of prospectively collected data was performed using the Hospital for Sick Children Brachial Plexus Database. Of 1432 patients assessed with OBPP between 1988 and 2010, 54 patients underwent primary nerve reconstruction for complete palsy. Data points of 4 and 8 years post operatively were used. Results are reported as Active Movement Scale (AMS) scores and conversion is made to Raimondi hand scores using a comparison table we have constructed. Results for function are reported using the Brachial Plexus Outcome Measure (BPOM) scale.

After exclusion criteria 38 patients had sufficient follow up of a minimum of 4 years. AMS scores are reported for the 8 recorded movements that are directly related to hand function. The following percentage of patients achieved an AMS score of 3 or greater for Pronation 30%, Supination 67.5%, Wrist flexion 80%, Wrist extension 30%, Finger Flexion 92.5%, Finger Extension 42.5%, Thumb Flexion 82.5%, Thumb Extension 10%. Using a conversion table from AMS Scores into Raimondi Scores, the following percentage of patients had Raimondi scores 1 – 0%, 2a – 27.5% 2b – 20%, 3 – 37.5%, 4 – 5%, 5 – 10%. BPOM scores at 8 years post surgery indicate over 90% of patients scoring 3 or greater (indicating a functionally useful hand) for each of the 3 tasks directly related to hand function.

Functionally useful hands are a realistic goal in primary reconstruction of obstetrical brachial plexus palsy. Direct comparison between AMS and Raimondi scores is difficult due to literal translation of descriptive words in the Raimondi scale into Numerical values used on the AMS and vice versa. Perhaps more importantly than these scores, over 90% of patients score 3 or greater on the BPOM indicating the vast majority of patients undergoing reconstruction for complete OBPP are able to achieve useful function from their reconstructed hand.

**Learning Objectives:**

- Participants will be able to identify the difficulties associated with evaluating hand function in infants.
- Participants will be able to describe the outcomes which are possible following reconstruction of hand function in obstetrical brachial plexus palsy.
- Participants will be able to identify the most important target in reconstruction of obstetrical brachial plexus palsy.

13

### MEASURING THE UTILITY OF HAND COMPOSITE TISSUE ALLOTRANSPLANTATION IN HAND AMPUTEE PATIENTS

**N Alolabi, J Chuback, S Grad, A Thoma**

**PURPOSE:** Composite tissue allotransplantation of the hand has been shown to be a potential reconstructive option for a hand

amputation, restoring sensation and intrinsic muscle function. Whether or not the functional, psychological, and cosmetic benefits are worth the risks associated with the required lifelong immunosuppression is still not known. The purpose of the present investigation is to use decision analysis modelling to ascertain the expected quality-adjusted life years (QALYs) gained with hand transplantation (versus remaining with a hand amputation) in an effort to assist surgeons with the decision of whether to adopt this procedure.

**METHOD:** Utilities were obtained from 30 participants from the general public and 9 hand amputee patients, using the standard gamble and time-trade off measures. The utilities were then translated into QALYs, and the expected QALYs gained with transplantation were computed.

**RESULTS:** Hand amputation was associated with a mean of 38.6 and 34.1 QALYs, as measured from the general public and hand amputees, respectively. Hand allotransplantation imparted an expected gain in QALYs of 0.9 in the general public and 8.7 in hand amputees.

**CONCLUSIONS:** Criticism of hand composite tissue allotransplantation is centered on inducing a state of immunocompromise in a physically healthy individual for a non-life-saving procedure. However, the potential benefits of transplantation must be carefully weighed against this. As demonstrated by a gain of 8.7 QALYs, amputee patients' valuation of quality of life is greater for hand transplantation with its side effects of immunosuppression than for a state of uncompromised physical health with a hand amputation.

**Learning Objectives:**

*This study presents an empiric basis for assessing patient's valuation of risk versus benefit of hand transplantation to aid in participants' understanding and decision of whether the procedure should be adopted.*

14

### OUTCOMES OF SENSORY NERVE REPAIR: SUB-GROUP ANALYSIS FROM A MULTICENTER STUDY ON PROCESSED NERVE ALLOGRAFTS

**B Safa, G Buncke, B Parrett, B Rinker, J Chao, D Brooks**

**PURPOSE:** Several treatment alternatives to the classic nerve autograft are available. However, limited clinical data is available on expected safety and outcomes. We have undertaken a multicenter study exploring the safety and efficacy of processed nerve allografts (Avance® Nerve Graft, AxoGen Inc.) with a goal of providing a better understanding of their role in nerve reconstruction.

**METHODS:** Twelve sites with 25 surgeons contributed a total of 132 nerve injuries over a two year period. IRB approval was obtained and standardized data reports were used to collect utilization and safety follow-up data. Follow-up evaluations included the adverse experiences, MRCC scale, 2-point discrimination (2-PD), Semmes-Weinstein Monofilaments (SWMF), and qualitative questionnaires. Demographic and covariate analysis was performed to further characterize the sub-groups and outcomes were assessed across the entire sub-population.

**RESULTS:** The sub-group analysis for sensory nerves included 49 nerve repairs with sufficient recovery time for outcomes assessments. The mean  $\pm$  SD (minimum, maximum) age was 41.4 $\pm$ 14 (18-70). The mean gap was 18.8 $\pm$ 8 (5-40) mm and average time-to-repair was 182 $\pm$ 323 (0-1460) days. Meaningful recovery, defined as S3-S4 on the MRCC scale, was demonstrated in 89% of the sensory nerve repairs reporting quantitative data. Mean static 2-PD, reported was 8 $\pm$ 2.9 mm (4-15). Average SWMF results were return to diminished light touch 3.61 (2.83-6.65). No adverse experiences were reported.

**CONCLUSION:** Processed nerve allografts provided reliable safety and efficacy outcomes. Sub-group analysis of quantitative endpoints found meaningful recovery in 89% of sensory repairs. Historical control from available literature found functional outcome to compare favourably to nerve autograft and exceed those for conduits. Continuation of this study will provide additional clinical evidence on the expanding role of processed nerve allografts.

# Learning Objectives:

- Provide an understanding and insight for the role of processed nerve allografts for nerve reconstruction.

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## FUNCTIONAL CONTRIBUTION OF T1 TO THE BRACHIAL PLEXUS IN INFANTS

**A Fattah, C Curtis, A Agur, H Clarke**

**PURPOSE:** Classical accounts of the T1 nerve root limit its activity to the hand and are based on anatomical dissection, clinical examination of injuries and electrical stimulation. Observations in our multidisciplinary brachial plexus clinic suggest that a greater range of movements may be attributed to this root than previously reported. This study aimed to determine which upper limb movements T1 could produce in isolation.

**METHODS:** 40 patients presenting with obstetric brachial plexus palsy who underwent resection and reconstruction of all roots with the exception of T1 were evaluated in the early postoperative period when no other nerve supply to the limb was present. Movements were assessed using the active movement scale and demonstrated considerable variability.

**RESULTS:** All movements of the upper limb were observed in this cohort with the exception of external rotation of the shoulder and elbow flexion. By contrast to previous reports, this study isolated the physiological activity of T1 and analysed the functional contribution of this root to arm movement.

**CONCLUSIONS:** We show a greater than recognised contribution of T1 to the upper limb in infants.

# Learning Objective:

- Participants will learn that the 'waiter's tip' sign can be reproduced by the action of T1 alone and thus the diagnostic specificity of this posture in infants is less discrete than originally described.

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## CANADIAN EXPERT PRESENTATION

### SIMULATION IN PLASTIC SURGERY EDUCATION

**D Anastakis**

# Learning Objectives:

Following this lecture, participants will be able to:

- define simulation in health professions education
- list the types/modalities of simulation available to the educator
- understand why simulation is playing a greater role in postgraduate education and continuing professional development
- describe future trends in health professions simulation

TP01

## TIPS AND PEARLS

### REMOTE MONITORING OF QUALITY OF RECOVERY OF POST OPERATIVE PATIENTS AT HOME USING MOBILE DEVICE (SMART PHONE)®

**J Sample, S Sharpe**

We have developed a cell APP that monitors patient's quality of recovery at home. The device is based on smart phone technology. The APP is composed of a questionnaire, the QoR 9 which is a validated quality of recovery instrument and a telemetry platform. The patient's answers are recorded on a touch screen using a ligert scale once a day. The surgeon can remotely view the patient's responses in a dashboard format on a tablet or desktop web portal.

TP02

## TIPS AND PEARLS

### WHEN, HOW, AND WHY PERFORM A BIPEDICLED FREE DIEP FLAP FOR BREAST RECONSTRUCTION

**T Zhong, S Hofer**

Indications: For patients who desire to use abdominal tissue for an unilateral breast reconstruction in whom a standard free DIEP or

TRAM would not provide sufficient volume.

Technique: The technique for flap harvest, recipient vessel selection, and breast mound shaping are discussed.

17

### A NOVEL METHOD TO ENHANCE SENSORY FEEDBACK AND IMPROVE FUNCTION OF MYOELECTRIC PROSTHESES AFTER UPPER LIMB AMPUTATION

**M Morhart, J Olson, J Hebert, M Chan, R Stiegelmar**

**PURPOSE:** To investigate the feasibility of a new surgical procedure for transhumeral amputees that would allow regenerating sensory nerve fibers from the median and ulnar nerves to reach the target receptors in specific areas of reinnervated skin for digital sensory feedback during functional prosthetic tasks.

**METHODS:** Cadaveric dissections were performed to examine the feasibility of isolating the cutaneous nerves in the upper arm close to the entry points of the cutaneous nerves to specific areas in the skin. This information was then used in the pre-surgical planning for a targeted motor and sensory reinnervation procedure in a transhumeral amputee. Somatosensory evoked potentials were recorded intra-operatively to determine the appropriate donor sensory nerves. Physiological measures and functional outcomes were obtained post-operatively to determine whether this novel procedure could be successful in providing meaningful sensory feedback to the subject while performing a functional task.

**RESULTS:** Cadaveric dissection provided potential sensory nerves with their associated skin territories. The size of the denervated cutaneous territories were mapped 6 weeks following surgery in our transhumeral patient and baseline results on pressure sensibility, 2 point discrimination, hot, cold and pain thresholds were recorded. The patient started experiencing hand sensations at 2 months following surgery, then at 4 months we performed detailed sensory mapping including pressure sensation, hot, cold and pain thresholds of the hand and digits.

**CONCLUSIONS:** We show that targeted sensory reinnervation is possible and that this procedure will greatly improve the ability of amputees to use the myoelectric prostheses naturally without direct visual input or aid.

# Learning Objective:

- To understand the novel approach of using both targeted muscle and sensory innervation in amputees using myoelectric prosthetics and the dramatic implications in their functional daily use.

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### 3D REMODELING TO DETERMINE BEST FIT FOR HEMI-HAMATE AUTOGRAFT ARTHROPLASTY

**J Shih, D Podolsky, P Binhammer**

**PURPOSE:** To determine best fit of the hamate osteochondral graft for a palmar base of middle phalanx articular fracture model, hemi-hamate arthroplasty using 3D remodeling.

**METHOD:** Using a 3D laser scanner and computer software, ten right hand cadaver proximal middle phalanx and distal hamate articular surfaces were superimposed to simulate a 50% comminuted 2nd digit middle phalanx palmar lip fracture. The specimens were aligned by landmarks (Landmark Method) and by free-hand (Visual Freeform Method). In the lateral viewpoint, the angle of offset, offset distance and distance to convergence was recorded describe the requirements for the graft. Midpoint distance and offset distance of remaining digits were measured for reference value.

**RESULTS:** The mean midpoint distance for the index finger was 2.96±0.41mm. The mean angle of offset was 20.09±7.34° using the Landmark Method, and 14.10±3.41° using the Visual Freeform Method. The mean graft offset distance was prominent by 1.23±1.23mm using the Landmark method, and 1.46±0.73mm using the Visual Freeform Method. The distance to divergence was 3.86±1.11 mm. The Reference Values for the 3rd, 4th and 5th middle phalanges midpoint distances were 3.26 ± 0.27mm, 3.130±0.32mm, and 2.48±0.25mm,

respectively. The offset distances of the 3rd and 5th digits were  $1.24 \pm 1.23$  mm and  $1.08 \pm 0.97$  mm, respectively.

**CONCLUSIONS:** This study provides information about best fit for placement of the autograft for the hemi-hamate arthroplasty procedure. These values provide guidance to surgeons about how the graft should appear when fit into an average defect and ensure that the volar lip geometry of the middle phalanx base is reconstructed.

**Learning Objectives:**

- Participants will gain a better understanding of how the hamate can be best used to reconstruct a proximal middle phalanx fracture.
- Participants will be able to describe how 3D remodeling can be used to create and reconstruct bone defects.

## 19

### HIERARCHICAL SCRATCH COLLAPSE TEST AS A PROVOCATIVE TEST OF THE DOUBLE CRUSH PHENOMENON

**K Boyd, J Barbour, A Yee, S Mackinnon**

**BACKGROUND:** The Scratch Collapse Test (SCT) is a recently described provocative test for diagnosis of peripheral nerve compression. It has been shown to have higher sensitivity and specificity than the Tinel's sign in both cubital tunnel and peroneal nerve compression. Recently, the authors have discovered a method of performing the SCT that allows a stratification of nerve compression, helping to prioritize surgical procedures.

**PURPOSE:** To introduce and demonstrate the hierarchical SCT as a method of provocative testing for the double crush phenomenon.

**METHODS:** The SCT is performed with the patient seated facing the examiner, shoulders relaxed, arms adducted, elbows flexed, wrists and hands neutral. The examiner resists the patient's attempt to externally rotate his shoulders. The examiner then stimulates potential sites of nerve compression with a scratch or light touch, and the attempt to externally rotate is repeated. Where nerve compression exists, the patient will temporarily lose the ability to externally rotate the shoulder and the ipsilateral side will "collapse". Ethyl chloride is a topical cold spray that temporarily numbs the skin. When applied over the site of nerve compression, the patient will no longer collapse at that site. Other sites can then be stimulated and be found to collapse in a hierarchical manner.

**RESULTS:** Sites of compression can be prioritized and the existence of a double crush phenomenon identified. This has impacted surgical decision-making in a number of settings: the decision to decompress a nerve at multiple sites (e.g. cubital tunnel and Guyon's canal), the decision to perform a concomitant nerve transfer (e.g. AIN to ulnar), and prioritizing the order of decompression in multiple affected extremities.

**CONCLUSION:** The hierarchical SCT is a valuable provocative test for nerve compression, and specifically the identification and treatment of a double crush phenomenon.

**Learning Objectives:**

- Participants will be able to use the SCT as a provocative test in nerve injury.

## 20

### MANAGEMENT OF SCAPHOID NONUNION WITH ILIAC CREST BONE GRAFT AND K-WIRE FIXATION

**A Seal, C Yao, M Stevanovic**

**BACKGROUND:** Scaphoid non-union can occur after failed initial acute scaphoid fracture management, or if there is a missed diagnosis at time of initial injury. This can result in significant problems in both the short term, with pain and functional limitations, and in the long term with a predictable pattern of degenerative arthritis in the wrist.

**PURPOSE:** To describe the surgical technique for treatment of scaphoid nonunion with ICBG and K-wire fixation and highlight the keys for success. Evaluate the success rate for healing with this technique compared to other techniques in literature.

**METHODS:** A retrospective review of a single surgeon was performed from 1996-2010. Using specific inclusion and exclusion criteria, 32 patients were identified to be included in the study. The patients demographic information was obtained, as well as, mechanism of injury, location of the fracture and the time from injury to surgery. The outcomes evaluated were achievement of union, time from surgery to union and complication rates. These were then compared to similar outcomes from other techniques in the literature.

**TECHNICAL DETAILS:** The technical details for treatment of scaphoid nonunions with iliac crest bone grafting and K-wire fixation, as well as, the keys to success are highlighted.

**RESULTS:** The mean age of the patients was 23, with 81% being male, and 13% smokers. 44% were found to have proximal pole scaphoid non-unions which is higher than other published series. 32 of 32 patients reviewed in this study went on to achieve bony union.

**CONCLUSIONS:** Scaphoid non-union can be reliably treated with iliac crest bone graft and K-wire fixation. There are several key technical details that are felt to be important to achieve this high union rate.

**Learning Objective:**

- Participants will be able to compare their scaphoid non-union operative techniques and outcomes to the series reviewed in this presentation.

## 21

### ARE THERE FACTORS THAT CONTRIBUTE TO FAILURE OF A ONE DAY LENGTH OF STAY PROTOCOL FOR TRAM FLAP BREAST RECONSTRUCTION?

**A Guttman, A Lanes, M Musgrave**

**PURPOSE:** Autogenous breast reconstruction, including pedicled transverse rectus abdominis myocutaneous (TRAM) flaps, has traditionally been associated with longer lengths of stay in hospital. The purpose of this study was to review our five year experience with a one day length of stay protocol for pedicled TRAM reconstruction to identify factors that might predict successful discharge.

**METHODS:** A retrospective chart review of 69 consecutive cases was performed. We collected demographic data as well as information about cancer stage, timing of surgery, type of surgery, barriers to discharge, medication usage, patient outcomes and disposition. Data was analyzed using t-test and multivariate analysis.

**RESULTS:** Of the cases discharged by 24 hrs, 90% were unilateral TRAMs and 84% were delayed reconstructions. Patients meeting the 24-hour discharge criteria tended to have lower BMIs, fewer comorbidities and unilateral procedures. We observed no significant increase in the number of early complications or readmissions in the cohort meeting the 24 hr discharge compared to the group that stayed greater than 24hrs. After multivariate analysis, comorbidities, timing of reconstruction and bilateral reconstruction remained significant factors identified with an increased length of stay.

**CONCLUSIONS:** A 24-hour discharge protocol for autogenous tissue reconstruction is safe, not associated with an increase in early complications, and feasible in selected patients. Patient factors appear to be the biggest barrier in achieving success.

**Learning Objectives:**

- Participants will become aware of factors that affect LOS in TRAM flap reconstruction.
- Participants will gain knowledge on how to select patients that are likely to have a successful 1-day length of stay.

## 22

### RANDOMIZED CONTROLLED TRIAL COMPARING HEALTH-RELATED QUALITY OF LIFE IN PATIENTS UNDERGOING VERTICAL SCAR VERSUS INFERIOR PEDICLE TECHNIQUES FOR REDUCTION MAMMOPLASTY

**A Thoma, T Ignacy, E Duku, R Patterson, A Dal Cin, C Levis**

**PURPOSE:** To compare health-related quality of life in women undergoing the vertical scar reduction (VSR) or inferior pedicle reduction (IPR) mammoplasty at 1 year post-op.



**METHODS:** 249 patients were randomized to the VSR or IPR immediately before surgery. Patients completed four validated instruments: a utility index, Health Utilities Index (HUI), a generic scale, the SF-36, and two specific scales, the Breast-Related Symptoms Questionnaire (BRSQ) and the Multidimensional Body-Self Relations Questionnaire (MBSRQ), at pre-op (1 week preop) and 1 year post-operatively.

**RESULTS:** No differences in age, BMI or mean weight of tissue were observed. Patients undergoing both techniques gained a statistical and clinically important improvement from baseline to 1 year post-op in the HUI ( $0.81 \pm 0.16$  to  $0.87 \pm 0.19$  [VSR];  $0.79 \pm 0.20$  to  $0.89 \pm 0.14$  [IPR]) and the BRSQ ( $52.3 \pm 24.5$  to  $92.4 \pm 9.4$  [VSR];  $53.7 \pm 24.4$  to  $94.2 \pm 9.8$  [IPR]). There was a statistically significant improvement in patients undergoing both techniques, in the SF-36 physical summary score ( $46.3 \pm 7.9$  to  $51.2 \pm 8$  [VSR];  $47.7 \pm 7.9$  to  $51.2 \pm 8.7$  [IPR]), and the MBSRQ appearance evaluation ( $2.57 \pm 0.70$  to  $3.02 \pm 0.77$  [VSR];  $2.62 \pm 0.72$  to  $3.10 \pm 0.85$  [IPR]), but not the SF-36 mental summary score or MBSRQ appearance orientation.

**CONCLUSIONS:** There was a clinically important improvement in quality of life between baseline and 1 year post-op in the VSR and IPR groups as measured with the HUI and BRSQ. No difference was observed between the change from baseline to 1 year post-op between the VSR and IPR groups.

#### Learning Objectives:

- Participants will gain a better understanding of the methodology used to conduct a randomized controlled trial.
- Participants will be able to identify the three types of health-related quality-of-life questionnaires and their applicability to plastic surgery.
- Participants will learn about patient preferences for the two predominant techniques for breast reduction

## 23

### USE OF THE TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK IN THE ABDOMINAL DONOR SITE FOLLOWING AUTOLOGOUS BREAST RECONSTRUCTION: A PROSPECTIVE COHORT STUDY

A O'Neill, K Wong, H Cheng, M Ohja, S Hofer, T Zhong

**PURPOSE:** The Transversus Abdominis Plane (TAP) block is an anatomically based peripheral nerve block that provides direct blockade of the T6 – L1 intercostal nerves as they pass deep to the internal oblique muscle to the anterior abdominal wall. This study investigates the efficacy of TAP blocks, placed under direct vision, in patients undergoing breast reconstruction with autologous abdominal flaps.

**METHODS:** 45 consecutive patients who underwent free DIEP or MS-TRAM breast reconstruction between June 2010 and March 2011 were included in the prospective cohort. A soft-tip epidural catheter was placed in the TAP, under direct vision, intra-operatively. 10ml of bupivacaine was injected through the catheter immediately post-operatively and repeated at 12-hour intervals until removal of the catheter on the third post-operative day. The control group consisted of 80 consecutive patients who underwent the same procedures without TAP blocks between January 2009 and May 2010. Both groups received a patient-controlled anaesthesia (PCA) system for the first two post-operative days. The primary outcome measure was consumption of parenteral PCA opioids used in the first 48 hours. Secondary outcomes included total consumption of opioids, anti-pruritics, anti-emetics, patient reported pain scores and length of hospital stay.

**RESULTS:** There were no complications associated with the TAP blocks. 48-hour parenteral opioid requirement in the TAP group was  $17.10 \pm 17.23$ mg (morphine equivalents) compared to  $48.44 \pm 39.53$ mg in the control group ( $p < 0.001$ ). Statistical significance was sustained on multivariate analysis for other possible confounding factors

**CONCLUSIONS:** Administration of bupivacaine through the TAP block significantly reduced opiate requirements by 65% compared to the historic control group following breast reconstruction with free DIEP or MS-TRAM flaps.

#### Learning Objectives:

- Demonstrate the technique of TAP block placement.
- Outline the benefits of TAP blocks in autologous breast reconstruction patients.

## 24

### RESISTANCE OF IMPLANTED HUMAN ACELLULAR DERMAL MATRIX TO CAPSULE FORMATION: A PROSPECTIVE CONTROLLED CLINICAL AND HISTOLOGIC COMPARISON

D Koumanis, J Singh, L Glickman, R Simpson

**PURPOSE:** Human acellular dermal matrix (ADM) (Alloderm, LifeCell Corp., Branchburg, N.J.) is often used as a soft tissue filler and as coverage and support for subpectoral tissue expanders inserted for post mastectomy breast reconstruction. Clinical observations indicate that some ADMs may be resistant to fibroblastic response as observed with implanted foreign bodies. Alloderm used as a soft tissue filler has been observed to be without encapsulation or adhesion formation. Therefore we set out to prove our hypothesis that Alloderm is resistant to the fibroblastic response associated with capsule formation and possibly capsular contracture. Techniques in ADM use and how to potentially lower capsular contracture rates are discussed.

**METHOD:** Eighteen female patients who underwent post mastectomy breast reconstruction with tissue expanders and Alloderm were evaluated for clinical and histologic evidence of capsule formation. The tissue expanders were explanted at 2 months and the implant pocket was examined for capsular bands. Photo documentation of contracture bands and Alloderm-capsule interface were obtained. Two groups of biopsy specimens were obtained for histologic analysis. Group 1 – biopsy of contracture bands; Group 2 biopsy of the Alloderm-capsule interface. Histologic analysis was performed using H & E staining, Verhoeff staining, immunohistochemistry and electron microscopy.

**RESULTS:** Alloderm is well integrated into the implant capsule as observed clinically and histologically. Clinically, capsular bands were observed most commonly in superior and medial poles. Histologic analysis revealed population of Alloderm with various inflammatory cells and endothelial cells. The concentration of myofibroblasts was less in Alloderm specimen of capsule as compared to capsular band specimen.

**CONCLUSION:** Alloderm is resistant to the foreign body fibroblastic response as evidenced by decreased concentrations of myofibroblasts in Alloderm versus capsular bands.

#### Learning Objectives:

- The histological difference between soft and contracted capsules
- Methods of reducing capsular contracture in breast reconstruction

## 25

### CANADIAN EXPERT PRESENTATION

#### COMMON FACIAL FRACTURES: NEW DEVELOPMENTS AND TREATMENT UPDATE

J Fialkov

The last decade has seen a shift in philosophy of treatment for common facial fractures. The concepts of "semi-rigid" fixation and auto-adjustment for the treatment of mandible fractures have, for instance, gained wider acceptance amongst practitioners. In addition, newer available technologies and surgical techniques have affected the criteria for operative intervention and have yielded more reliable outcomes in the treatment of orbital and zygomatic fractures.

Current treatment recommendations, surgical indications, and technical considerations for mandibular, zygomatic and orbital fractures will be reviewed with an emphasis on recent developments and innovations.

#### Learning Objectives:

- Participants will be able to identify current recommendations for the surgical treatment of mandibular, zygomatic and orbital fractures.
- Participants will be familiar with the concepts of "auto-adjustment" and "semi-rigid fixation" in the treatment of mandibular fractures.

- Participants will be familiar with the current surgical indications and treatment options for acute isolated orbital fractures.
- Participants will be familiar with current indications and surgical techniques in the treatment of acute isolated zygomatic fractures.

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## A.W. FARMER LECTURE

### CANADA'S LEADING ROLE IN WORLD AFFAIRS

Lieutenant General Roméo Dallaire (retired)

Dallaire shares his insights into Canada's role as a compassionate and self-giving middle power. He speaks of our responsibility to be the leading middle power and to hopefully one day prevent conflict.

Lieutenant-General Roméo Dallaire has, over a 35-year career in the military, combined his exemplary humanitarian vision with the highest ethical and military principles. He has been honoured on numerous occasions for outstanding altruism, professionalism, perseverance, resourcefulness and bravery. General Dallaire is surely well known to CSPS members. As Dr. Patricia Bortoluzzi noted in her brief for this lecture, "We are Canadian, we are physicians, we are fortunate, we can improve this globalized world, we can make a difference, and we should look to our proven leaders to inspire us."

### REVISION OF THE UNSATISFACTORY RESULT IN AESTHETIC BREAST SURGERY

Mitchell Brown

Learning Objectives:

*Following this session, the learner will be able to:*

- list the common causes of re-operation in aesthetic breast implant surgery
- describe various surgical approaches to the treatment of capsular contracture
- describe various surgical approaches to the treatment of implant malposition

27

### CHARACTERIZING THE SHAPE OF THE AGING EYEBROW

T Delyzer, K Bray-Jenkyn, A Yazdani

**PURPOSE:** Ideal eyebrow aesthetics have been refined over the years and give a framework for the goals of eyebrow and forehead rejuvenation procedures. Most authors agree upon an ideal eyebrow shape with a lateral slant that terminates lateral to the lateral limbus. Our study aims to characterize the change in eyebrow shape that occurs with age, and to correlate this with changes in forehead wrinkles, in order to better direct brow rejuvenation procedures.

**METHOD:** We analyzed AP standardized facial photographs of 100 women aged 20-80 at rest and with active elevation of the brow. The height of the eyebrow at the medial limbus, and at the highest point, was measured from a mid-pupillary horizontal, and the slope of the eyebrow calculated. Wrinkle number and severity was recorded, using a validated wrinkle severity score, for medial and lateral forehead, glabella, and crow's feet. We used a linear regression model to analyze the relationship between the slope of the eyebrow and age, and the relationship between slope and forehead wrinkles.

**RESULTS:** In our analysis we found that there is a correlation between increasing age and a decrease in the slope of the eyebrow. As well, with decreasing slope of the eyebrow, we found an increase in the number and severity of medial forehead wrinkles.

**CONCLUSIONS:** Our results suggest that with increasing age the slope of the eyebrow decreases, suggesting a flattening in the shape. As well, with this flattening there is increasing severity of medial forehead wrinkles at rest, suggesting increased frontalis activity at rest. Brow rejuvenation procedures aimed at decreasing medial frontalis activity should create a more youthful brow shape.

### Teaching Objectives:

- At the end of this talk participants should be able to describe the changes that occur to eyebrow shape with aging.

28

### SUBGLANDULAR BREAST AUGMENTATION WITH TEXTURED, ANATOMIC, COHESIVE SILICONE IMPLANTS: A REVIEW OF 440 CONSECUTIVE PATIENTS

R Tutino, A Khan, J Ahmad, F Lista

**PURPOSE:** The Allergan Style 410 implant is a textured, anatomic, cohesive silicone breast implant. Recently, concerns with late seroma have been reported in patients with these textured implants. Despite the widespread use of the Style 410 implant in both Europe and Canada, limited data exists regarding long-term outcomes and no specific data is available regarding the incidence of late seroma. The purpose of this study was to investigate outcomes using the Style 410 implant for primary subglandular breast augmentation in a consecutive series by a single surgeon.

**METHODS:** A retrospective chart review was performed identifying all patients who underwent primary subglandular breast augmentation with the Style 410 implant. Patient demographics and clinical characteristics were documented, as well as implant specifications. Complications including delayed wound healing, infection, seroma, hematoma, capsular contracture, flipping, and reoperations were examined.

**RESULTS:** Between 2002 and 2011, 440 consecutive patients were identified. The average patient age at the time of surgery was 35 years old (range 17 to 62 years) and the average body mass index was 22.3 kg/m<sup>2</sup>. The average implant volume was 385 cc (range 215 to 775 cc). 18.2% of patients experienced a complication and 8.6% required reoperation. The most frequent indication for reoperation was hematoma (2.7% of patients). Capsular contracture developed in 5.6% of patients. Flipping of the implant occurred in 3.6% of breasts but was largely managed nonoperatively. Seroma occurred in 1.8% of breasts; 0.7% occurred 3 months or more after surgery.

**CONCLUSIONS:** To our knowledge, this is the largest reported series of primary subglandular breast augmentation performed using the Style 410 implant. Our study expands the existing literature describing the safety profile of this device and its potential complications. This knowledge will assist plastic surgeons in counselling their patients when deciding the most appropriate approach to breast augmentation.

### Learning Objectives:

- To shed light on a single surgeon's experience on a rather controversial implant.

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### A REVIEW OF THE COMPLICATIONS ASSOCIATED WITH BIOALCAMID™ INJECTION IN PATIENTS WITH HIV RELATED FACIAL LIPOATROPHY

S Guerra

The implementation of antiretrovirals (ARVs) to control HIV infection has resulted in a reduction in both morbidity and mortality of HIV. However, ARVs can also cause the development of adverse effects in some patients including lipoatrophy. The term lipoatrophy encompasses peripheral lipoatrophy, dorsocervical fat accumulation, insulin resistance, hyperglycemia, and hyperlipidemia.

BioAlcamid™, a permanent injectable filler, has been used to improve the appearance of facial lipoatrophy in HIV patients. It consists of 96% water and 4% polymeric polyalkylimide that forms a collagen capsule once it has been injected subcutaneously. In the past, BioAlcamid™ had been shown to be a safe corrective procedure and provides an improvement to quality of life, and reduction in anxiety following injection and thus had been a popular treatment method. Unfortunately this filler has caused several devastating complications. Migration of the material, infection at the injection site, and inflammatory nodules are the difficult complications to treat.



Case reviews of eleven patients from the Vancouver area were used to evaluate and discuss the specific complications related to this product. Seventy-three percent of patients experience infection and/or inflammation at the treatment site. Complications from injection were seen, on average, of thirty-one months after the product was injected. The product was fragmented in the subcutaneous layer in all cases requiring removal. A facelift approach to access the BioAlcamid™ particles was necessary, and at times, multiple procedures were required to eradicate the inflammatory process.

This study will provide the foundation for future surgical methods necessary to treat patients with existing BioAlcamid™ in the face.

#### Learning objective:

- Identify the complications associated with permanent injectables in HIV patients

### 30

#### DETERMINING THE IN VITRO AND IN VIVO IMMUNE RESPONSE TOWARDS DECELLULARIZED PORCINE TRACHEAL ALLOGRAFTS FOR AIRWAY TRANSPLANTATION

**S Haykal, Y Zhou, S Hofer, T Waddell**

Malignancy, subglottic stenosis and traumatic injury to the trachea require surgical resection. The advances in airway allotransplantation focused on tracheal decellularization techniques which allow for removal of the immunogenic components. Despite the multiple advances in this field, the local and systemic immune response to these decellularized tracheal segments remains unexplored.

**METHOD:** Tracheae were harvested from Yorkshire pigs (n=6) and decellularized using three different decellularization protocols. Tracheae were evaluated histologically and by immunostaining for MHC I and MHC II markers. CFSE labelling in a Mixed Lymphocyte Reaction (MLR) assay was used to assess CD4<sup>+</sup> and CD8<sup>+</sup> T cell proliferation following incubation with tracheal pieces. Native and decellularized tracheal allografts were heterotopically transplanted and tracheal segments were biopsied each week for 3 weeks for histology, immunohistochemistry, PCR and flow cytometry looking at infiltrating cells.

**RESULTS:** Following decellularization, cells within the glands continue to stain positive for anti-MHC I and anti-MHC II. MLRs on tracheal pieces show an increase in the proliferation index of CD4<sup>+</sup> T cells using Protocol B. In Vivo heterotopic transplantation reveals a delay in leukocyte infiltration following decellularization and an increase in CD4<sup>+</sup> CD25<sup>+</sup> Foxp3<sup>+</sup> T cells. The infiltrating macrophages are of an M2 phenotype.

**CONCLUSIONS:** Decellularized tracheal segments appear to elicit a different immune response both in vitro and in vivo compared to native segments. Decellularization delays leukocyte infiltration and results in subtle changes in the type of cells recruited but they ultimately undergo a degradation associated with infiltration.

#### Learning Objectives:

- To identify the histological difference between native and decellularized grafts
- To describe the difference in T cell proliferation in an in vitro assay
- To elicit the differences in infiltrating leukocytes following heterotopic transplantation

### 31

#### A QUALITY OF LIFE ANALYSIS OF PATIENTS RECONSTRUCTED FOR MAJOR FACIAL DESTRUCTION

**L Paek, Y Wolf, A Hadjinicolaou, L Xu, N Low, A Danino**

**PURPOSE:** Facial allotransplantation has recently emerged as a potential option for patients with disfigurements not adequately correctable by conventional reconstructive surgery. In this context, measurement of major disfigurement as a handicap is necessary. We conducted a comprehensive psychosocial and quality of life (QoL) assessment of patients reconstructed following major facial destruction in order to ultimately evaluate the effectiveness of conventional reconstructive techniques.

**METHODS:** A cross-sectional study was conducted on patients aged 18 or older reconstructed for major disfigurement from 2007-2011 at one hospital center by two surgeons. Eligible patients had deficits of at least 30% of the facial surface area or two aesthetic subunits. Etiologies of destruction included cancer resection, burn and trauma. A control population matched for age, sex and etiology (with facial sparing) will be included.

Participants were administered 18 self-report questionnaires assessing socio-demographic data, QoL (SF-36, EORTC), anxiety (SPIN, PSWQ, PD screen), depression (BDI), substance abuse (ASSIST, DAST), self-esteem (Rosenberg), body image (MBSRQ, SIBID), suicidality, social support, coping styles and identity. Data was analysed using SPSS.

**RESULTS:** Preliminary analysis of 11 patients indicates that 67% are dissatisfied with their facial appearance. 64% consider themselves at least moderately disfigured and 55% are at least moderately distressed by their facial appearance. 45% of patients had at least moderate social phobia. Data analysis is ongoing; an endpoint of 30 patients is expected.

**CONCLUSIONS:** Following conventional reconstructive surgery for major facial destruction, residual disfigurement may have profoundly negative effects on patients' mental health and overall QoL. This study, to our knowledge, constitutes the most comprehensive QoL and psychosocial assessment aimed at this specific patient population. Currently ongoing analysis of our cohort will serve to expand upon these initial results.

#### Learning Objectives:

- Participants will be able to appreciate pertinent QoL and psychosocial measurement tools and their application to severely disfigured patients

### 32

#### MORPHOLOGIC AND HISTOLOGICAL COMPARISON OF HYPERTROPHIC SCAR IN NUDE AND KNOCKOUT MICE DEFICIENT IN T, B AND NATURAL KILLER CELLS

**M Momtazi, P Kwan, J Ding, C Anderson, D Honardoust, E Tredget**

**PURPOSE:** The nude mouse has demonstrated morphologic and histological similarities to human HSc and represents a promising animal model. The advent of gene knockout technology has provided the opportunity to study the effect of deleting subsets of immune cells in various disease processes. Our objectives are to demonstrate that grafting split thickness human skin onto TCR (T-cell receptor) $\alpha\beta^{-/-}\gamma\delta^{-/-}$ , RAG (recombination activating gene)-1<sup>-/-</sup> and RAG-2<sup>-/-</sup> $\gamma c^{-/-}$  mice results in murine scars that are morphologically and histologically consistent with human HSc and to characterize the morphologic, histologic and cellular changes that occur in murine scars with the removal of specific immune cell subsets.

**METHOD:** Nude, TCR $\alpha\beta^{-/-}\gamma\delta^{-/-}$ , RAG-1<sup>-/-</sup> and RAG-2<sup>-/-</sup> $\gamma c^{-/-}$  mice (n=20 per strain) were xenografted with split thickness human skin and euthanized at 30, 60, 120 and 180 days postoperatively. Control animals (n=5 per strain) were autografted with full thickness mouse skin. Scar biopsies and normal skin were harvested at each time point. Sections were stained with hematoxylin and eosin (H & E), Masson's trichrome and toluidine blue. Immunohistochemistry included anti-human HLA-ABC,  $\alpha$ -smooth muscle actin (SMA), decorin and biglycan staining.

**RESULTS:** TCR $\alpha\beta^{-/-}\gamma\delta^{-/-}$ , RAG-1<sup>-/-</sup> and RAG-2<sup>-/-</sup> $\gamma c^{-/-}$  mice grafted with human skin developed shiny, firm, elevated scars with histological and immunohistochemical similarities to human HSc previously observed in nude mice. Controls autografted with mouse skin showed no evidence of pathological scarring. Knockout animals demonstrated a capacity for scar remodeling not observed in nude mice. This was reflected in alterations in  $\alpha$ -SMA staining pattern, mast cell density and scar thickness that occurred over time.

**CONCLUSIONS:** Split thickness xenografts transplanted onto TCR $\alpha\beta^{-/-}\gamma\delta^{-/-}$ , RAG-1<sup>-/-</sup> and RAG-2<sup>-/-</sup> $\gamma c^{-/-}$  mice result in murine scars with morphologic and histologic features of human HSc. Remodeling of murine scars generated in knockout animals is analogous to changes

known to occur in human HSc and suggests scars in these animal models may better represent the natural history of HSc.

**Learning Objectives:**

- Identify morphologic and histological similarities between human HSc and murine scars in xenografted RAG knockout animals
- Identify the effects of immune cell deletion on murine scar characteristics in xenografted RAG knockout animals
- Consider the scar response pattern in xenografted RAG-1<sup>-/-</sup> knockout mice and how this animal model may best represent the behavior of human HSc

**33**

**POSTOPERATIVE COGNITIVE DYSFUNCTION AFTER MAJOR RECONSTRUCTIVE BREAST SURGERY**

**C Temple, O Ayeni, N Mychalisyhn, D Ross, M Brackstone, N Imasogie**

**PURPOSE:** Postoperative cognitive dysfunction (POCD) is a well-documented complication related to major cardiac surgery. Given the paucity of literature investigation the incidence of this condition in reconstructive surgery, the aim of this project was to establish the incidence of POCD in breast reconstruction patients and to establish any associated risk factors.

**METHOD:** A sample of 36 patients was recruited from which 17 underwent non-microsurgical breast reconstruction, while 19 underwent microsurgical breast reconstruction. As a baseline, each patient completed a battery of neuropsychological tests to assess cognitive dysfunction. Postoperatively, each patient completed the same battery of neuropsychological tests 1 week, 3 months, and 1 year after surgery. We examined descriptive variables (age, height, weight, BMI) and procedural variables (type of reconstruction, anaesthetic time, postoperative infection, lowest intraoperative blood pressure). The primary outcome was to determine the incidence of POCD in breast reconstruction patients.

**RESULTS:** There was an incidence of 38.9% of POCD within the total sample. Of this total, the majority (57.1%) of patients that experienced postoperative cognitive dysfunction underwent microsurgical breast reconstruction.

**CONCLUSIONS:** Postoperative cognitive dysfunction was observed in a higher proportion amongst patients undergoing microsurgical breast reconstruction, particularly around 1 week post operatively.

**Learning Objectives:**

- At the conclusion of this presentation, participants will be able to better communicate potential risks associated with breast reconstructive options. Participants will also enrich their ability to guide surgical decision making with evidence.

**34**

**FUNCTIONAL RECOVERY AFTER SCIATIC NERVE LACERATION AND DIRECT OR TRANS-CUTANEOUS ELECTRICAL STIMULATION IN MICE**

**AM Pion, AA Roy, E Beaumont, J Lin**

**PURPOSE:** Direct electrical nerve stimulation (DES) for one hour increases the rate of peripheral nerve regeneration in rats after nerve laceration and repair. In a clinical setting, this would require lengthening surgery time or using implanted electrodes that must be removed at a subsequent time. This study examines whether trans-cutaneous electrical stimulation (TCES) is as effective as direct electrical stimulation at improving functional recovery after sciatic nerve laceration and repair in a mouse model.

**METHODS:** In this study, we evaluated functional recovery after sciatic nerve laceration and immediate repair followed by either trans-cutaneous electrical stimulation of the proximal sciatic nerve, or direct electrical stimulation on the nerve. Using a mouse model, the sciatic nerve was transected, repaired and the proximal nerve stump was subjected to either DES or TCES for one hour. Every 2 weeks, for a total of 8 weeks, the functional recovery of the affected hind limb was evaluated using a walking-track analysis and kinematic study.

Electrophysiological and histological parameters were used at the end of the study period to evaluate functional muscle recovery.

**RESULTS AND CONCLUSION:** In our pilot study, electrical recordings from the lumbar spinal cord demonstrated that TCES induces the same electrical response in the lumbar spinal cord as DES, suggesting that both may be effective in accelerating axonal regeneration following nerve laceration and repair. The functional studies are currently underway and results will be presented.

**Learning Objectives:**

**The participant will be able to:**

- understand the potential role of electrical nerve stimulation as a treatment in peripheral nerve injuries; and
- understand functional assays used to evaluate mouse recovery after sciatic nerve laceration and repair.

**35**

**A QUALITATIVE ASSESSMENT OF THE JOURNEY TO DELAYED BREAST RECONSTRUCTION**

**H Cheng, I Snell, J Lipa, C Macmillan**

**PURPOSE:** Canada has low immediate breast reconstruction (IBR) rates compared with United States and Europe. Breast cancer survivors may live with their mastectomy defects for years while waiting for delayed breast reconstruction (DBR). This preventable loss in quality of life represents an area for improvement in breast cancer care.

**OBJECTIVES:** To explore: 1) information provided about breast reconstruction at the time of cancer diagnosis; 2) inefficiencies in referral practices that may contribute to consultation wait times.

**METHODOLOGY:** Fifty-one consecutive patients seen in consultation for DBR at a tertiary care centre completed a questionnaire examining their experience of pursuing breasts reconstruction. Seven semi-structured interviews were conducted to further explore patient knowledge and decision-making. Questionnaire responses were tabulated. Interviews were recorded and transcribed. Data was analyzed for recurring ideas and themes using standard qualitative techniques.

**RESULTS:** Questionnaires revealed that IBR is infrequently discussed, or barriers to timely access are often cited to discourage patients from pursuing IBR. Patients stated that more information about reconstructive options is needed at diagnosis, and this information could be provided by general surgeons, oncologists, or cancer nurses. 49% of patients had seen another plastic surgeon for DBR prior to attending consultation at our institution.

**CONCLUSIONS:** Misinformation/lack of information about options/access are contributing factors to under-utilization of IBR in Canada. Changes can be instituted by providing accurate information to the multi-disciplinary cancer care team and patients at diagnosis. Systematic inefficiencies exist in DBR referral practices. By minimizing number of consultations per patient and appropriately matching surgeon referrals to an individual's specific needs would allow more women timely access to breast reconstruction.

**Learning Objectives:**

**Participants will be able to:**

- describe information delivery about reconstruction before mastectomy in Canada;
- identify strategies to improve information delivery

**36**

**PROCESSES OF CARE IN AUTOGENOUS BREAST RECONSTRUCTION WITH PEDICLED TRAM FLAPS: EXPEDITING POSTOPERATIVE DISCHARGE IN AN AMBULATORY SETTING**

**K Davidge, P Morgan, M Brown, J Semple**

**PURPOSE:** A multidisciplinary patient care plan was developed to facilitate early discharge following breast reconstruction with pedicled TRAM flaps, and included the following components: 1) preadmission patient education; 2) standardized perioperative protocol for multimodal pain management; 3) intraoperative segmental nerve blocks

and abdominal closure with mesh; 4) post-discharge access to telephone advice. The primary objective of this retrospective study was to evaluate the success of this care plan in the first 18 months after its implementation. Secondary objectives included exploring predictors of discharge time in this population.

**METHODS:** All consecutive women undergoing pedicled TRAM flap breast reconstruction between November 2009 and May 2011 were included. The primary outcome was time to discharge; secondary outcomes were: 1) postoperative complications; 2) readmission; 3) delayed discharge (>24 hours); and 4) postoperative condition as assessed by a standardized nursing questionnaire. Stepwise multivariable regression modeling was utilized to examine predictors of discharge time.

**RESULTS:** 91 women (mean age  $50.0 \pm 8.5$  years) underwent autogenous reconstruction with pedicled TRAM flaps (76% unilateral; 81% delayed), of whom 77% received the intended multimodal analgesia protocol. Mean time to discharge was  $38.7 \pm 27.6$  hours (40% within 24 hours). Five patients had a postoperative complication, and two required readmission. Key predictors of shorter discharge time were use of multimodal analgesia, lower ASA class, and surgery >6 months post-implementation of the care plan.

**CONCLUSIONS:** Our initial experience has supported the safety and feasibility of expedited discharge following pedicled TRAM flap breast reconstruction, with adherence to our care plan improving steadily over the study period. Multimodal pain management proved a key modifiable factor in facilitating early discharge. A prospective study is currently underway to evaluate patient-reported quality of recovery following ambulatory surgery in this population.

#### Learning Objectives:

- To evaluate a patient care model designed to expedite discharge following TRAM flap breast reconstruction.

### 37

#### A COMPARISON OF CANCER-SPECIFIC DISTRESS CHANGES BETWEEN IMMEDIATE AND DELAYED BREAST RECONSTRUCTION FOLLOWING FREE DIEP OR MS-TRAM FLAP RECONSTRUCTION

**J Zhang, K Wang, S Hofer, T Zhong**

**PURPOSE:** The objective was to evaluate and compare the changes in cancer-specific distress levels between immediate and delayed breast reconstruction groups undergoing microscopically transferred muscle sparing- transversus abdominus myocutaneous (MS-TRAM) or deep inferior epigastric artery perforator (DIEP) flap using a longitudinal perspective.

**METHODOLOGY:** A total of 59 patients who underwent free MS-TRAM or DIEP reconstruction for breast cancer or BRCA gene positivity were included in this prospective cohort study. Impact of Event Scale (IES) questionnaires were completed by the patients before reconstruction, at post-operative week 3 and month 6. Both Repeated measure ANOVA and mixed model analysis were used to quantify three dependent variables (IES total score, IES intrusion, and IES avoidance subscales).

**RESULTS:** There were 31 patients in the immediate group and 28 patients in the delayed group. The mean level of post-surgical cancer-related distress on the IES total score, IES intrusion and IES avoidance subscales significantly decreased at 3 weeks post reconstruction and remained decreased at 6 months compared to the baseline ( $p=0.000$ ,  $0.000$ ,  $0.015$ , respectively) in both immediate and delayed groups. There were not a significant difference in the IES scores between 3 weeks and 6 months post reconstruction in either the immediate or delayed groups. The tests of between-subject effects showed no significant effect of timing of reconstruction on the total IES ( $p=0.960$ ), intrusion subscale ( $p=0.309$ ), or avoidance subscale scores ( $p=0.371$ ).

**CONCLUSIONS:** Both immediate and delayed breast reconstruction patients undergoing free abdominal tissue transfer experienced similarly improved levels of cancer-specific distress using IES measurement early post reconstruction and continued to maintain low distress

at 6 month post reconstruction. There is no difference in the change distress levels over time between patients undergoing immediate and delayed reconstruction. Our study suggests that breast cancer patients experienced significant improvements in cancer-specific distress following free MS-TRAM or DIEP flap reconstruction regardless of the timing of reconstruction.

### 38

#### CREATION OF OBJECTIVES FOR A VALIDATED TEST ON BREAST RECONSTRUCTION COMPREHENSION

**H Lee, D Ross, N Guay**

**PURPOSE:** To develop educational objectives for a validated test to assess the level of patient knowledge in breast reconstruction.

**METHOD:** Using a modified Delphi method, a panel of experts in breast reconstruction were interviewed using a scripted questionnaire to ascertain what they considered to be the minimum knowledge required by patients to make an informed decision about surgery for breast reconstruction. Parallel focus groups consisting of patients who previously underwent breast reconstruction, were recruited to provide patients' perspective on the adequacy of the education they received pre-operatively. Recorded comments were reviewed for content and common themes. Items generated were organized to create objectives based on recurrent answers or ones that generated consensus within patient focus groups.

**RESULTS:** 5 experts were interviewed with 22 standard questions. 2 patient focus groups, each with 10 members, discussed 21 topics on the adequacy of pre-operative breast reconstruction education. The expert and patient focus groups identified key themes including: information about differing techniques for breast reconstruction, timing and duration of each procedure, number of required clinic visits, and complications. Educational objectives were then generated to reflect the emphasis placed on each topic.

**CONCLUSION:** Objectives with high face validity were created using a multifaceted approach combining expert panel interviews and patient group discussions. These objectives will be the basis for developing a validated test for breast reconstruction knowledge.

#### Learning Objectives:

- Outline areas of emphasis for adequate informed consent in breast reconstruction.
- Describe the benefits and limitations of scripted interviews and focus groups in the generation of educational objectives.

### 39

#### DO THE RISKS OF KETOROLAC OUTWEIGH ITS BENEFITS IN PATIENTS UNDERGOING BILATERAL REDUCTION MAMMOPLASTY

**J Catapano, J Mahoney, M Musgrave**

**PURPOSE:** The objective of this study was to investigate the benefit of ketorolac in managing postoperative pain in patients undergoing reduction mammoplasty.

**METHOD:** We retrospectively reviewed the charts of one-hundred consecutive patients having had reduction mammoplasty at St. Michael's Hospital, Toronto. Data collected included demographics, comorbidities, operative use of ketorolac, post-operative narcotic analgesia and post-operative complications. The primary outcome measure was amount of narcotic analgesia in the presence or absence of ketorolac administration. Secondary outcome measures included: time to discharge and post-operative complications including hematoma.

**RESULTS:** The average patient age was 41.7 years with an average BMI of 29.3. The average number of comorbidities was 1. Of the 100 patients reviewed, fifty-two patients (52%) received ketorolac (15-30mg) either intraoperatively ( $n=37$ ) or in the recovery room ( $n=15$ ). The amount of narcotic administered based on morphine equivalents was 8.80 mg in the ketorolac group and 10.98 mg in the non-ketorolac group ( $p=.0918$ ). Of the 100 patients who underwent reduction mammoplasty there were only 3 post operative hematomas,



two in the ketoralac group and one in the non-ketoralac group. Two cases (one from each group) required operative management.

**CONCLUSIONS:** The use of ketoralac intra- or post-operatively does not appear to increase the incidence of post-operative hematoma requiring operative management. Patients who received ketoralac used less analgesia but did not leave the recovery room earlier. Our retrospective study would suggest that the use of ketoralac in breast reduction does not increase bleeding complications, in particular post-operative hematoma, and may reduce the use of post-operative analgesia.

**Learning Objectives:**

- To understand the risks and benefits of ketoralac administration in patients undergoing reduction mammoplasty
- To consider the use of ketoralac in breast surgery

#### 40

##### **PREDICTORS OF COMPLICATIONS AFTER BREAST RECONSTRUCTION IN PATIENTS WITH MACROMASTIA**

**J Platt, T Zhong, S Hofer**

**PURPOSE:** To describe the predictors of 1) major and multiple complications and 2) revision surgery, among breast reconstruction patients with macromastia.

**METHOD:** Data were collected retrospectively on 163 consecutive women with macromastia who underwent postmastectomy breast reconstruction between 2008 - 2011. Macromastia was defined as cup size C, autologous flap weight of 500g or implant size of 500cc or greater. The primary outcome was major or multiple (> 2) complications and the secondary outcome was revision surgery. Predictors of outcomes were determined using univariate and multivariable regression.

**RESULTS:** Median age was 48 years (range 27 – 77) and BMI was 28.1 kg/m<sup>2</sup> (range 19.1 – 42.5). The majority of patients had invasive disease (71.2%) and 32.5% had previous radiation. Type of reconstruction was autologous flap in 83.4%, tissue-expander and implant in 9.8% and combined in 6.8%. 63 patients (38.7%) had a major complication or > 2 complications; the majority of major complications were hematoma requiring reoperation (13 [15.9%]). 52 patients required revision surgery. On univariate analysis, prophylactic procedures, implant-based, bilateral, and immediate reconstruction, previous radiation and BMI were associated with major or multiple complications. Only BMI (OR = 1.16 [95% CI 1.07 – 1.25]) and immediate reconstruction (OR = 3.93 [95% CI 1.80 – 8.58]) were significant predictors on multivariable logistic regression. Unilateral surgery and delayed reconstruction significantly predicted need for revision surgery (OR = 25.1 [95% CI 5.2 – 121.1] and OR = 2.69 [95% CI 1.004 – 7.21], respectively) on multivariable analysis.

**CONCLUSIONS:** When performing breast reconstruction in patients with macromastia, patients with increased BMI are at higher risk for developing both major and/or multiple complications, and the need for revision surgery.

**Teaching Objectives:**

- To describe complications and revision surgery.
- To evaluate patient selection for breast reconstruction in women in macromastia.

#### 41

##### **EFFECT OF BREAST REDUCTION SURGERY ON INDICATORS OF INSULIN RESISTANCE: A PILOT STUDY**

**R Neinstein, M Musgrave, P Connelly, J Ray, J Mahoney**

**PURPOSE:** Breast adiposity may be an indicator of a higher risk of diabetes mellitus (DM) and insulin resistance (IR). The current study evaluated whether breast reduction surgery is associated with a decrease in biochemical markers of IR.

**METHODOLOGY:** We completed a prospective before-and-after pilot study of women who underwent breast reduction surgery at St. Michael's Hospital, Toronto. The primary outcome was the mean

change in the homeostatic model assessment of insulin resistance (HOMA-IR) before vs. 6 weeks after the surgery. Secondary study outcomes comprised physical measures, fasting serum lipids, glucose, HbA1c and insulin, CRP and specific hormones produced by adipose tissue that regulate glucose and fatty acid metabolism.

**RESULTS:** Seven women completed the pilot study. The mean age was 37 y, BMI was 31 kg/m<sup>2</sup>, and breast tissue mass removed was 1200 g. Changes in markers of IR were as follows: HOMA-IR before surgery was 1.62 and 1.95 after surgery (p=0.34), fasting glucose (mmol/L) was 4.95 before and 5.03 after surgery (p=0.32), total cholesterol (mmol/L) was 5.24 before and 5.48 after surgery (p=0.08).

**CONCLUSIONS:** This is the first study to evaluate whether breast adipose removal alters markers of insulin resistance. No significant effect was noted, but the small study sample size limits our ability to infer much about the changes in insulin resistance markers. A larger study is feasible.

**Learning Objectives:**

- At the end of this presentation the learner will understand the role adipose tissue plays in controlling insulin resistance.
- At the end of this presentation the learner will understand the role breast reduction plays in controlling insulin resistance

#### 42

##### **COMPARISON OF OUTCOMES FOLLOWING AUTOLOGOUS BREAST RECONSTRUCTION – AN INSTITUTIONAL REVIEW**

**A Knox, A Ho, P Lennox, N VanLaeken, S Macadam**

**PURPOSE:** To compare the clinical outcomes of patients receiving a Deep Inferior Epigastric artery Perforator (DIEP) flap or a Pedicled Transverse Rectus Abdominal Muscle (pTRAM) flap for autologous breast reconstruction.

**METHODS:** A retrospective review of all patients receiving autologous breast reconstruction under supervision of Vancouver's main breast reconstructive surgeons from September 2000 until September 2010 was performed. All patients who underwent either a DIEP or a pTRAM flap were included. Patient groups were compared regarding demographics, operating room times, abdominal wall related complications and flap related complications.

**RESULTS:** A total of 388 women underwent pTRAM breast reconstruction (321 unilateral, 67 bilateral, 455 flaps total). Conversely, 88 women had reconstruction using the DIEP technique (52 unilateral, 36 bilateral, 124 flaps total). DIEPs have longer operative time and have a higher rate of flap related complications. Reconstruction with pTRAM flaps have an increased use of mesh during abdominal wall closure and have a higher rate of abdominal hernia or bulge requiring additional surgery.

**CONCLUSION:** Both DIEP and pTRAM flap techniques have a useful role in autologous breast reconstruction. UBC's autologous breast reconstruction program has complication rates comparable to the published literature. Although DIEP reconstruction takes significantly longer to perform, the pTRAM patients require significantly higher rates of revisional surgery for abdominal hernia and bulge. Further analysis is needed to determine which procedure is more economical.

**Learning Objectives:**

- Participants will be able to compare and contrast the advantages and disadvantages of the DIEP and pTRAM flaps for autologous reconstruction and make better informed decisions when offering these procedures to their patients.

#### 43

##### **COMPLICATIONS AND REOPERATIONS IN PRIMARY BREAST AUGMENTATION AND AUGMENTATION MASTOPEXY: A SINGLE SURGEON'S REVIEW OF 1700 CASES**

**R Somogyi, M Brown**

**PURPOSE:** This study was designed to examine implant and technique related complications and reasons for reoperation in primary breast augmentation and augmentation mastopexy.

**METHOD:** A retrospective review of a single surgeon's prospectively maintained clinical database over the last 15 years was performed. All primary bilateral breast augmentation (BBA) and primary single-stage mastopexy augment (BBA/MA) patients were included. For each patient, implant characteristics, including implant type, fill, shape, texture and projection as well as incision type and pocket location was collected. All complications and reasons for reoperation were analyzed with Kaplan Meier survival curves and a Cox proportional hazards ratio is described for each.

**RESULTS:** 1700 patients with 3400 implants were included (1539 BBA, 161 BBA/MA). 534 had saline implants and 1166 had silicone implants placed. Average follow up was  $15 \pm 24$  months. Total complication and reoperation rates were 7.4% and 8.0% respectively. Inframammary incisions as well as the use of shaped textured implants were associated with lower rates of complications. The use of a dual plane pocket as well as implant volumes over 400cc were associated with higher rates of complications. Full projection round implants had equivalent rates of complications and reoperations as moderate projection devices. No differences were found between BBA and BBA/MA.

**CONCLUSIONS:** Both implant and technique related factors influence complications in primary breast implant surgery. Single-stage augmentation mastopexy can have a similar risk profile as primary breast augmentation alone, in carefully selected patients.

#### Learning Objectives:

- Participants will be able to identify the variables that influence complications in primary breast augmentation surgery.

## 44

### A CHARACTERIZATION OF BURN INJURIES EXPERIENCED BY MANITOBA'S FIRST NATIONS POPULATION

**I MacArthur, J Gawaziuk, B Elias, S Logsetty**

**PURPOSE:** Numerous disease processes occur at a heightened incidence in Manitoba's First Nations population. Burn injury patterns experienced by this group have not been previously examined. This study analyzes burn injuries experienced by both First Nations and non- First Nations populations in Manitoba between 2006 - 2010 with a focus on demographics, etiologies and surrounding circumstances of the injury. Results will be used to develop culturally-sensitive burn prevention programs.

**METHOD:** A retrospective chart review was completed for all patients requiring inpatient admission for a burn injury at Manitoba's burn center between 2006 - 2010.

**RESULTS:** During the study period 22.8% of all burn inpatients were of First Nations Descent, who compose 11.3% of the province's population. The province's northern-most health region had a 3.5 fold increased relative risk for experiencing burn injuries compared to the provincial rate. Compared to their non- First Nations counterparts, First Nations inpatients were younger (20.3 vs. 34.4 years of age), had lengthier hospital stays (26.3 vs. 14.9 days), larger burns (14.5 vs. 10.4% TBSA) and more operations (2.0 vs. 1.4 average surgeries). Injury mechanisms and circumstances also differed between the two groups.

**CONCLUSIONS:** Manitoba's First Nations population experiences more frequent and more severe burn injuries compared to the rest of the province. These results have been the basis for a resolution passed by the MKO regional chiefs organization covering the northern First Nations communities in Manitoba, aimed at developing specific areas targeted for burn injury prevention.

#### LEARNING OBJECTIVES:

At the conclusion of the session, the participant will be able to:

- describe the differences between burn injuries sustained by Manitoba's non- First Nations and First Nations populations; as well as
- to identify potential target areas to be addressed with culturally-specific burn prevention programs.

## 45

### FREE FLAP RECONSTRUCTION OF BURN INJURIES: A RETROSPECTIVE REVIEW

**B Ball, T Kwan-Wong, H Shankowsky, E Tredget**

**PURPOSE:** Reconstruction of complex burn wounds is a challenging problem. While many burn wounds may be covered with skin grafts and local flaps, more complex defects may require reconstruction with free flaps. The goal was to determine outcomes following free flap reconstruction for burn defects.

**METHODS:** A retrospective review was performed for adult patients admitted to a burn centre who underwent free flap reconstruction between 2001 and 2011. All types of burn injuries were included. Data gathered included demographics, indications for flap, type of flap, and complications.

**RESULTS:** 20 free flaps were performed in 17 patients. Males represented 94% of the patients, and the mean age was 38 years. The mean total body surface area burned was 13%. 11 patients suffered electrical injury, while 6 had burns from other causes. Most flaps were performed for exposed bone or tendon (n=19), and 1 was for reconstruction of an unstable wound. The most common type of flap performed was the radial forearm (n=11). The remainder included latissimus dorsi (n=5), ALT (n=2), rectus abdominis (n=1) and venous flow-through (n=1). Recipient sites included lower extremity (n=11), upper extremity (n=5) and head and neck (n=4). 35% of the flaps were re-explored for a suspected thrombosis. The thrombosis rate was 25% representing 3 venous and 2 arterial thromboses. Four of these flaps were salvaged. The overall flap failure rate was 5%.

**CONCLUSIONS:** The most common flap performed was the radial forearm, and the most common recipient was the lower extremity. Although the rate of re-exploration was higher than expected, most flaps affected by thrombosis were salvaged. The survival rate is similar to that for other types of free flap reconstruction.

#### Learning Objectives:

- Learn the common types of free flaps used to reconstruct deformities from burn wounds, and the outcomes of these procedures.

## 46

### INTRAOPERATIVE DATASET BACKUP WITH C-ARM DEVICE FOR NAVIGATION CONTROLLED SURGERY

**TL Stewart, P Voss, M Metzget, G Louie, D Schultz, R Schmelzeisen**

Computer assisted surgery enables more predictable results in bony peri-orbital and midface reconstruction. Intraoperative tomograms with a C-arm device can directly verify the obtained bone position, which may be correlated with the preoperative planning. The purpose of our study was to demonstrate the usefulness of direct intraoperative verification of anatomical positioning with preoperative planned reconstruction for immediate and accurate results in form and function.

**METHOD:** Twelve patients with unilateral midface and periorbital trauma underwent surgical treatment assisted by the navigation software VoXim. After computer planned and navigation controlled reconstruction, we acquired intraoperative datasets using the mobile C-arm device BV Pulsera with 3D-RX. An 18x18x18 cm volume scan was acquired with 379 projections in 30 seconds. The datasets were imported into the navigation software and fused with the preoperative planning. A control cone beam CT scan was obtained 4 weeks postoperatively and compared with the preoperative images.

**RESULTS:** Device positioning, data acquisition, data reconstruction, import and fusion were complete after a median of 12 minutes (Range 9 to 14 minutes). One patient required intraoperative surgical adjustment following image fusion. In all 12 cases the postoperative scan showed adequate anatomic reduction and no revision surgery was necessary.

**CONCLUSIONS:** We describe here the first case series combining both an intraoperative mobile C-arm device with a navigational system for a direct comparison of preoperative imaging. This system is easy to handle, produces high quality images with decreased radiation exposure and is ideal for surgical cases with limited surgical access and

visualization. Patient care is streamlined producing immediate real-time results avoiding future revision surgery.

**Learning Objectives:**

- *The participants will have an increased understanding of the use of computer-assisted surgery for achieving form and function in midface and orbital trauma.*

**47**

**INCIDENCE OF BRAIN INJURY IN FACIAL FRACTURES**

**A Grant, A Ranger, B Young, A Yazdani**

**PURPOSE:** Plastic surgeons are responsible for treating a significant number of facial fractures. These fractures can be associated with head and cervical spine injury, as impact forces are transmitted through the head and neck. The incidence of minor brain injury in these patients is not well defined. Minor brain injury can result in morbidity, affecting function, safety, and return to work, as well as potential mortality. This prospective study aims to determine the incidence of minor brain injury in one hundred consecutive patients with facial fractures.

**METHODS:** Data were collected over a nine-month period by a craniofacial surgeon in a level one trauma centre. A clinical questionnaire was designed to capture information about major and minor brain injury in patients with facial fractures. Assessments were completed in a variety of hospital settings during the first patient encounter.

**RESULTS:** The average age was 34 years, the majority of whom were male. Time between injury and assessment ranged from less than 72 hours to greater than three weeks. The incidence of brain injury in this group was 67 percent overall; 29 percent with major, and 38 percent with minor brain injury. Subgroup analysis revealed that major brain injury was commonly diagnosed early in the emergency room or the intensive care unit. However, minor brain injury tended to be diagnosed late in outpatient craniofacial clinic.

**CONCLUSION:** These results demonstrate that facial fractures are often associated with brain injury. Furthermore, there should be a high level of suspicion for minor traumatic brain injury in patients with facial fractures.

**Learning Objectives:**

- *To increase awareness of brain injuries associated with facial fractures, and to encourage participants to maintain a high index of suspicion for these injuries in clinical practice.*

**48**

**EVALUATING RISK FACTORS AND OUTCOMES IN ALLOPLASTIC AND FREE FLAP AUTOGENOUS BREAST RECONSTRUCTION USING A COMPLICATION IMPACT SCORE: ANALYSIS OF THE ACS-NSQIP**

**A Ho, M Testa, YS Chun, S Macadam**

**PURPOSE:** Diabetes, smoking, body mass index (BMI), and age are considered by many to be contraindications for pedicled flap breast reconstruction. Microvascular flap breast reconstruction techniques may be preferred in these patients as they provide improved flap vascularity. Published rates of complications in free flap patients do not account for the severity and nature of complications. A Complication Impact Scale (CIS) was developed to evaluate risk factors in free flap breast reconstruction, and to compare free flap patients to tissue expander (TE)/implant patients.

**METHODS:** Breast reconstruction patients were identified from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) using Current Procedural Terminology codes. The CIS was constructed using expert opinions collected with a structured survey. Mean CIS scores of free flap reconstruction technique and TE/implant technique were compared and multivariate regression models were constructed to evaluate predictors of the CIS score.

**RESULTS:** 73,320 breast reconstruction patients were identified from 2005-2009 ACS-NSQIP data. There was a higher mean CIS score in free flap patients compared to the TE/implant group, adjusting for smoking, diabetes, age, and BMI ( $p < 0.0001$ ). Smoking and BMI were

significantly associated with a higher CIS score irrespective of surgical procedure type. There was a multiplicative increased risk for smoking diabetic individuals.

**CONCLUSION:** A significant increase in CIS score amongst free flap reconstruction patients was associated with smoking and BMI. Age and diabetes were not found to be independent risk factors. These results suggest that surgeons should encourage patients who are active smokers and obese to undergo alloplastic breast reconstruction, as it is associated with less morbidity compared to free flap reconstruction.

**Learning Objectives:**

**At the end of this presentation, the learner will be able to:**

- *appreciate the limitations of traditional binary variables in evaluating health outcomes, specifically post-operative morbidity.*
- *gain a better understanding of how the Complication Impact Scale was constructed and how it can be used to account for both the nature and severity of post-breast reconstruction complications.*
- *understand the unique risk factors for complications associated with free flap breast reconstruction surgery.*

**49**

**CRITICAL ANALYSIS OF CONSECUTIVE UNILATERAL CLEFT LIP REPAIRS BY PARENTS VERSUS SURGEONS: DETERMINING IDEAL SAMPLE SIZE**

**S Power, D Matic**

**PURPOSE:** Previously we found poor agreement between cleft surgeons when evaluating lip repairs and no statistical support for presenting 10 consecutive cases to reflect average outcomes. The purpose of this follow-up study is to compare parents' evaluations of cleft severity and outcomes to those of surgeons. Secondary objectives are to determine the validity of showing consecutive lip repairs to parents and to calculate inter-rater reliability.

**METHOD:** Consecutive pre- and two-year post-operative photographs of the unilateral cleft lip/nose complex were included from one practice. Photographs were randomized and evaluated by parents of patients with clefts within a multidisciplinary clinic using descriptive and qualitative scales. Evaluations were compared to those performed by senior cleft surgeons at the American Cleft Palate-Craniofacial meeting. Parametric and non-parametric analyses were performed according to chronologic, consecutive order. The mean standard deviation over all raters enabled calculation of expected 95% confidence intervals around a mean tested for various sample sizes.

**RESULTS:** Photographs of 39 patients were evaluated by 20 parents and 10 senior cleft surgeons. Parents demonstrated higher inter-rater agreement for cleft severity (ICC=0.77) and outcomes (0.84) than surgeons (ICC=0.65 and 0.21, respectively). Narrowing 95% confidence intervals within one point on both post-operative grading scales required presenting 27 consecutive cases to surgeons versus 12 cases to parents. Within both groups, outcomes did not correlate with severity (parents,  $p=0.56$ ; surgeons,  $p=0.28$ ).

**CONCLUSIONS:** Parents demonstrated stronger agreement than surgeons when evaluating cleft severity and outcomes, which may reflect different evaluation criteria or surgeon bias when evaluating a colleague's results. There may be statistical validity in showing 12 consecutive lip repairs to parents as an educational tool in pre-operative consultations.

**Learning Objective:**

- *To understand statistical support for presenting consecutive lip repairs to parents versus surgeons.*

**50**

**CONTRALATERAL AURICULAR COMPOSITE GRAFT FOR EAR RECONSTRUCTION AFTER RESECTION OF MELANOMA**

**ME Pépin, D Rizis, JM Servant, A Danino**

**PURPOSE:** The resection of melanoma requires a wide excision with oncologically safe margins and reconstruction achieving the best symmetry with the contralateral ear is required. We present our technique and



experience with the contralateral auricular composite graft for ear reconstruction following resection of melanoma as well a case series demonstrating acceptable results with regard to morphology and symmetry.

**METHOD:** Between 2006 and 2010, seven patients diagnosed with melanoma of the ear were treated with contralateral auricular composite grafts. A retrospective chart review of those patients was conducted. Patient follow-up was performed at one week, 14 days, 30 days and 3 months to evaluate outcomes, complications, and patient satisfaction. Standardized pictures were also taken and assessed for auricular morphology using a Likert scale by a panel of three nurses recruited from the hospital's surgical department.

**RESULTS:** Seven patients were included in the study with a mean age of 46.6 years. After resection, the surgical deficits ranged from 4 cm to 5 cm in size. Clinical follow-up revealed no complications at the graft or donor sites. There have been no recurrences to date in all seven patients. Patients stated an appreciation for the use of a single procedure for reconstruction and for the symmetry obtained for the two ears. Evaluation of standardized pictures using a Likert scale demonstrated that the surgical technique succeeds in obtaining morphology in the reconstructed ear that is similar to that of a normal ear.

**CONCLUSION:** In our opinion, the contralateral auricular composite graft should be considered the first choice for reconstruction of the ear after wide excision of malignant melanoma of the ear.

#### Learning Objectives:

- Describe the surgical goals of excision and reconstruction of the ear in an oncological setting.
- Learn a specific surgical technique for reconstruction of the ear after resection of melanoma.

## 51

### COMPARISON OF THE SENSORY MODALITY EFFECTS OF BUPIVACAINE DIGITAL NERVE BLOCKS WITH AND WITHOUT EPINEPHRINE: A LEVEL ONE STUDY

**K Calder, B Chung, C O'Brien, D Lalonde**

**INTRODUCTION:** There are no published reports to indicate the duration of action of bupivacaine with epinephrine in digital nerve blocks. The effect of bupivacaine with epinephrine on the various sensory modalities as compared to bupivacaine alone has not been studied. Furthermore, the duration and magnitude of bupivacaine-induced vasodilation has not been quantified. The goals of this double-blind randomized control trial are:

- 1.) To determine the duration of bupivacaine anesthesia on digital nerve blocks  $\pm$  epinephrine.
- 2.) To assess the duration of action of bupivacaine  $\pm$  epinephrine on the digital sensory modalities of pain, touch and pressure.
- 3.) To assess the skin temperature changes that result from bupivacaine finger injection  $\pm$  epinephrine.

**METHODS:** A sample size calculation revealed that forty-three subjects were required for this study. Ring fingers were randomized to receive 2ml of 0.5% bupivacaine injection with (+) or without (-) 1:200,000 epinephrine. All injections were performed using the single volar subcutaneous technique by one injector blinded to the injectate. Pain was elicited using diabetic lancets and measured on a numeric rating scale (0-10). Touch was assessed using a Semmes-Weinstein monofilament. The duration of time for digits to return to normal pain, touch and pressure sensations were recorded. Temperature was measured using a digital infrared thermometer to quantify the vasoactive effects of bupivacaine injection. All measurements were recorded at 1h, 6h, 12h, 14h and each subsequent hour from injection until the subject's finger regained normal sensation.

**RESULTS:** None of the subjects experienced any adverse reaction or ischemic injury with bupivacaine  $\pm$  epinephrine injection. Return to normal sensation was 29.25h ( $+\sigma=10.29$ ) and 28h ( $-\sigma=10.29$ ). Pressure sensation returned at 16h ( $+\sigma=2.76$ ) and 14h ( $-\sigma=3.95$ ) with touch returning at 17h ( $+\sigma=3.88$ ) and 15h ( $-\sigma=5.16$ ). Onset of pain return began at 16.5h ( $+\sigma=2.62$ ) and 15h ( $-\sigma=3.25$ ) but was not complete until 20h ( $+\sigma=3.53$ ) and 19.5h ( $-\sigma=4.51$ ). Temperature change [ $>1^{\circ}\text{C}$

difference compared to the index finger] began within 1h of administration and lasted 16h ( $+\sigma=6.91$ ) and 15h ( $-\sigma=6.65$ ). Peak effect occurred at 12h ( $+\sigma=7.22$ ;  $-\sigma=6.82$ ) with an absolute temperature measurement of  $33.6^{\circ}\text{C}$  ( $+\sigma=3.03$ ) versus  $34^{\circ}\text{C}$  ( $-\sigma=2.26$ ) and a relative temperature difference of  $6.8^{\circ}\text{C}$  ( $+\sigma=3.33$ ) and  $7.35^{\circ}\text{C}$  ( $-\sigma=3.71$ ).

**CONCLUSION:** Bupivacaine with epinephrine is safe for use in digital nerve blockade. It does not affect the sensory modalities as compared to bupivacaine alone. Bupivacaine with or without epinephrine may be used clinically to induce digital temperature elevation through its vasodilatory properties.

#### Learning Objectives:

- To understand the duration of effect bupivacaine with and without epinephrine has on the various sensory modalities in digital blocks.
- To learn potential and appropriate uses for bupivacaine digital blockade.

## 52

### A COST-UTILITY ANALYSIS OF NEEDLE APONEUROTOMY, PARTIAL FASCIECTOMY AND COLLAGENASE INJECTION FOR THE TREATMENT OF SINGLE-DIGIT DUPUYTREN'S CONTRACTURE

**H Baltzer, P Binhammer**

**PURPOSE:** To compare the cost-effectiveness of injectable collagenase (IC) to the two current Canadian treatment options of Dupuytren's Contracture (DC), partial fasciectomy (PF) and needle aponeurotomy (NA).

**METHODS:** We carried out a systematic review of the literature to establish baseline probabilities for complications and recurrence, and utility values, for treatment of single digit DC. A cost analysis was performed from a societal perspective. We constructed an expected-value decision analysis model with an arm representing each treatment. Sensitivity analyses were performed and the standard threshold for cost effective treatment (\$50,000-100,000/QALY gained) was used.

**RESULTS:** The expected QALYs for a patient with DC is 14.8, assuming a life expectancy of 15 years. The expected values for PF, NA and IC were 14.85, 14.87, and 14.89, with expected costs of \$8850, \$4630, and \$7700, respectively. Partial fasciectomy was the least cost effective strategy costing \$149,000/QALY gained over no treatment. The total cost of IC over no treatment was \$88,597/QALY gained. NA was the most cost-effective treatment strategy, costing \$63,338/QALY gained. The incremental cost-effective ratio comparison of NA to injectable collagenase was \$193,750, favouring NA. Sensitivity analyses identified that NA was below the \$50,000/QALY threshold when the probability of recurrence reached 39%. Injectable collagenase was the preferred strategy when the total cost of an injection series cost \$700 and met the cost-effective threshold when priced at \$300.

**CONCLUSIONS:** Our model identified NA to be the most cost effective treatment strategy for single digit DC, with IC becoming cost effective priced significantly lower than the current American market price. In this model, PF is not a cost-effective strategy for the primary treatment of single digit DC.

#### Learning Objectives:

- To consider the cost of Dupuytren's Contracture treatment from a societal standpoint.
- To value the role of cost-utility analyses in clinical decision making.

## 53

### EXPERT CONSENSUS ON ASSESSMENT OF PEDIATRIC UPPER EXTREMITY FUNCTION USING DELPHI METHODOLOGY

**M McRae, E HO, Y Hao, K Bala, G Borschel**

**PURPOSE:** To establish systematic consensus among experts for evaluating upper extremity (UE) function in children. Methods: 48 experts were invited to participate. Two rounds of questionnaires were developed to attain consensus using Delphi methodology. The following information was obtained in the 1st round: demographics; outcome

measures used to assess UE functioning by International Classification of Function (ICF) domain; merits of currently used assessments; identification of important components of pediatric UE functional evaluation. Qualitative analysis identified themes in expert's responses and informed development of the 2nd round survey. The following information was obtained in the 2nd round: ranking assessments by ICF domains; rating ability to comprehensively assess ICF domain; ranking the merits of measures; ranking the important components of UE measures; ranking ICF domains according to relative importance in pediatric UE assessment. Consensus was defined as agreement  $\geq 0.8$  using Cronbach's  $\alpha$ .

**RESULTS:** 27 experts completed the first survey and 17 completed the second. A list of outcome measures along with their merits were generated and sorted by ICF domain. Consensus was achieved regarding the best outcome measures in domain of Body Structure and Function (BSF) (0.955C $\alpha$ ), Activity (0.857C $\alpha$ ), Participation (0.877C $\alpha$ ), important components of comprehensive pediatric UE assessment (0.835C $\alpha$ ), most important ICF domain in contributing to pediatric UE function (0.839C $\alpha$ ), the least desirable disadvantages (0.814C $\alpha$ ). Consensus was not achieved for satisfaction with ability to assess BSF domain and most desirable advantages (0.638C $\alpha$ ) of current outcome measures.

**CONCLUSION:** Systematic assessment of expert opinion using Delphi methodology is useful in establishing consensus for the assessment of pediatric UE function. This information can inform the development of a comprehensive assessment tool for the pediatric UE.

**Learning Objectives:**

- Familiarize yourself with basics of Delphi methodology.
- Identify important aspects of assessment of pediatric UE function

## 54

### PEDAGOGICAL CHALLENGES IN PLASTIC SURGERY: THE RESIDENTS' POINT OF VIEW

S Salhi, J Lin

**INTRODUCTION :** « Plastic », from the Greek « plastikos », means to give shape or mould. Indeed, plastic surgeons aim at transforming complex tissue deficits into lesions that can be reconstructed. This makes it a versatile specialty encompassing various subjects from tissue reconstruction with flaps and grafts, hand and upper limb surgery, reconstruction of peripheral nerve lesions, to treatment of craniofacial fractures as well as cosmetic and pediatric plastic surgery. Moreover, the Royal College of Physicians and Surgeons of Canada expects graduating residents to show excellent knowledge in all of these subjects and more. However, during a typical plastic surgery residency, clinical and operative exposure to the different subjects varies, and may be lacking in some cases.

**METHODS :** We attempted to uncover the pedagogical challenges in the Quebec Plastic Surgery programs, as perceived by the residents themselves. We thus designed two polls that were consecutively addressed to Quebec plastic surgery residents.

**RESULTS :** We retained senior resident (R4 and R5) responses only. Six subjects were identified as difficult to master by the end of residency : cosmetic surgery, wrist surgery, craniofacial syndromes, reconstruction of head and neck cancers, congenital hand pathologies and brachial plexus surgery.

**CONCLUSION :** We were able to identify common pedagogical challenges in Quebec Plastic Surgery programs, as seen by the residents themselves. The next step is to offer these same polls to Plastic Surgery residents across Canada and compare their answers to those obtained in Quebec. This will help us to design teaching tools to address the residents' perceived pedagogical challenges.

**Learning Objectives:**

- Identify the different fields of expertise expected to be mastered in a typical plastic surgery residency.
- Identify the most difficult subjects, as chosen by the residents themselves.

## 55

### ARE UPPER EXTREMITY SURGEONS ADEQUATELY TRAINED IN INTRA-OPERATIVE FLUOROSCOPY UTILIZATION AND SAFETY AWARENESS?

K Genoway, R Morley, C Reilly, C Verchere

**PURPOSE:** To evaluate the practice patterns, surgical training and safety awareness of fluoroscopy utilization of BC adult and Canadian pediatric upper extremity surgeons.

**METHOD:** All plastic and orthopedic surgeons in British Columbia and pediatric surgeons in Canada were contacted by email to participate in this study. Respondents completed a questionnaire focusing on intra-operative and emergency room fluoroscopy practice patterns, surgeon training/safety/knowledge, knowledge of intra-operative fluoroscopy policies, and pediatric considerations.

**RESULTS:** Of the 113 respondents, 23% reported receiving training for the use of standard c-arm fluoroscopy while 45% received training for mini c-arm fluoroscopy. Amongst plastic surgeons in the group these numbers were only 11% and 47% respectively. Few surgeons were aware of resident training for the use of either standard (4%) or mini c-arm (12%) fluoroscopy. Only 17% of surgeons were able to correctly state the relative radiation exposure of standard c-arm and 11% for mini c-arm fluoroscopy when compared to a standard chest x-ray. Forty-four percent of respondents knew that there were hospital policies for standard c-arm use. Only 25% were aware of such policies for mini c-arm fluoroscopy.

In contrast, the majority of upper extremity surgeons commonly used intra-operative fluoroscopy (60% used standard c-arm and 84% mini c-arm) and felt that the use was moderately to very important to their practice (46% for standard c-arm and 91% for mini c-arm).

**CONCLUSIONS:** Fluoroscopy, especially mini-c-arm, is a widely used and important tool for upper extremity surgeons. Despite its significance there appears to be a lack of formal training and radiation awareness amongst surgeons using it.

**Learning Objectives:**

- To identify the role of fluoroscopy in the treatment of adult and pediatric upper extremity injuries
- To demonstrate a need for increased education regarding fluoroscopy utilization, safety and exposure amongst by both surgeons and resident

## 56

### BETA-BLOCKERS FOR THE TREATMENT OF PROBLEMATIC HEMANGIOMAS

V Sharma, D Dumestre, F Fraulin, R Harrop

**PURPOSE:** To examine the efficacy of beta-blocker treatment for problematic hemangiomas.

**METHODS:** This is a retrospective analysis of patients presenting to the Vascular Birthmark Clinic at the Alberta Children's Hospital with hemangiomas treated with oral beta-blocker therapy. Patients were identified using the Vascular Birthmark Database and their charts reviewed. Data concerning response to treatment, time to resolution, and rebound growth were extracted, along with side effects, duration of treatment, and beta-blocker dosage. The aggregate data was then analyzed.

**RESULTS:** Between 2009 and 2011, 105 patients were treated with beta-blockers (70.5% female, 14.3% premature-births). 45 individuals completed beta-blocker treatment, with the remainder still undergoing therapy. Indications for treatment were functional concerns (71.5%) and disfigurement (29.5%). Functional concerns included: ulceration 29.5%, periocular 28.6%, syndromic 5.7%, airway interference 4.8%, visceral 0.95%, and auditory interference 0.95%. The median age at beta-blocker initiation was 3.25 months (range 0.75-18.5). In those who completed treatment, the median duration of therapy was 10.63 months (range 3.25-28.25), and the median maximal dose given was 1.5 mg/kg/day for propranolol, and 1.6 mg/kg/day for atenolol. 98 patients (93.3%) responded to therapy with size reduction, color changes, softened texture, and/or healing of ulceration. 11.4% of

patients received one or more additional treatment modalities including steroids, surgical debulking, and/or embolization. 21.9% had rebound growth requiring another course of beta-blocker therapy. Side effects from beta-blockers included cool extremities (26.7%), irritability (17.1%), lower GI upset (14.3%), emesis (11.4%), hypotension (10.5%), poor feeding (7.6%), lethargy (4.8%), bronchospasm (0.95%), and rash (0.95%). Resolution of the primary indication occurred in 88 individuals (83.8%) and took a median time of 3 months (range 0.5-17.5).

**CONCLUSIONS:** The treatment of infantile hemangiomas with beta-blocker therapy is generally well-tolerated. Almost all patients demonstrated a response to treatment. The use of beta-blockers is rapidly becoming a mainstay in the treatment of difficult hemangiomas.

#### Teaching Objective:

- Understand the role of beta-blocker therapy in managing patients with hemangiomas.

## 57

### PEDIATRIC FLEXOR TENDON INJURIES: A 10-YEAR ANALYSIS AT BRITISH COLUMBIA CHILDREN'S HOSPITAL

**J Arneja, S Sikora, M Lai**

**PURPOSE:** To determine the outcomes of pediatric flexor tendon injuries involving zones I, II and III over the past decade, and identify treatment paradigms that improve therapeutic outcome.

**METHODS:** A retrospective chart review between April 2001 and December 2010.

**RESULTS:** Forty-nine patients with a median age of 7.9 years (range 0.03-16) had 106 tendon injuries. 48 tendons injured were FDS, 47 FDP, 10 FPL and 1 APL. Zone III had the highest number of injuries (47), followed by zone II (39). 92 tendons were repaired with polyester, the most common size being 4-0. Modified Kessler repair was used in a majority of cases (68). 22 tendons had an epitenon repair. Splint immobilization was used in 32 patients, and a full cast in 17 patients. The median duration of immobilization was 4 weeks. 42 patients underwent post-operative hand therapy. Using the ASSH Total Active Motion (TAM) score, 42 out of 49 patients had complete recovery with no functional limitations. 2 patients had a score of less than 100%, not necessitating further surgery. A second operation was required for 5 patients. due to rupture (1), tenolysis (2) and two-stage tendon reconstruction (2). All patients in this group received 100% TAM at 1 year.

**CONCLUSION:** Pediatric flexor tendon injuries are rare but have excellent functional outcomes (95.9%). Repair technique chosen was related to the size of tendon involved and immobilization of young children for 4 weeks was determined to be safe. Of the patients requiring a second procedure, no link was found between outcome, cause, location, repair, rehabilitation protocol or zone of injury.

#### Learning Objectives:

- List the common causes of pediatric flexor tendon injuries.
- Describe the commonly used repair methods for pediatric flexor tendon injuries.
- Discuss post-operative immobilization and rehabilitation for different age groups.

## 58

### NERVE TRANSFER FOR OBSTETRICAL BRACHIAL PLEXUS INJURIES: OUTCOMES OF SPINAL ACCESSORY NERVE TO SUPRASCAPULAR NERVE TRANSFER USING A POSTERIOR APPROACH VERSUS AN ANTERIOR APPROACH

**R Guilfoyle, A Ladak, M Morhart, M Chan, J Olson**

**PURPOSE:** The purpose of this study is to compare functional outcomes of spinal accessory nerve to suprascapular nerve transfer using a posterior approach versus an anterior approach. We hypothesize that a posterior approach has improved functional outcomes due to the release of the suprascapular ligament, a theoretical point of compression, and a more distal site of coaptation. Outcomes are measured

using active movement scale (AMS) scores in external rotation and abduction of the affected shoulder.

**METHOD:** A retrospective chart review is actively underway on all patients who sustained upper trunk obstetrical brachial plexus injury and were referred to the Edmonton Brachial Plexus Clinic and the Alberta Children's Hospital between 2000 and 2010. Patients who underwent repair of a total brachial plexus injury were excluded from the study.

**PRELIMINARY RESULTS:** A total of nine patients in the posterior approach arm had improved function from baseline. At 12 months, mean AMS scores for external rotation had improved from 1.8 to 5 ( $p < 0.01$ ), while shoulder abduction improved from 3.6 to 5.3 ( $p = 0.054$ ). Complete data collection for patients in the anterior approach arm is still pending. To date, the mean improvement in AMS scores for external rotation is 1 to 2 and for shoulder abduction 2 to 3.

**CONCLUSIONS:** While more data is still being collected for our study, preliminary results show that the posterior approach is met with improved functional outcomes in external rotation and shoulder abduction.

#### Learning Objectives:

- This study will allow the reader to become familiar with the two types of upper trunk reconstruction performed for obstetrical brachial plexus injuries and their associated functional outcomes.

## 59

### LIVING WITH SMALL BREASTS: AN OBJECTIVE PROSPECTIVE OUTCOME STUDY

**H Sinno, A Izadpanah, A Izadpanah, S Thibaudeau, Y Tahiri, S Lin, K Schwarz, G Schwarz**

**PURPOSE:** Augmentation mammoplasty is the most frequently performed aesthetic surgical procedures in North America. Our goal was to objectify the quality of life of patients living with severe breast hypoplasia that may be enhanced by augmentation mammoplasty surgery.

**METHODS:** Three validated quality of life utility score measures [visual analogue scale (VAS), Time-trade off (TTO), and standard gamble (SG)] were used in this prospective survey to determine the utility scores of living with severe breast hypoplasia from a sample of the general population and medical students. Utility scores for monocular blindness (MB) and binocular blindness (BB) were determined to validate and compare the scores and rule out erroneous responses. Utility scores were compared using the paired t-test. Linear regression was performed using age, race, and education as independent predictors of each of the utility scores.

**RESULTS:** The utility scores (VAS, TTO, SG) for severe breast hypoplasia from our 102 volunteers measured ( $0.89 \pm 0.15$ ,  $0.93 \pm 0.11$ , and  $0.93 \pm 0.10$ , respectively). These were higher ( $p < 0.005$ ) when compared to those of MB ( $0.67 \pm 0.16$ ,  $0.83 \pm 0.20$ , and  $0.84 \pm 0.18$ , respectively) and BB ( $0.36 \pm 0.20$ ,  $0.62 \pm 0.29$ , and  $0.62 \pm 0.29$ , respectively). Utility scores (VAS, TTO, SG) between medical students ( $n = 6$ ) ( $0.96 \pm 0.07$ ,  $0.95 \pm 0.04$ , and  $0.89 \pm 0.08$ ) and the sample from the general public ( $n = 96$ ) ( $0.93 \pm 0.10$ ,  $0.93 \pm 0.12$ , and  $0.89 \pm 0.16$ ;  $p = 0.375$ ,  $0.444$ , and  $0.647$ , respectively) did not differ statistically. Linear regression analyses showed that age was inversely proportional to the TTO, and SG utility scores ( $p < 0.05$ ), decreasing a utility score of 0.0232, and 0.0304 respectively for every year increase in life.

**CONCLUSIONS:** Our sample, if faced with living with severe breast hypoplasia have measured utility scores corresponding to a willingness to sacrifice a theoretical 2.5 years of life and to go through an augmentation mammoplasty surgery with a theoretical 7% chance of death. Furthermore, the older volunteers were more willing to sacrifice years of their remaining life and chance of death for a procedure such as bilateral breast augmentation.

#### Learning Objectives:

- Understand the importance and objectivity of utility scores
- Understand the impact of living with severe breast hypoplasia on quality of life
- Be able to apply utility scores to other health states



## 60 – GUEST SPEAKER

### RISK MANAGEMENT – DON'T TAKE CHANCES; MANAGE RISKS

#### Dave Williams

Williams believes in a “no error strategy,” which involves defining methods that establish zero tolerance for mistakes. Relying on his experience as an emergency room doctor and as an astronaut, he knows the catastrophic consequences that can happen when lives are at stake.

Dave Williams is one of the most accomplished astronauts ever to participate in the NASA space program. He has two space shuttle missions under his belt and also holds the Canadian record for spacewalks. With a passion for healthcare and risk management, prior to entering the Canadian Space Agency's program, Williams worked as an emergency room doctor and later as director of emergency services at Sunnybrook Health Sciences Centre in Toronto. In July 2011, Williams became President and Chief Executive Officer of Southlake Regional Health Centre.

## 61

### A REVIEW OF SUBCUTANEOUS MASTECTOMIES AND MALE CHEST CONTOURING – THE UBC EXPERIENCE

#### A Knox, A Ho, S Hynes, S Macadam, C Bowman

**PURPOSE:** To compare the clinical outcomes of female-to-male transsexual patients undergoing a concentric circular (CC) or a free nipple graft (FNG) technique.

**METHODS:** Retrospective review of all female-to-male transsexual patients who underwent bilateral subcutaneous mastectomies as part of UBC's Sex Reassignment program between 2005-2010. Logistic regression analysis was used to evaluate the odds of complications and revision surgery while controlling for confounders.

**RESULTS:** A total of 101 patients underwent 202 subcutaneous mastectomies (92 CC, 110 FNG). The groups were comparable for comorbidities with the exception of greater age and BMI in the FNG group. In accordance with our selection algorithm, the CC patients had smaller, less ptotic breasts with better elasticity. After adjusting for age and BMI there was 2.1 times the odds of revision surgery (95% CI 1.9, 2.6; p-value <0.0001) as well as a 4.7 times the odds of a complication (95% CI 4.4, 5.2; p-value <0.001) amongst the CC group compared to the FNG group.

**CONCLUSION:** The CC group is associated with higher rates of complications and need for revisional surgery despite more favorable pre-operative characteristics. Despite higher rate of complications and need for revisions, the CC technique remains the preferred procedure due to fewer scars, more natural NAC, & potential for retained nipple sensation. Identification of high risk patients within this group would allow modification of selection algorithm to optimize outcomes.

#### **Learning Objectives:**

- Participants will appreciate current operative techniques for female to male chest contouring and understand the selection algorithm for optimizing clinical and aesthetic outcomes in these patients.

## 62

### INTERNATIONAL PREDICTORS IN RATES OF RECONSTRUCTION FOLLOWING PROPHYLACTIC MASTECTOMY IN BRCA1 AND BRCA2 MUTATION CARRIERS

#### J Semple, K Metcalfe, S Ping, S Narod

**OBJECTIVES:** Breast reconstruction (BR) is a common option for women with BRCA1 and BRCA2 that choose prophylactic mastectomy (PM) as a means of cancer prevention. Predictive factors for BR following PM in women with mutations from 9 countries are identified.

**METHODS:** Women with a BRCA1 or BRCA2 mutation completed a questionnaire after receiving their genetic test result and data were gathered regarding their preventive practices. Information was recorded on PM and BR. Eligible subject were drawn from an

international database of carriers of deleterious mutations in either the BRCA1 or the BRCA2 gene. Women have been assessed for genetic risk at 41 centers within 9 countries (Austria, Canada, France, Italy, Norway, Holland, Poland and USA and were found to have BRCA1 or BRCA2 mutations. The 1659 eligible subjects were reclassified into two groups (cancer and non cancer).

**RESULTS:** Of the 1659 women with BRCA1 and BRCA2 mutations 1123 (69.1%) had PM. Of the 655 women without breast cancer who had PM, 517 (78.9 %) had BR. Women without breast cancer had PM at younger age 42.5 (20-77) in comparison to women with a diagnosis of breast cancer 44.6 (23-79). There were large differences in the uptake BR by country of residence. Utilization of BR was higher in European countries (80%) compared to Canada (66.9%) and USA (71%). BR with implants was the preferred method both in European and North American countries following PM.

**CONCLUSIONS:** BR is accepted method as an acceptable option when choosing PM as a preventive measure. There were large differences in the uptake of BR by country of residence.

#### **Learning Objectives:**

- Participants will be able to identify reconstruction options for BRCA1 and BRCA2 patients. Participants will be able to describe differences in reconstruction in different countries. Participants will be able to identify predictive factors of reconstruction.

## 63

### QUALITY OF LIFE AFTER BREAST REDUCTION SURGERY: A RETROSPECTIVE ANALYSIS UTILIZING THE BREAST Q QUESTIONNAIRE: DOES BREAST SIZE MATTER?

#### MA Gonzalez, LT Glickman, J Tan, LR Simpson

**BACKGROUND:** We hypothesize that breast reduction surgery has a high satisfaction rate, and that BMI, and the amount of breast tissue removed should not alter this outcome. The purpose of this study was to determine if there is an improvement in Quality of life in patients undergoing breast reduction surgery, and whether breast volume or patient size influences this outcome.

**METHODS:** A retrospective chart review was performed on 600 consecutive patients at a single institution. Patients were mailed The Breast Q questionnaire to complete, and then were followed by a telephone call. Demographic, surgical and clinical data were collected and entered into a data base. Descriptive Statistical analysis was conducted using SAS Software version 9.1.3 with statistical significance determined at p<0.05.

**RESULTS:** A total of 178 surveys were returned and included in our study. Patient data included a mean BMI of 28.3 ± 4.6 (kg/m<sup>2</sup>), and mean total amount of breast tissue removed of 1220.9 ± 665.4 (grams). The primary indications for patients having breast surgery were for: symptomatic macromastia (85%), asymmetry (5.6%), and for cosmetic reasons (2.5%). The Breast Q questionnaire demonstrated patients overwhelmingly agreed that they were satisfied with their breast surgery. The mean response was 2.8 with a standard deviation of 0.47 (where 1=disagree; 2 = somewhat agree; 3 = definitely agree). Patient BMI and total amount of breast tissue removed had a statistically significant positive correlation (0.479; P<0.0001). There was no statistically significant difference between the amount of total breast tissue removed and patient response. (p=0.57).

**CONCLUSIONS:** Over 95% of the patients surveyed were satisfied with their surgery, and would do it again. Quality of life improved regardless of the amount of breast tissue removed. This study suggests that the size and weight of the patient has no impact on this outcome. As we face new government and insurance restrictions for surgeries that have both cosmetic and reconstructive value, patient reported outcome studies may have an influence on future third party payer commitments to authorizing surgery on this group of patients.

#### **Learning Objectives:**

- This outcome study suggests that the size of the patient, and the size of the breasts in breast reduction surgery, does not have a significant role in determining patient satisfaction.

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# THE EFFECT OF REDUCTION MAMMAPLASTY ON PULMONARY FUNCTION: A SYSTEMATIC REVIEW AND META-ANALYSIS

**J Klok, M Allen, R Hodder**

**PURPOSE:** The impact of reduction mammoplasty on lung function has been studied and may be an important benefit of this surgery. As health resources are becoming increasingly scarce, we need to investigate specific outcomes to show the value and necessity of certain procedures. The goal of this study was to systematically review the literature for studies evaluating pulmonary function following bilateral breast reduction (BBR) and determine effect through meta-analysis.

**METHODS:** The databases MEDLINE, CENTRAL, EMBASE, and CINAHL were searched electronically. Studies were eligible if they were randomized controlled trials (RCTs) or cohort studies evaluating pulmonary function following BBR. Full-text selection and data abstraction were carried out by two reviewers independently and in duplicate. A meta-analysis of studies was conducted when possible.

**RESULTS:** Five eligible studies were identified—one RCT and four prospective cohort studies. Three studies were included in the meta-analysis. Pooled results were significant ( $p=0.03$ ) for peak expiratory flow rate (PEFR) in the pre and post surgery comparison. There was no significant difference in the remainder of the pooled data. Similarly, BBR did not show an effect on lung function in the individual studies (one RCT, one cohort) that were not included in the meta-analysis.

**CONCLUSIONS:** There is some evidence in the literature to show improvement in pulmonary function following BBR. However, studies to date are not adequately powered to show a difference. Additionally, only static and not dynamic respiratory parameters were considered. Future studies can improve on methodology, as well as measurements of other relevant domains of pulmonary function.

## Learning Objectives:

- To consider the potential benefit of BBR on pulmonary function as an outcome to support this procedure
- To review the literature and be made aware of the need for future research in this area

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# BRITISH COLUMBIA ADULT MAJOR BURN CLINICAL PRACTICE GUIDELINES

**T Gregory, MP Vu, DD Sweet, EN Vu, V Dhingra, R Brown, A Papp**

**PURPOSE:** Major burns are associated with significant morbidity and mortality, and can consume substantial resources. Much attention has been placed recently on the first 24hrs of burn care, and how this crucial time period can affect acute and long-term outcomes. The goal of this literature review was to improve patient care through the development of Clinical Practice Guidelines.

**METHODS:** Following PRISMA methodology, an in-depth search of articles on the early management of burns patients was conducted. Standard definitions for major burns applied (i.e. partial- or full-thickness 20% TBSA any age group, >10% TBSA ages <10 or >50yrs, burns to hands, face, feet, genitalia, joints, full-thickness burns >5% any age, electrical/chemical burns, inhalation injury, burns associated with major trauma).

**RESULTS:** After screening 25 articles for eligibility, 8 articles were included for review. A multidisciplinary team of physicians representing burns & plastic surgery, trauma surgery, ICU, ER, anaesthesiology, and EMS reviewed content and developed the first set of Major Burns Clinical Practice Guidelines (CPG) for our province. Highlights from these guidelines include use of a resuscitation formula (set starting rate 3cc/kg/TBSA for the first 24 hrs post-burn), strict urine output goals (30-50cc/hr) with selective, early use of colloids to mitigate risk associated with high-volume crystalloid resuscitation, and use of the Lund-Browder system for more consistent estimation of TBSA.

**CONCLUSION:** Major burns are associated with significant morbidity and mortality. Recent literature highlights the risk of both

under- and over-resuscitation in acute and sub-acute phases. We present the first known Canadian major burns CPGs in an attempt to provide more consistent evidence-based, rationale-guided, best practice for rural and urban practitioners.

## Learning Objectives:

- Participants will gain an understanding of current approaches to caring for major burn patients.
- Participants will learn how the multidisciplinary model can be applied to improve patient care.

66

# RHINOPLASTY IN THE BURNED NOSE

**J Bouguila, R Viard, CH Qoc, JL Foyatier**

**INTRODUCTION:** The nose is the prominent central organ of the face, which has crucial effect on Aesthetic appearance. This organ is particularly exposed to facial burn accidents due to its situation. The aim of our study is the discussion of how rhinoplasty can be done safely in these victims with pleasing outcome.

**MATERIEL AND METHOD:** We present 10 cases, with complete or subtotal nasal burn. Classic aesthetic rhinoplasty operations were performed to create a better appearance and correct any internal or external deviations. Standard view photographs were taken before and after operation. Patients and surgeon satisfaction were asked and recorded.

**RESULTS:** Ten patients were operated, 9 women and 1 men whose noses had burn scar or has been grafted with split thickness skin or reconstructed with frontal flap. Patient age ranged from 18 to 46. We performed the classic rhinoplasty operation to create a better appearance and correct any internal or external deviations. These procedures are carried out under severely burned skins, or previously grafted and reconstructed noses. Cases were followed for about a 9 months period. The cosmetic results, discussed by 3 surgeons and subjective patient feelings, were considered satisfactory in 90% of cases.

**DISCUSSION:** It is a common belief that surgical intervention under the scarred or grafted nose is risky and may result in skin or covering graft necrosis. It should be noted that nasal skin flaps should be thick enough to prevent probable necrosis in distal part. The other problem in these cases is the rigid covering grafted or scarred skin, which is less pliable to take the form of the modified osteocartilagenous skeleton.

**CONCLUSION:** Rhinoplasty seems to complete and improve the results of the standard surgical approach in burned face.

## Learning Objectives:

- Functional and esthetic particularities of burned nose
- Techniques for safely rhinoplasty in burned nose

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# CORRELATION OF INHALATION INJURY SEVERITY WITH ADVERSE OUTCOMES

**O Ho, R Cartotto, D Woodster**

**PURPOSE:** While it is recognized that the presence of smoke inhalation worsens the prognosis of a burn patient, it is not known if the severity of the inhalation injury correlates with outcomes. This study aims to assess whether a correlation exists between inhalation injury grade and various clinically important morbidity and mortality outcomes.

**METHODS:** A retrospective chart review was performed on patients meeting the inclusion criteria over a two year period from January 1, 2008 to December 31, 2009. Patients' inhalation injuries were graded using the Abbreviated Injury Score (AIS). Baseline characteristics between inhalation injury grades were assessed for differences. Primary and secondary outcome measures include total fluid resuscitation volume in the first and second 24 hours post-burn, oxygenation, airway pressures, base deficit, lactate, pneumonia, ARDS, tracheostomy, reintubation, rescue ventilation, duration of mechanical ventilation, length of stay, and survival.

**RESULTS:** Fifty patients were included in the study. There was a statistically significant correlation between the severe injury group and total fluid resuscitation volume at the second 24 hours after burn ( $p=0.039$ ), worst base deficit ( $p = 0.027$ ), and worst serum lactate ( $p=0.020$ ). Patients with severe inhalation injury generally showed poorer oxygenation.

**CONCLUSIONS:** While it is established that the presence of inhalation injury increases morbidity and mortality, research regarding whether the severity of inhalation injury has any bearing on outcome remains scarce. This study helps to validate the use of bronchoscopy determined AIS by showing a correlation between grades and certain outcomes.

**Learning Objectives:**

- Participants will be able to identify the inhalation injury severity grades in the AIS.
- Participants will be able to recognize the clinical importance of inhalation injury severity grades.
- Participants will be able to discuss whether to implement the AIS in their practice.

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**DONOR-SITE MORBIDITY OF THE IGAP FLAP FOR BREAST RECONSTRUCTION IN TEENAGERS**

**F Godbout, L Caouette-Laberge, I Farmer, P Bortoluzzi**

**PURPOSE:** Few options are available for autologous breast reconstruction in teenagers, outside of the buttock area. Donor-site morbidity of the inferior gluteal musculocutaneous flap has been studied in 2007 by our team. The aim of this study is to objectively evaluate and compare the impact in preserving the gluteus maximus muscle and minimizing the zone of dissection with the inferior gluteal artery perforator (IGAP) flap.

**METHOD:** A retrospective review was performed of all IGAP flaps for breast reconstruction in teenagers between June 2006 and April 2011 in our institution. Patients were then appointed for a physical evaluation and questionnaire on aesthetic and functional outcomes.

**RESULTS:** Thirteen records and eleven photographic charts were reviewed. Lateral buttock asymmetry/flattening was noticeable in eight of eleven cases. Three patients had a lower displacement of the inferior gluteal crease. All six patients available for the appointment presented with a zone of dysesthesia or hypoesthesia in the territory of the operated buttock and/or posterior thigh. No motor impairment was found. The questionnaire, filled out by eight patients, showed that six were satisfied or very satisfied with the surgery. Appearance of the operated buttock was rated 3,44 on a scale from 1 to 5 (5 being normal) compared to normal side.

**CONCLUSIONS:** The IGAP flap remains a good option for breast reconstruction in slim teenagers. Our results did not show improvement regarding dysesthesia and hypoesthesia in the buttock and posterior thigh region when compared to the musculocutaneous flap. However, the lateral depression visible when harvesting the gluteus maximus muscle is much less significant with the perforator flap.

**Learning Objectives:**

- At the end of this presentation, participants will be able to give an alternative to the DIEP/TRAM flaps for autologous breast reconstruction in thin patients and explain benefits and drawbacks of the IGAP flap in the pre-operative consent.

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**CEPHALOMETRIC LONG-TERM SURGICAL OUTCOMES IN HEMIFACIAL MICROSOMIA PATIENTS**

**C Caro, B Tompson, A Fattah, J Phillips**

**BACKGROUND:** The term, Hemifacial Microsomnia, encompasses a spectrum of disorders characterised by the hypoplasia or aplasia of 1st and 2nd branchial arch derivatives. When unilateral, the hallmark of this condition clinically is facial asymmetry, which reflects the involvement of soft, skeletal and neuromuscular tissues. One of the

major functional issues on skeletal maturation is malocclusion, which is largely the result of mandibular and maxillary hypoplasia but is also contributed to by the hypoplastic muscles of mastication. This manifests as facial symmetry, deviation of the chin to the affected side, a marked occlusal cant and cross-bite sometimes associated with anterior open bite. Orthognathic surgery in this subset of patients is extremely challenging due to multiple previous surgeries, poor bone stock and the quality of the soft tissues.

**OBJECTIVE/AIM:** To determine the long-term cephalometric outcome of orthognathic surgery in patients with Hemifacial Microsomnia with regard to stability of Lefort I and bilateral sagittal split osteotomy (BSSO) movements and correction of occlusal cant.

**METHODS AND MATERIALS:** A review of all hemifacial cases at the Hospital for Sick Children treated by a single surgeon (JP) between the years 1993-2006 was performed. Complete Posterior-Anterior (PA) cephalometric and orthodontic records were assessed at three time-points: Pre-surgery (T1), immediately post-surgery (T2) and at least 1 year post-surgery (T3). PA Cephalograms were assessed for mandibular offset (distance of mandible from midline), Condyle to Menton (Co-Me) distance (a composite measurement reflecting both horizontal and vertical mandibular movement) and the Right and Left A6 molar height (reflection of occlusal plane). The net movement (T1 to T3), surgical movement (T1 to T2) and relapse (T3 to T2) were calculated for each patient. A two-sided 95% confidence interval was constructed for the mean difference in cephalometric variables and p-values calculated.

**RESULTS:** A total of 20 patients with Hemifacial Microsomnia were identified as having undergone orthognathic surgery performed by the senior author (JP) between 1993-2006. Only 9 of these met the inclusion criteria of this study. Six of these were right-sided cases, 2 left sided and one was bilateral. The mean age of the patients at surgery was 18 years and 4 months.

All 9 patients had undergone Lefort I osteotomy and BSSO with 5 of them undergoing a (vertical reduction) genioplasty performed either at the time of the surgery or at a later stage. The mean net chin point (mandibular offset) movement (T1 to T3) was 8.8mm with good correction of the chin point toward the midline. The majority of this correction was due to the net setback of the mandible on the unaffected/less affected site rather than a stable advancement on the affected side. This was reflected by a negligible net change in Co-Me on the hemifacial side (0.2mm) but with a marked reduction in the Co-Me on the contralateral side (5.5mm). The mean net extrusion of the maxilla on the hemifacial side was 2.7mm, with contralateral net intrusion being negligible but the overall correction of the occlusal plane was acceptable with an improvement of right and left molar height difference and correction of anterior-open and cross bite. There was marked relapse of the mandibular advancement on the affected side.

**DISCUSSION:** Orthognathic surgery in hemifacial microsomnia is effective in correcting the chin point toward the midline. While there is significant relapse of the mandibular advancement on the affected side the movement of the chin point to the midline is predominantly due to the stability of the mandibular setback on the unaffected side. The partial correction of the cant, anterior open bite and cross bite suggests that while the soft tissues resist movement, and relapse is significant, surgery in these patients is beneficial. A significant proportion may require another procedure to address remaining deformities.

**Learning Objectives:**

- Participants will be able to describe the occlusal and skeletal relationship found in patients with hemifacial microsomnia.
- Participants will learn how to examine long-term outcomes in facial skeletal orthognathic movements.
- Participants will begin to understand the skeletal relapse that may be expected in the orthognathic surgical treatment of patients with hemifacial microsomnia.



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## THE NDA CLASSIFICATION SYSTEM OF AURICULAR DEFORMITY

**S Vrouwe, G Wilkes, J Olson, E Lam, A Arkoubi**

**PURPOSE:** Several classification systems for auricular deformity have been previously developed. Those currently in use are based on either anatomical location, severity of the deformity, or surgical approach, largely focusing on congenital anomalies. We propose a system that references both location and severity, applies to all deformities irrespective of etiology, and permits easy coding into a database.

**METHODS:** The ear is divided into seven anatomic subunits, each with unique reconstructive requirements: the lobule (1), the middle (2) and superior (3) helical rim, the upper (4) and lower (5) scaphal antihelical fold, the conchal region (6) and the tragus (7). Each subunit is characterized as Normal, Deformed, or Absent (NDA). Etiology is coded as congenital, traumatic, burn, oncologic, or miscellaneous (C-T-B-O-M). Further, lobule size, preauricular tags, and features of the external meatus are documented, along with any bilateral deformities.

**RESULTS:** The NDA classification system simultaneously provides a visual representation of an auricular deformity and a short alphanumeric code (eg, microtia = C:1D2-7A, basal cell carcinoma = O:2-5D, helical rim burn = B:2-3A). A database was constructed using FileMaker Pro, designed for user-friendly data collection in the clinic. Data is standardized automatically and sorted to permit easy comparison of deformity patterns, etiology, and treatment outcomes.

**CONCLUSION:** The NDA classification system of auricular deformity unifies previous systems and attempts to resolve shortcomings in their usage. Designed to be independent of surgical approaches, it should remain useful as surgical techniques change. In addition, it is easily coded into database software in the setting of office charting and clinical research.

### Learning Objectives:

- To explore the strengths and weaknesses of previous auricular deformity classifications.
- To describe the basis of the NDA classification system for auricular deformity.
- To demonstrate the utility of the NDA system in a clinic or research database.

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## Canadian Expert Presentation

## AN EVIDENCE BASED ALGORITHM FOR SELECTION OF BREAST IMPLANTS

**F Lista**

### Learning Objectives:

- The participant will learn the differences in performance between saline and silicone devices. The participant will be able to identify the risks and complications associated with smooth and textured devices and will be able to apply an algorithm to the selection of the correct implant on the individual patient based on the current knowledge base surrounding breast implant surgery.

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## RECONSTRUCTION OF COMPLEX PEDIATRIC CRANIAL VAULT DEFORMITIES WITH CAD/CAM ALLOPLASTIC IMPLANT TECHNOLOGY

**D Khechoyan, D Forrest**

**PURPOSE:** To review a single-center, large-volume experience with pediatric cranial reconstruction utilizing CAD/CAM alloplastic implant technology.

**METHODS:** A retrospective review of consecutive patients (n=42, 23M:19F) treated in our center from 2001 to 2011 was performed, noting age at operation, type and size of implant, indications for cranio-plasty, operative details, and any complications, among other variables.

**RESULTS:** The majority of patients underwent delayed cranial vault reconstruction following a decompressive craniotomy for trauma or tumour (n=31, 74%), while 26% (n=11) underwent reconstruction following cranial vault reshaping for synostosis. Mean age at the time of reconstruction was 10.5±5.1 years (range 2.75 – 20.1 years). Mean implant size was 64.9±38.2 cm<sup>2</sup>. Mean operative time was 199±54 minutes (131 – 305 minutes), while average length of stay was 3.8±2.1 days (3 – 10 days). Average follow-up was 20.1 months. Post-operative surgical site infections were rare.

**CONCLUSIONS:** CAD/CAM alloplastic implant technology is a safe, effective, and reliable method of cranial vault reconstruction in the pediatric population. This technology eliminates donor site morbidity and allows for surgical management of extensive and complex pediatric cranial vault deformities.

### Teaching Objectives:

- To review the indications, surgical planning and operative technique of CAD/CAM technology in complex pediatric cranial vault reconstruction.
- To delineate singular advantages and disadvantages of particular forms of alloplastic cranial implants (eg, HTR-PMMA vs PEEK).
- To communicate long-term follow-up results from our series and convey "lessons learned" from a large-volume, single-surgeon experience.

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## ANATOMIC RECONSTRUCTION OF THE PARALYZED LOWER EYELID – INITIAL OUTCOMES USING A NOVEL CRANIOFACIAL TECHNIQUE

**M Moses, J Yoo, D Matic**

**PURPOSE:** Ectropion following lower eyelid paralysis is often bothersome to the patient since the paralyzed orbicularis muscle allows the entire lower eyelid to fall away from the globe. In addition to increased exposure of the cornea, the medial component of the ectropion prevents effective drainage of lacrimal secretions leading to increased tearing. Available surgical techniques commonly address only the lateral ectropion, and therefore the results are often unsatisfactory. Furthermore, any benefit is often only temporary, and the patient frequently requires revision surgery.

**METHOD:** To address these problems, we have developed a procedure that incorporates craniofacial techniques used to treat fractures of the naso-orbito-ethmoidal complex. A tendon graft (palmaris or plantaris) is threaded along the lower eyelid margin and anchored both to the lateral orbital wall and trans-nasally, to elevate the eyelid to the level of the lower limbus. This anatomical re-suspension of the lower eyelid leaves it apposed to the globe along its entire length.

**RESULTS:** The first 11 patients to undergo lower lid suspension with this technique were reviewed. Follow-up ranged from four to 39 months. All had normal lid position restored compared to the unaffected eye. One patient had some increased laxity on snap test at three months comparable to immediately postoperatively. All patients were extremely pleased with the results of their surgery.

**CONCLUSION:** The novel technique described provides a durable solution to the difficult problem of ectropion following paralysis of the lower eyelid. It addresses both the medial and lateral components of the paralytic lower lid, with long-lasting relief of symptoms.

### Learning Objectives:

- Audience will understand the anatomy of the ectropion in the paralyzed eyelid.
- Audience will understand the limitations of traditional techniques of surgery for lower eyelid ectropion.
- Audience will be introduced to a new technique based on established craniofacial principles.

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# **THIGH DEFORMITY AFTER MASSIVE WEIGHT LOSS: AN ASSESSMENT OF HEALTH STATE STUDY**

A Izadpanah, H Sinno, J Vorstenbosch, S Thibaudreau, S Lin

**PURPOSE:** The presence of excess skin following massive weight loss, particularly in the thighs, not only contributes to a negative body image but can also lead to functional deficits in mobility. In the present study, we quantified the health state utility of living with excess skin in the thighs in an attempt to objectively establish the burden on the quality of life in patients living with abnormal thigh contouring.

**METHOD:** Using visual analogue scale (VAS), time trade-off (TTO), and standard gamble (SG) the utilities for thigh-lift were compared with monocular, and binocular blindness from a prospective sample of medical students and the general population. Utility scores were compared using paired t-test. Linear regression was performed using age, race, and education as independent predictors of each of the utility scores.

**RESULTS:** One hundred thirty-four participants were enrolled over a six months period, out of which 112 met our inclusion criteria. The utility outcome scores for thigh lift (VAS, TTO, SG:  $0.77 \pm 0.15$ ,  $0.90 \pm 0.11$ ,  $0.89 \pm 0.14$ , respectively) were statistically different from binocular blindness (VAS, TTO, SG:  $0.37 \pm 0.18$ ,  $0.70 \pm 0.23$ ,  $0.70 \pm 0.26$ , respectively;  $p < 0.001$ ), but other than VAS ( $0.67 \pm 0.15$ ,  $p < 0.001$ ), similar to monocular blindness (TTO, and SG:  $0.89 \pm 0.13$ , and  $0.81 \pm 0.14$ , respectively;  $p > 0.05$ ). SG ( $0.89 \pm 0.14$  versus  $0.97 \pm 0.02$ ;  $p = 0.003$ ) and TTO ( $0.89 \pm 0.11$  versus  $0.95 \pm 0.03$ ;  $p = 0.038$ ) were different general population and medical students, respectively, corresponding to 3.96 versus 1.80 years to sacrifice ( $p < 0.05$ ). Additionally, SG was higher in Caucasians versus non-Caucasians who were willing to take an 8% chance of mortality compared to 15%;  $p = 0.001$ )

**CONCLUSIONS:** We have objectified the utility of living with thigh deformity after massive weight loss. Our sample population if faced with the condition was willing to sacrifice 3.6 years of life and to take a procedure with an 11% chance of mortality.

## **Learning Objectives:**

*Participants will be able to*

- Understand the significance of different common utility scores
- Appreciate the burden of abnormal thigh contouring on quality of life assessed from a sample of general population and medical students

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# **THE PEDICLED MASSETER MUSCLE TRANSFER FOR SMILE RECONSTRUCTION IN FACIAL PARALYSIS: A NEW SURGICAL TECHNIQUE**

D Matic, J Yoo

**PURPOSE:** To introduce the pedicled masseter muscle transfer (PMMT) as a new reconstructive option for dynamic smile restoration in patients with long standing irreversible facial paralysis. The masseter muscle is detached from both its origin and insertion and transferred to a new position to imitate the function of the native zygomaticus major muscle.

**METHODS:** Part one of this study consisted of cadaveric dissections of 4 heads (eight sides) in order to determine whether the masseter muscle could be a) pedicled solely by its dominant neurovascular bundle and b) repositioned directly over the native zygomaticus major. The second part of the study consisted of clinical assessments in three patients in order to confirm the applicability of this muscle transfer. Commisure excursion and vector of contraction following PMMT were compared to the non-paralyzed side.

**RESULTS:** In all eight cadaver sides, the masseter muscles were successfully isolated on their pedicle and transposed on top of and in-line with the ipsilateral zygomaticus major. The mean length of the masseter and its angle from Frankfurt's horizontal line after transposition compared favorably to the native zygomaticus major muscle. In the clinical cases, the mean commissure movements of the paralyzed and normal sides were 7 mm and 12 mm respectively. The mean angles

of commissural movement for the paralyzed and normal sides were 620 and 590, respectively.

**CONCLUSIONS:** The PMMT can be used as a dynamic reconstruction for patients with permanent facial paralysis. As we gain experience with the PMMT, it may be possible to use it as a first-line option for patients not eligible for free micro-neurovascular reconstruction.

## **Learning Objectives:**

- Participants will better understand the anatomy of the masseter muscle and how it can be used as a flap based only on its vascular pedicle. In addition, they will be able to understand the importance of the vector of pull of the oral commissure during smile reconstruction.

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# **IMPLEMENTATION OF A MICROSURGICAL MONITORING SYSTEM**

G Landes, E Boghossian, J BouMerhi, A Gagnon, P Harris, A Danino

**PURPOSE:** In January 2007, the World Health Organisation adopted surgical safety as the theme for the 2nd global patient safety challenge. Evaluation of surgical services was identified among the four surgical care areas in need of improvements. In fact, the lack of standardized data establishing a routine monitoring of capacity, volume and surgical outcomes is one of the most notable gaps. Aware of this challenge, an interactive surgical follow-up platform (PICS) – which aims at ensuring consistency of care, accessibility and sustainability of data – was implemented. The research hypothesis was to reduce the short-term failure rate of microsurgical reconstruction procedures.

**METHOD:** In May 2010, major guidelines for free flaps surgical management were drawn. Based on these, a tool for capturing and analyzing data (PICS) – accessible on the hospital's intranet – was established. All patients who underwent free flap reconstruction were registered in the platform. The primary endpoints to evaluate the effectiveness of this tool are the rates of surgical re-exploration and complete necrosis of the flap.

**RESULTS:** From May 2010 to December 2011, 129 cases of free flap reconstruction were recorded. The rate of total flap necrosis was 10.0% before the database was introduced and declined to 3.1% afterward ( $p < 0.05$ ). Surgical re-exploration occurred in 27.0% of free flap reconstructions at baseline and in 10.1% after introduction of the platform ( $p < 0.01$ ).

**CONCLUSION:** The implementation of PICS is associated with a significant improvement of postoperative outcomes in free flap surgery. This tool is effective to evaluate care services and provides an increased surgical safety for patients.

## **Learning Objective:**

- At the end of this lecture, the learner will be able to consider the value of a microsurgical surveillance system in the evaluation of surgical services and the management of patients' safety.

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# **SELF EFFICACY IS A DETERMINANT OF POST-DECISION REGRET FOLLOWING DELAYED POSTMASTECTOMY BREAST RECONSTRUCTION**

E Starenkyj, T Zhong, J Hu, K Butler, K Metcalfe, S Hofer

**PURPOSE:** Patients undergoing breast reconstruction have varying levels of knowledge seeking behavior, a characteristic known as self-efficacy (SE). The purpose of this study was to investigate the relationship between SE and post-reconstruction regret in patients who had delayed postmastectomy breast reconstruction (PMBR).

**METHODS:** Consecutive patients who underwent delayed PMBR at a university hospital between January 2009 and March 2011 completed a demographic questionnaire, the Modified Stanford SE Scale and the Decision Regret Scale. Multinomial logistic regression analysis was used to detect the effect of SE on post-decision regret.

**RESULTS:** The decision regret scores of 98 participants (response rate=70%) were evaluated. No regret was reported by 60% (n=59), mild regret by 25% (n=24) and 15% (n=15) had moderate to severe

regret. The unadjusted mean SE score was 6.83 (sd 2.02) in those with moderate to severe regret compared to 8.20 (sd 1.75) with no regret and 7.57 (sd 1.67) with mild regret. After controlling for covariates (prior radiation, chemotherapy, active hormonal therapy, and highest level of education), each SE score unit increase reduced the odds of having moderate to severe regret by 39% (OR=0.61, p=0.01) compared to no regret.

**CONCLUSION:** Although most patients expressed no or mild post-treatment regret after undergoing delayed reconstruction, SE scores were significant negative predictors of post-treatment regret after controlling for the covariates. Our findings highlight the importance of recognizing the patients with low SE prior to surgery who may be at higher risk for developing post-treatment regret.

#### Learning Objectives:

- To understand self-efficacy and how it affects patient participation in a joint decision-making process with the plastic surgeon to undergo breast reconstruction.
- To understand decision regret, an important endpoint for evaluating decision-making in healthcare.
- To understand the emerging relationship between self-efficacy and decision regret in the context of delayed breast reconstruction.

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## ROSS TILLEY LECTURE

### THE CITY THAT NEVER LET ME SLEEP: TWO YEARS OF MICROSURGERY AND BIostatISTICS IN NEW YORK CITY

**L Snell**

I completed a two-year combined research and clinical fellowship in New York City from 2008-2010. The research component of the fellowship consisted of the completion of a Masters of Science degree in Clinical Research Methods at Columbia University, with a thesis under the supervision of Dr Andrea Pusic. The clinical component consisted of a one-year microsurgery fellowship at Memorial Sloan Kettering Cancer Center under the supervision of Drs P Cordeiro, J Disa, B Mehrara, A Pusic, and C McCarthy. I have since returned to practice in Canada at Sunnybrook Health Sciences Centre, University of Toronto, where my research focuses on patient reported outcomes, and my clinical practice focuses on the reconstruction of complex oncologic defects.

The 2008 Ross Tilley Fellowship was instrumental in allowing me to gain this invaluable education in oncologic reconstruction and patient outcomes, both of which are directly relevant to my current practice.

#### Learning Objectives:

- To describe the way that the 2008 Ross Tilley Scholarship was utilized.
- To present my fellowship experience in both research and clinical areas.
- To describe how I was able to complete my Master's degree, finish my microsurgery fellowship, and have a baby all within a short 2-year period while still experiencing much of what New York City has to offer.

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### BUSINESS MANAGEMENT EDUCATION IN PLASTIC SURGERY RESIDENCY

**R Chambers, D Peters**

**PURPOSE:** To identify areas of business administration education lacking in plastic surgeons and residents.

**METHODS:** A survey was conducted of 20 practicing plastic surgeons and 25 senior residents in plastic surgery. They were asked about areas of business which had been lacking under the current CanMEDs Manager Role specific to training to be a plastic surgeon which could have facilitated a more successful practice. Such domains included employment law, accounting, finance, human resource management, operations and organizational behaviour. Responses were compared between groups.

**RESULTS:** Both residents and practicing surgeons concurred that greater emphasis on finance, accounting and employment law would be beneficial in establishing and running a practice.

**CONCLUSION:** There is a paucity of management education in the current CanMEDs guidelines and otherwise in plastic surgery residency programs as it pertains to establishing and maintaining a successful career. Such education would ease the transition to practice and may improve efficiencies for practicing plastic surgeons.

#### Learning Objectives:

- To increase awareness of topics in business administration.
- To develop the groundwork for curriculum development in business topics within plastic surgery residencies.

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### LEADERSHIP TRENDS IN CANADIAN PLASTIC SURGERY: DO DIVISION HEADS AND PROGRAM DIRECTORS HAVE THE TOOLS NECESSARY TO PROVIDE EFFECTIVE LEADERSHIP?

**J Arneja, C McInnes, N Carr, P Lennox, R Petersen, D Skarlicki**

**PURPOSE:** Effective leadership is imperative in a changing health-care landscape driven by increasing expectations in a setting of rising fiscal pressures. As evidence suggests that leadership abilities are not simply innate, but rather effective leadership can be learned, it is prudent for Canadian plastic surgeons to evaluate the training and challenges of their leaders, as there may be opportunities for further support. This study investigates the practice profiles, education/training, responsibilities and challenges of leaders within academic Canadian plastic surgery.

**METHODS:** Following ethics approval, an anonymous online survey was sent to division heads and program directors from all 16 university-affiliated Canadian plastic surgery divisions. Question themes included demographics, education/training, job responsibilities and challenges.

**RESULTS:** A 74% response rate was achieved (17 responses). The majority of respondents were male (94%), promoted to their current position at a mean of 48 years, did not have a leadership focused degree (88%), directly manage 30 people (14 staff, 16 faculty) and were not provided with a job description (65%). Respondents worked an average of 65 hours per week, of which 18% was on their leadership role, 59% clinically, and the remainder on teaching, and research. A delta existed between time spent on their leadership role (18%) and related compensation (10%). Time management (50%) and system issues (25%) were described as the greatest daily challenges by respondents.

**CONCLUSIONS:** Several gaps were identified including gender imbalance, lack of formal leadership training and requisite skill set, and compensation. Leadership and managerial and skills are key CanMEDS competencies and this study provides evidence that academic departments may benefit by re-evaluating how they train, promote and support their leaders in plastic surgery.

#### Learning Objectives:

- The demographics, training, and practice characteristics of the leaders in Canadian plastic surgery.
- How leadership integrates within the CanMEDS framework.

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### FUNCTIONAL OUTCOME AFTER FLAP RECONSTRUCTION FOLLOWING UPPER LIMB SOFT TISSUE SARCOMA RESECTION

**SOP Hofer, C Payne, T Zhong, P Ferguson, A Griffin, J Wunder**

**BACKGROUND:** Upper limb preservation after radical sarcoma resection often requires flap reconstruction. The aim of this study was to compare pre- and one-year postoperative upper limb function after having shoulder, elbow or wrist/hand sarcoma resection and reconstruction with a pedicled or free-flap.

**PATIENTS:** Between 1989 and 2008, 113 patients underwent wide resection of an upper limb sarcoma requiring flap reconstruction. Perioperative morbidity, mortality and flap loss were studied. Functional



outcome measures were: Toronto Extremity Salvage Score (TESS), and Musculoskeletal Tumor Society Rating Scale (MSTS) 87 preoperatively and one year post-operatively. The type of flap and the correlation with functional scores was studied.

**RESULTS:** Patients underwent 64 shoulder, 27 elbow and 22 wrist/hand reconstructions, with 77 pedicled and 36 free flaps. Analysis of the post-operative MSTS 87 data (n=88) revealed no significant difference between free and pedicled flaps. A significant pre- to postoperative difference was observed on the MSTS 87 ( $p<0.001$ ) for six specific patients with joint ablating surgery and pedicled flaps and in five patients with radical vital structure extirpation and free flaps using the MSTS 93. For the TESS (n=84) there was no significant difference in any group with respect to overall change in functional activities. There were 11 patients with significant impairment of function on the MSTS 87 and both groups self-assessed as maintaining their function.

**CONCLUSION:** Reconstruction post sarcoma ablation to the upper limb maintains a satisfactory level of upper limb activity whether the defect is repaired with a pedicled or free flap. The TESS scores showed that patients consistently scored themselves functionally higher.

**Learning Objective:**

- *At the end of the presentation the audience will be able to describe the functional outcomes of upper limb flap reconstructions following soft tissue sarcoma resection.*

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### CANADIAN EXPERT PRESENTATION

#### THE EVOLVING ROLE OF PERFORATOR FLAPS IN RECONSTRUCTIVE SURGERY

**S Morris**

Over the past century, surgeons have gradually improved the reliability and quality of tissue transfers. Perforator flaps are the most recent stage of that evolution and represent our most sophisticated approach to flap surgery thus far. A perforator flap was initially defined as a musculocutaneous perforator flap since the vessels supplying the flap emerged through a muscle and were from a source vessel which supplied both the muscle and overlying skin. Gradually, the term perforator flap has become synonymous with isolated perforating vessels to the skin. In reconstructive microsurgery, it is obviously well known that tissues can be reliably transferred based on the skeletonized vessels supplying the flap. However, once the concept of individual perforators being used to supply tissue transfers, both local perforator flaps (also known as propeller flaps) and free perforator flaps throughout the body have been described. There are over 400 individual perforators supplying the human integument and each could potentially be used to supply a tissue transfer, depending on the diameter of the perforator, its expendability and size of the defect. Free style perforator flaps, based on whichever perforator is determined at the time of the surgery to be most appropriate, is a fairly new approach to reconstructive surgery based on the perforator flap concept. Perforator flaps have provided surgeons with an increased number and superior flap options for reconstructive challenges. Over the coming years, the role and value of individual flap options will be reported and debated, leading to an improved appreciation of the role of perforator flaps.

**Learning Objectives:**

- *The participant will understand the historical context of perforator flaps.*
- *The participant will gain knowledge of the pattern of perforators throughout the body and the concept of flap design*
- *The participant will understand the terms "free style free flap," "propeller flap," and "perforator to perforator flap transfer."*

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### OPERATION RAINBOW OUTCOME REVIEW

**K Rai**

The purpose of the review is:

1. to see the benefit of residents going on Operation Rainbow missions.
2. the value of participation in ORC missions.

Operation Rainbow Canada has serviced many countries in the last 15 years. Missions have taken place in China, India, Cambodia, Philippines, Mexico, and Lebanon. Over 2,000 patients have been treated in those areas with successful outcomes.

Surgeries done: cleft lip, cleft palate, unilateral and bilateral and palate combination surgeries, burn contracture management, deformities and miscellaneous operations.

All procedures were done in an operating room setting, where two operating room tables are placed in one surgical facility. The trips last approximately two weeks, with seven operating days lasting from approximately 07:00 to 18:00. Over 100 patients were treated at each mission. Rates of infection, wound breakdown etc were less than 1%. The operating room time for lip repair was one hour, and under two hours for cleft palate repair. The change-over times were very short, less than 15 minutes. The infection rates within the theatre were less than 1% or nil.

Plastic Surgery residents have exposure to varied cases with facial deformities. So far, 24 residents have gone on missions. They have been shown: 1) how to manage post-burn contracture treatment plan; 2) understanding and performing cleft lip and palate repairs; 3) this gave them a very good background in plastic surgery, and learning to work in a different environment; 4) to perform in adverse conditions; and 5) being aware of issues and problems around the world related to their specialty.

**CONCLUSION:** 1) Over 2,000 patients have been treated for facial deformities and post-burn contractures. 2) Infections and complications have been kept to less than 1%. 3) Residents in Plastic Surgery have all expressed positivity and appreciation for participating in the missions. 4) The plastic surgery residents have enriched their education in facial cleft surgery and post-burn contracture management. 5) The team has learned to work in adverse conditions, learned how to handle political and economic issues in these various countries 6) Learning compassion and commitment.

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### COMPETITIVE STRATEGIES IN PLASTIC SURGERY IN CANADA: THE ROLES OF COST LEADERSHIP AND VALUE DIFFERENTIATION IN THE CANADIAN AESTHETIC SURGERY MARKETPLACE

**I Maxwell, D Peters**

**PURPOSE:** In his 1980 book "Competitive Advantage" Harvard business professor Michael Porter describes two distinct strategies with which businesses attain profit: Cost Leadership and Differentiation. We investigated the apparent strategy used by plastic surgeons in Canada by examining their websites to look for a predilection towards one of these two strategies.

**METHOD:** Using the Canadian Society of Plastic Surgeons' list of plastic surgeons in Canada we examined the websites for all plastic surgeons in Canada and using pre-defined criteria attempted to determine how many surgeons used a cost leadership strategy versus a differentiator strategy.

**RESULTS:** Surgeons who listed prices on their websites, offered limited varieties of procedures, had offices in low rent areas and with obviously less expensive websites were put into the cost leadership category. Conversely those who advertised proprietary or less common procedures, had offices in high rent locales and had obviously expensive websites were labelled differentiators. Based on these criteria we found most surgeons used elements of differentiator strategy but some had aspects of cost leadership in their promotional strategies.

**CONCLUSION:** There is relatively little emphasis on business education in Canadian plastic surgery training. Armed with knowledge of the above strategies of cost leadership and value differentiation we believe that plastic surgeons could optimize their promotion strategies. Also we suggest that business strategy is an important part of the training of plastic surgeons in Canada that is currently underrepresented.

**Learning Objectives:**

- *At the end of this presentation the participant will be able to describe Michael Porter's concepts of cost leadership and differentiation, will be able to understand their applicability to plastic surgeons and will have additional tools to gain competitive advantage*

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**DEVELOPING A PATIENT-REPORTED OUTCOME MEASURE FOR CLEFT LIP AND/OR PALATE (CLEFT-Q): A CONCEPTUAL FRAMEWORK**

**K Wong, T Goodacre, C Forrest, A Pusic, S Cano, A Klassen**

**PURPOSE:** The goal of cleft surgery is to improve the physical, psychological and social well-being of patients with cleft lip and/or palate (CLP). The purpose of this study was to develop a conceptual framework for health concerns in patients with CLP as a first step towards creating the CLEFT-Q, a patient-reported outcome (PRO) instrument for this population.

**METHODS:** We conducted a systematic literature review to identify all health concepts important to patients with CLP. Our team then conducted in-depth qualitative interviews with children with CLP, aged 6-22, in three different countries. Interviews were transcribed verbatim and line-by-line coding was used to establish categories and themes. Constant comparison was used to examine relationships within and across codes and categories. Interviewing continued until no new themes emerged.

**RESULTS:** Our systematic review synthesized evidence from 26 studies and identified a range of health concepts important to this population. Patient interviews revealed a number of different concepts not identified in the systematic review. Using both sources of information, we identified themes important to patients with CLP that will be discussed. These themes were used to develop a conceptual framework to account for the main health concerns of patients with CLP.

**CONCLUSIONS:** We are using this conceptual framework to form the basis of the CLEFT-Q, the first PRO instrument being designed for children with CLP. The ability to measure outcomes from the patients' perspectives should greatly enhance our understanding of how best to manage and prioritize treatment protocols for this complex group of patients.

**Learning Objectives:**

*Audience members will be able to:*

- *understand the themes important to children with CLP, and*
- *recognize the need for a PRO instrument designed specifically for patients with CLP.*

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**THE INCIDENCE OF VERMILION HEIGHT ASYMMETRY IN THE UNILATERAL CLEFT LIP**

**I Sitzman, D Fisher**

**PURPOSE:** Optimal cleft lip repair requires the precise alignment and approximation of paired cleft margins. Alignment of the various components (skin, vermilion, and mucosa) of the medial and lateral lip elements presents the challenge because they tend to be of different vertical dimensions in the native state. Failure to appreciate and correct vermilion height differences results in a stair-step deformity of the red line (vermilion-mucosal junction) and exposure of mucosa with the lips in repose. Techniques exist to correct the asymmetry during primary lip repair, yet few surgeons routinely employ them. We hypothesize that vermilion height differences between the medial and lateral lip elements are a common occurrence in patients with unilateral cleft lip.

**METHODS:** We performed a retrospective review of prospectively collected measurements for all patients undergoing unilateral cleft lip repair by the senior author between January 2000 and August 2011. Patients with contralateral cleft variant (eg, forme fruste) and previous cleft operation were excluded from the analysis. The senior surgeon obtained measurements with 0.5 mm precision. Statistical significance was determined by student's t-test.

**RESULTS:** Three-hundred thirty-one patients met enrolment criteria. The mean vermilion height of the medial lip element was 2.5 mm, compared with a lateral lip vermilion height of 3.9 mm ( $p < 0.0001$ ). This represents a 36.9% deficiency of the medial lip vermilion height. Vermilion height asymmetry  $\geq 1$  mm occurred in 88.5% of patients. Height asymmetry  $\geq 2$  mm occurred in 31.4% of patients.

**CONCLUSIONS:** Vermilion height asymmetries are a common occurrence in patients with unilateral cleft lip. Surgeons should address this asymmetry during primary cheiloplasty to prevent exposure of oral mucosa with the lips in repose.

**Teaching Objectives:**

- *Define the incidence of vermilion height asymmetry in patients with unilateral cleft lip.*

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**IS SOCIOECONOMIC STATUS RELATED TO WAIT TIMES FOR SPECIALIZED PAEDIATRIC SURGERY? AN ANALYSIS OF 39,402 CASES**

**M Szyrak, J Wright, G Borschel**

Even in a publicly funded health care system, health is strongly correlated with socioeconomic factors, such as income, race, age, gender and early home environment. Lower socioeconomic status (SES) may contribute to increased morbidity, earlier mortality and worse access. For children the effects may be even greater when, for example, delays in surgical procedures can have profound functional, social and psychological effects extending into adult life. Therefore this study aimed to investigate whether SES is related to meeting surgical wait-time access targets.

**METHODS:** At The Hospital for Sick Children, patient addresses, referral wait times, and surgical wait times for 39,402 surgical interventions between 2007 and 2011 were captured. Postal code, census data, income quintile, distance to hospital, and social and material indices (markers for deprivation) were correlated with surgical wait times and the percentage of children who received surgery within target (using the Pediatric Canadian Access Targets for Surgery).

**RESULTS:** Surgical wait times did not correlate with SES. Approximately 27% of individuals across all income quintiles exceeded their projected wait time.

**CONCLUSIONS:** Access to surgical interventions as measured by surgical wait times is equal across income quintiles, suggesting children with lower SES are not disadvantaged in Ontario.

**Learning Objectives:**

- *The audience will introduced to the current methods of wait time assignment under the Pediatric Canadian Access Targets for Surgery. Furthermore, this presentation will provide a framework for quantifying socioeconomic status using a host of demographic data.*

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**IMPACT OF 22Q DELETION SYNDROME ON SPEECH OUTCOMES FOLLOWING PRIMARY SURGERY FOR SUBMUCOUS CLEFT PALATE**

**M Bezuhly, S Fischbach, P Klaiman, D Fisher**

**BACKGROUND:** Patients with 22q deletion syndrome are at increased risk of submucous cleft palate and velopharyngeal insufficiency. The authors' aim is to evaluate speech outcomes following primary Furlow palatoplasty or pharyngeal flap for correction of velopharyngeal insufficiency in submucous cleft palate patients with and without 22q deletion syndrome.

**METHODS:** Records of submucous cleft palate patients who underwent primary surgery between 2001 and 2010 were reviewed. Data

included 22q deletion syndrome diagnosis, age at surgery, procedure, preoperative nasopharyngoscopy and nasometry, speech outcomes, complications and secondary surgery rates.

**RESULTS:** Seventy-eight submucous cleft palate patients were identified. Twenty-three patients had 22q deletion syndrome. Fewer 22q deletion syndrome patients obtained normal resonance on perceptual assessment compared to nonsyndromic patients (74% versus 88%). A similar difference existed based on postoperative nasometric scores. Among 22q deletion syndrome patients, similar success rates were achieved with Furlow palatoplasty and pharyngeal flap. No difference in the proportion improved postoperatively was noted between 22q deletion syndrome and nonsyndromic groups. One complication was experienced per group. More revision surgeries were indicated in the 22q deletion syndrome group (17%) compared to nonsyndromic group (4%). Median times to normal resonance for 22q deletion syndrome and nonsyndromic patients were 150 weeks and 34 weeks, respectively. Adjusting for multiple variables, 22q deletion syndrome patients were 3.6 times less likely to develop normal resonance.

**CONCLUSIONS:** Careful selection of Furlow palatoplasty or pharyngeal flap for primary repair of submucous cleft palate is highly effective in 22q deletion syndrome patients and yields results approaching those of nonsyndromic patients.

**Learning Objectives:**

- Participants will appreciate how 22q deletion syndrome impacts speech outcomes following submucous cleft palate repair.
- Participants will understand how proper selection of cleft palate repair technique in 22q deletion syndrome and non-syndromic patients can yield comparable results.

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**MONTREAL CHILDREN'S HOSPITAL FORMULA FOR NAM CLEFT THERAPY**

**H Al-Ajmi, B Jamal, Y Tahiri, E Mok, M Gilardino**

**PURPOSE:** For cleft teams that employ Nasoalveolar Molding (NAM) in the treatment of cleft lips, an as yet unresolved issue is a method to objectively determine ideal corrected cleft nasal height and treatment completion. The latter is complicated by a non-cleft nasal height, which is depressed by the shifted nasal pyramid native to the deformity. In this study, the authors introduce a formula to calculate ideal corrected nasal height (ICNH) to guide completion of NAM therapy.

**METHODS:** The nasal impressions of 20 consecutive patients with unilateral cleft lips who underwent NAM therapy were analyzed. The following points were identified on the non-cleft side: P1 - junction of columella to nasal base, P2 - junction between ala and nasal base, and P3 - junction of columella and ala, to form a non-right angled triangle. Once fixed distances (P1-P2 and P2-P3) were measured using digital calipers, the Pythagorean Theorem was used to calculate ICNH (distance P1-P3) in a right-angle triangle, reflecting the anticipated verticalization of the columella following completion of NAM therapy. Statistical analysis was performed using the Pearson correlation test to determine the predictive value of the formula.

**RESULTS:** Twenty patients were included in the study. One patient was excluded due to a poor quality nasal impression. The analysis demonstrated a statistically significant positive correlation (high degree) between predicted nasal heights and those measured following completion of NAM therapy ( $r=0.760$ ,  $p<0.01$ ).

**CONCLUSION:** Predicted nasal height using The Montreal Children's Hospital Formula has a high degree correlation with that measured at the end of NAM therapy. The formula therefore serves as a useful and objective tool to guide progress and completion of pre-operative NAM treatment for cleft lips.

**Learning Objective:**

- The participant will learn the application of a mathematical formula to guide the pre-surgical treatment of cleft lips.

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**INCIDENCE OF PRENATALLY DIAGNOSED ISOLATED CLEFTS IN BRITISH COLUMBIA: WHAT IS THE RATE OF TERMINATION?**

**R Evans, A Lehman, I Burnell, D Pugash, C Verchere**

**PURPOSE:** The purpose of this study is to examine the birth status of fetuses diagnosed prenatally with isolated facial clefting at BC Women's and Children's Hospital and to determine the rate of therapeutic abortion in that population. Results will help inform prenatal counselors and families and potentially determine resource allocation.

**METHODS:** The medical records of consecutive pregnant women referred to the BC Women's Fetal Diagnostic Service prior to 24 weeks gestation for level II ultrasound to confirm facial clefting were reviewed retrospectively. Data was collected for patients presenting between 2000 and 2009 and included record of termination of pregnancy or of live birth. Diagnosis of cleft was confirmed at birth and by autopsy in aborted fetuses. Termination rate was calculated.

**RESULTS:** Over the ten years examined, there were 66 fetuses prenatally diagnosed with clefting confirmed on level II ultrasound. Of these, 14 were terminated giving a rate of 21.2%. This rate appears stable over the study period.

**CONCLUSIONS:** The rate of termination of prenatally diagnosed isolated facial clefts in BC is not insignificant. This knowledge may help in further development and evaluation of our prenatal counseling pathway.

**Learning Objectives:**

- At the end of this presentation, the learner will be able to discuss the prenatal counseling pathway in fetuses diagnosed with isolated facial clefting in BC.
- Participants will be able to describe the rates of termination of fetuses diagnosed with isolated facial clefting in BC.

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**STRATEGIES FOR REDUCING COMPLICATIONS IN AUTOLOGOUS AURICULAR RECONSTRUCTION**

**L Kasrai, D Fisher**

**PURPOSE:** To review results of autologous ear reconstruction comparing two time periods (early and recent) in an effort to identify risk factors for an unfavourable result.

**METHODS:** We present a case series of 110 consecutive cases of autologous ear reconstruction (78 patients and 84 ears). Patient satisfaction, surgeon satisfaction and appearance of the ear were considered in the assessment of the outcome. We compared the results of the first 42 ears in the series with the latter 42 ears.

**RESULTS:** Risk factors for an unfavorable result included: 1) small conchal type microtia, 2) associated syndromes, 3) low hairline, 4) two stage reconstruction, 5) 1st stage complication, and 6) 2nd stage complication. Satisfactory results were associated with: 1) large conchal type microtia, 2) secondary reconstruction, 3) acquired auricular defect, and 4) single stage reconstruction. The influence of these factors has influenced our patient selection and surgical technique over time. Accordingly, our success rate has improved from 74% for the first 42 cases of ear reconstruction to 93% for the subsequent 42 cases.

**CONCLUSIONS:** Risk factors for an unfavourable result in autologous ear reconstruction have been identified. Recommendations for patient selection and modification of surgical techniques will be discussed with the goal of improving outcomes.

**Learning Objectives:**

- Participants will be able to classify ear anomalies.
- Participants will be able to identify the goals of autologous ear reconstruction.
- Participants will be able to identify risk factors associated with unfavourable outcomes in autologous ear reconstruction.



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## PROPRANOLOL VERSUS CORTICOSTEROIDS IN TREATMENT OF INFANTILE HEMANGIOMA; A SYSTEMATIC REVIEW

A Izadpanah, J Kanevsky, A Izadpanah, K Schwarz

Infantile hemangiomas are benign vascular neoplasms that can lead to numerous functional or cosmetic problems. There have been some recent promising reports of Propranolol use in the treatment of infantile hemangioma as both first line and concurrent therapy with corticosteroids. However to this date there are no clear indications of its superiority compared to corticosteroids. Thus, we attempted to review the literature for role and comparison of Propranolol and corticosteroids in the treatment of infantile hemangiomas.

**METHOD:** A literature review from 1965 to May 2011 was performed for articles published in treatment of hemangiomas using corticosteroids or Propranolol. Articles were reviewed for reports of clinical cases, reported side effects, doses, duration of treatment, number of patients and response rate to treatment.

**RESULTS:** Seven hundred and forty five studies were identified, out of which only 38 studies met our inclusion criteria. Nineteen studies comprising 2,697 patients reported the use of local or oral steroids with a success rate of 76.1% and 19 studies comprising 177 patients reported the use of Propranolol, out of which 82 patients (46.3%) had received prior corticosteroid therapy. Overall response rate for Propranolol was 98.9%. Statistical analysis using Chi-square demonstrates the systemic Propranolol administration (91.0% resolution rate) to be superior to both oral corticosteroids therapy (84.5% resolution rate) and local administration of corticosteroids (66.4% resolution rate) ( $p < 0.0001$ ) (Table 3).

**CONCLUSION:** Propranolol is an emerging therapy for infantile hemangioma with fewer side effects and greater efficacy than corticosteroid therapy. Present systematic review demonstrates that the regression of hemangioma when treated with Propranolol as first line therapy is consistently better than corticosteroids.

### Learning Objectives:

**At the end of the presentation, the participants will be able:**

- to identify the evidence and pathophysiology of propranolol treatment of haemangioma.
- to compare the complication profile of steroid and propranolol in treatment of infantile haemangioma.

P01

## POSTERS

### CREATION OF A 3D DIGITAL MODEL OF THE GRACILIS MUSCLE: APPLICATION TO FREE FUNCTIONING MUSCLE TRANSFER

A Fattah, K Ravichandiran, R Zuker, A Agur

**PURPOSE:** The gracilis is used for facial reanimation and other functioning muscle transfers. Anatomical descriptions are limited to either vascular or neural patterns of supply. Scant attention is given to the arrangement of the muscle fibres and no studies present the inter-relationship of these structures. We aimed to create a detailed 3D model of the gracilis to allow assessment of muscle architecture for planning of functional muscle transfer.

**METHODS:** Twenty specimens were dissected under magnification and digitised using a Microscribe G2 Digitizer. The digitised data were used to create virtual models for analysis using Autodesk Maya (3D animation software). From these data the internal architecture of the dissected muscle was mapped.

**RESULTS:** The nerves and vessels ran alongside each other but the relationship was not strictly maintained. Three patterns of arterial branching exist within the muscle, with venae comitans draining distinct regions. Secondary pedicles varied in number and formed a robust anastomotic chain along the anterior border of the muscle. The motor nerve divided into two main divisions that brace the vascular

pedicle in 90% of cases, with the superficial division supplying the anterior portion of the muscle and the deep division ramifying over the posterior region. The neurovascular structures were biased to the deep surface of the muscle. Muscle fibre arrangement demonstrated that each muscle is made up of five to six muscular units in a spiral arrangement with the neurovascular structures running between these units.

**CONCLUSIONS:** The neural and vascular arrangements are classified and neuromuscular compartmentalisation of the gracilis muscle is described. Radical partitioning based on the neurovascular and muscle fibre arrangement is technically feasible.

### Learning Objectives:

- Participants will learn the internal anatomy of the gracilis muscle and be able to apply this to flap planning for free muscle transfer.

P02

### SEROMA FORMATION AFTER ABDOMINAL LIPECTOMY: A SYSTEMATIC REVIEW AND META-ANALYSIS

A Izadpanah, J Kanevsky, A Izadpanah, L Xu, L Lessard, A Aly

**INTRODUCTION:** Abdominal lipectomy is a commonly performed procedure due to the increasing prevalence of obesity and bariatric surgery for aesthetic and functional purposes. However, it is not short of complications. Seroma is a post-operative complication which can lead to associated morbidities. Thus, we sought to perform a systematic review and a meta-analysis to further identify the efficacy of potential proposed preventive measures for preventing post-operative seroma in abdominal lipectomy/abdominoplasty patients.

**METHOD:** A MEDLINE search was performed for all relevant articles describing the incidence of seroma after abdominal lipectomy or abdominoplasty. The PubMed database of the National Center for Biotechnology Information, National Library of Medicine (Bethesda, Md), Google Scholar, and MEDLINE was used to collect reports using the key words "lipectomy", "seroma", "abdominal lipectomy", and "body contouring". All articles were reviewed for reports of clinical cases, complications, number of patients, seroma prevention method, seroma rate and study design. The difference of seroma rates between use of drains, progressive tension sutures, and minimal undermining was compared by meta-analysis. Comparing the use of electrocautery versus sharp dissection was not possible due to limited number of studies.

**RESULTS:** Twenty-four studies including a total of 2,782 cases of abdominal lipectomies were identified, 19 retrospective, three prospective and two randomized controlled trials. The overall rate of seroma formation was 14%. Studies with no mention of any preventive methods had a higher rate of seroma formation at 16% ( $p > 0.05$ ). Placement of drains decreased the incidence of seroma to 14%. Placement of quilting stitches and minimal undermining decreased the incidence to 12% ( $p > 0.05$ ).

**CONCLUSION:** Our present systematic review and meta-analysis of 2,782 cases suggests that the use of drains, quilting stitches and minimal undermining could reduce the rate of seroma formation in abdominal lipectomy procedures. Unfortunately due to limited number of studies and absence of adequate number of randomized control trials, results could not be demonstrated to be statistically significant. However, it still stays a complication occurring between 12-14 %. Further randomized control trials are necessary.

### Learning Objectives:

**At the end of the presentation, the participants will be able:**

- to describe the risk factors for developing seroma post abdominal lipectomy procedures.
- to compare different modalities to decrease formation of seroma post abdominal lipectomy procedures.

**P03**

**BODY MASS INDEX IMPACTS INFECTION RATES IN IMMEDIATE BREAST RECONSTRUCTION**

**L Willoughby, H Baltzer, J Mahoney, M Musgrave**

**PURPOSE:** To identify patient characteristics, surgical details and cancer features that increase risk of post-operative infection following breast reconstruction in our population.

**METHOD:** We performed a retrospective chart review of patients with breast cancer who underwent reconstructive surgery over a ten year period at St Michael's Hospital in Toronto. Infection was defined by a positive wound culture or the surgeon's clinical assessment based on at least two of: erythema, purulent discharge, fluctuant area suggestive of abscess or wound breakdown. Continuous and categorical data were analyzed using two-sample t-Test and Fisher's exact test respectively.

**RESULTS:** A total of 456 procedures were performed on 264 patients. Only 29 cases of post-operative infection were identified. Overall, primary reconstructive procedures were associated with more infections compared to secondary procedures (mound revisions, nipple creation etc.) ( $p < 0.01$ ). Within the primary reconstruction group, risk factors for infection included: autogenous reconstructions compared to alloplastic ( $p < 0.02$ ), length of hospital admission ( $p < 0.001$ ) and immediate reconstruction rather than delayed ( $p = 0.01$ ). Subgroup analysis revealed increased risk of infection with immediate-autogenous versus immediate-alloplastic procedures ( $p < 0.03$ ). Further analysis demonstrated patients with greater body mass index receiving immediate-autogenous reconstruction had a greater risk of infection ( $p < 0.003$ ). Factors unrelated to infection risk included history of irradiation, smoking, cancer stage, tumour type (invasive vs non-invasive) and tumour size.

**CONCLUSIONS:** Our findings suggest that risk of infection is higher in immediate-autogenous reconstructions particularly when patients are overweight (BMI  $> 30$ ). Our data does not support a relationship between infection and irradiation, features of cancer or repeated reconstructive procedures.

**Learning Objectives:**

*At the end of this presentation, participants will be able to:*

- identify obesity, immediate reconstruction and autogenous reconstruction as risk factors for post-operative infection;
- consider history of irradiation and repeat reconstructions to be of less importance in risk of post-operative infection.

**P04**

**COCAINE PSEDOVASCULITIS: WHAT YOU NEED TO KNOW BEFORE IT GOES ON THE RISE**

**J Lutfy, M Noland, M Jarmuske**

**PURPOSE:** The prevalence of cocaine induced pseudovasculitis (CIP) causing cutaneous destruction is increasing and plastic surgeons need to be aware of this condition as we are a part of the multidisciplinary treatment team. Differentiation of CIP from a true autoimmune vasculitis can be exceedingly challenging, and misdiagnosis with ensuing treatment may be fatal. A succinct literature review of CIP is presented, aided by clinical case of 30% total body surface area skin necrosis, to familiarize the viewer with this syndrome.

**METHODS:** Literature review using SCOPUS was performed independently by two reviewers with key keywords: cocaine, free base, crack, levamisole, vasculitis, pseudovasculitis, ischemia, necrosis, gangrene. All abstracts between 1950-2010 were read and pertinent articles selected.

**RESULTS:** History of cocaine use, ANCA patterns and target antibodies inconsistent with vasculitis, lack of typical biopsy findings and localized disease are clues in the diagnosis of cocaine pseudovasculitis. Testing for anti-human neutrophil elastase (anti-HNE) and levamisole show good sensitivity. Medical treatment consists of pain management, anticoagulation and/or antithrombotics, abstinence from cocaine, and in isolated cases IV nitroglycerine and iloprost. The suggested surgical management is similar to that of meningococemia and burns. Vasculitis treatment with prednisone and immunosuppression is ineffective and potentially harmful.

**CONCLUSION:** Without patients disclosing the use of cocaine, correctly diagnosis CIP can be very challenging. Initial investigations include a true autoimmune vasculitis panel work-up, with the addition

of anti-HNE and levamisole. The proposed cutaneous defect reconstructive algorithm is a cross between meningococemia and burns.

**Teaching Objective:**

- The audience will acquire the knowledge and confidence to diagnose and treat cocaine pseudovasculitis without causing patient harm.

**P05**

**USE OF INTERPOSITION ARTERIAL BYPASS GRAFTS IN HYPOTHENAR HAMMER SYNDROME**

**A Iskur**

**PURPOSE:** Hypothenar hammer syndrome is an uncommon vascular condition in which the ulnar artery undergoes repetitive trauma leading to eventual aneurysm and/or thrombosis. Interpositional vein grafts across the occluded segment have been the mainstay of treatment. Cardiac surgery literature demonstrates improved long-term patency rates in radial artery grafts compared to vein grafts. Similarly, arterial bypass grafts may provide a better alternative in hypothenar hammer syndrome. Characteristics of the donor arterial vessels may provide additional advantages over vein grafts.

**METHOD:** Three patients presenting with hypothenar hammer syndrome since July 2008 underwent ulnar artery bypass grafting with the use of an arterial bypass graft. A deep inferior epigastric artery was used in two patients and the descending branch of the circumflex femoral artery was used in one patient. All grafts were performed proximally to the distal ulnar artery and distally to common digital arteries. Minimum of two distal arterial anastomoses were performed. One patient underwent additional anastomosis to the superficial palmar arch in addition to the common digital arteries.

**RESULTS:** All arterial bypass grafts have remained patent to date with a mean follow-up of 14 months as demonstrated on Allen's testing and angiogram. All patients have had resolution of symptoms. All donor sites healed uneventfully with no symptoms of muscle weakness. One patient complains of persistent paresthesia around the donor site scar.

**CONCLUSION:** Arterial bypass grafts harvested from donor sites commonly used for free flaps provides an alternative to vein grafts with numerous advantages: better tissue handling, better size match at proximal and distal anastomosis sites, and increased branching patterns to allow for numerous end-to-end distal anastomoses. Improved long-term patency rates and decreased stenosis rates may be due to the lack of intimal hyperplasia.

**Teaching Objectives:**

- The audience will be able to identify the advantages of arterial grafts over vein grafts.

**P06**

**COMPREHENSIVE 3D MUSCLE AND TENDON DATA OF ALL MUSCLES OF ONE FOREARM AND HAND**

**Z Li, K Ravishandiran, N McKee, A Agur**

**PURPOSE:** To create a 3D computer database of the intricate details of the musculotendinous structure of the forearm and hand from a cadaveric specimen using digitization. The 3D volumetric model of 37 muscles will include detailed fibre bundle architecture, internal and external tendons, attachment sites and their relationships to each other.

**METHODS:** One formalin-embalmed male cadaveric specimen was used in this study. All the musculotendinous components of 37 muscles of the forearm and hand were digitized with a MicroScribe™ G2 digitizer and the bony elements scanned using a FARO Laser ScanArm. The muscle, tendon and bone data were reconstructed in Maya® to create a volumetric 3D model of the forearm and hand.

**RESULTS:** Depending on the size and complexity of the muscle, between 150 fibre bundles (eg, extensor indicis) to 1300 fibre bundles (eg, extensor digitorum communis) were digitized. The 3D model can be viewed from any angle, enabling comparison of muscle architecture (eg, fibre bundle length, pennation angle, muscle volume, physiological cross-sectional area), tendon attachments and dimensions, and regional variations within the muscle. From the model, muscles, their tendons and bones can be examined individually or in any combination.

**CONCLUSIONS:** Digitization and 3D modelling allowed the creation of a detailed, anatomically accurate model of all forearm and hand muscles, as in situ, from the same specimen. This data can be used as a tool to better understand the musculotendinous architecture of the forearm and hand musculature. The 3D data will serve as the basis for programming muscle contractions and for ongoing work on modelling refinement of realistic muscle function.

**Learning Objective:**

- To visualize the detailed anatomy of the forearm and hand muscles and bones that will be the basis for a new, more robust and accurate 3D computer model of hand function.

**P07**

**SYSTEMATIC REVIEW OF ECONOMIC EVALUATIONS IN PLASTIC SURGERY**

**N Ziolkowski, S Voineskos, T Ignacy, A Thoma**

**PURPOSE:** 1) To perform a systematic review of economic evaluations in plastic surgery. 2) To assess the quality of these economic evaluations using the Quality of Health Economic Studies (QHEs) instrument.

**METHOD:** A systematic review was performed to identify economic evaluations published in plastic surgery literature using the following electronic databases: MEDLINE, EMBASE, Cochrane, HEED, OVID HEALTHSTAR and Business Source Complete from 1970-2011. Included economic evaluations where the data was either primary (stochastic analysis) or secondary (probabilistic analysis). Data extraction included: domain of plastic surgery, research question posed, country of origin, date and journal of publication. Cost utility, effectiveness, and cost benefit analyses were further evaluated for their quality of reporting using the QHEs instrument.

**RESULTS:** 1873 articles were identified with 80 articles meeting the inclusion criteria. These articles were classified into cost, cost utility, cost-effectiveness and cost-benefit analyses. Cost analyses, which are partial economic evaluations, accounted for the majority of articles (n=70; 87.5%). Ten articles were full economic evaluations in which they integrated cost and effectiveness. The vast majority of articles were labeled as cost effective studies when in fact they were not. The term "cost effective" was misused in 62% of cases.

**CONCLUSIONS:** Full economic evaluations consist of 12.5% (10 articles) of all analyses with significant deficits in appropriateness of methods, validity of results, and/or comprehensiveness of reporting. Cost utility, cost effectiveness, and cost benefit analyses were determined as moderate quality by the QHEs.

**Learning Objectives:**

- Participants will learn about the various types of economic evaluations and when they can be used in a clinical setting.
- Participants will be informed of a tool that can help them evaluate the quality of cost utility, cost effectiveness, and cost benefit analyses.
- Participants will learn tips on how to conduct higher quality economic evaluations.

**P08**

**VENOUS THROMBOEMBOLISM IN PLASTIC SURGERY – A CANADIAN EXPERIENCE**

**E Mutter, M Musgrave**

**PURPOSE:** To assess the practice patterns of venous thromboembolism (VTE) prevention in Canadian Plastic Surgery.

**METHODS:** An online survey was distributed to all Canadian plastics surgeons registered with the CSPS/CSAPS between 2009 and 2010, inclusive. A modified Dillman protocol was used to recruit participants. The online survey was comprised of three sections including: demographics, experience and practice with respect to DVT/PE and its prophylaxis and knowledge base. Data was analyzed using SAS.

**RESULTS:** A total of 82 surgeons responded, with equal representation between academic and community practices. Of those responding, 95% reported performing a minimum of 400 surgical procedures in the past five years. Approximately one quarter of respondents reported having more than one VTE event in the past five years. There was no statistically significant difference between prophylaxis users and non users when

comparing incidence of VTE events. Of those that used prophylaxis regularly, 42% reported no reference to specific guidelines in their practice, while 57% report being "confident only for a certain set of procedures/patients" or "very hesitant" about the use of prophylactic measures.

**CONCLUSIONS:** While VTE prophylaxis strategies have become an important aspect of patient safety and quality improvement programmes at many Canadian hospitals, there appears to exist a deficiency in the knowledge, use, and standardization of VTE prophylaxis by Canadian plastic surgeons. This study points to an educational opportunity for continuing medical education for Canadian Plastic Surgeons

**Learning Objectives:**

- To review VTE events in patients undergoing plastic surgery in Canada.
- To identify current guidelines used by Canadian plastic surgeons for prophylaxis.
- To discuss education needs with respect to VTE prophylaxis.

**P09**

**KNOWLEDGE, ATTITUDES AND PERCEPTIONS OF CANADIAN ONCOLOGY AND GENERAL SURGERY RESIDENTS ABOUT BREAST RECONSTRUCTION**

**J Platt, M Musgrave**

**PURPOSE:** To describe the knowledge, attitudes and perceptions regarding breast reconstruction (BR) among Canadian residents involved in oncological care.

**METHODS:** This is a cross-sectional survey of all Canadian PGY4/5 residents in general surgery and radiation and medical oncology. Knowledge, attitudes and perceptions about BR were addressed using Likert scale and open-ended questions. Differences between resident groups were compared using Fisher's exact test.

**RESULTS:** Overall we achieved a 46.4% response rate (90/196) consisting of 61.6% of oncology and 34% of general surgery residents. Most were between 20-40 years of age (96.7%) and female (53.3%). The majority did not report attitudinal or misperception barriers to BR across targeted questions. However, 31.1% reported they felt reconstruction may delay the detection of local recurrence and 11.1% were concerned that oncologic soundness of surgery may be compromised by reconstruction. Oncology and general surgery residents differed significantly on only two items: remuneration for BR surgery and the role radiation plays in cosmesis of the reconstructed breast (p=0.001 and 0.002, respectively). Shared responsibility for referral across disciplines was reported by 26.6%. General surgery was reported to be the most responsible for BR referral by 58.9% and oncology by only 1.1%; results did not differ between groups. Open-ended responses from general surgery were supportive of BR and a multidisciplinary approach, whereas oncology expressed responsibility should remain with general surgery.

**CONCLUSIONS:** The majority of Canadian residents do not report negative attitudes regarding BR, but there may be knowledge barriers. Incorporating education regarding BR across all involved treating specialties may increase shared responsibility for referring breast cancer patients for this reconstructive procedure.

**Learning Objectives:**

- To examine attitudes of resident physicians and surgeons regarding breast reconstruction.
- To consider residency training a target for strategies aimed at improving awareness of BR among multidisciplinary colleagues.

**P10**

**COMPARING PATIENT OUTCOMES IN THE USE OF AN INFRAMAMMARY FOLD INCISION VERSUS THE MASTECTOMY SCAR IN DELAYED TWO-STAGE ALLOPLASTIC BREAST RECONSTRUCTIONS**

**N Cho, G Rockwell**

**PURPOSE:** In delayed mastectomy alloplastic breast reconstruction, the implementation of an inframammary fold incision (IMF) is hypothesized to move the surgical site to thicker, less adherent tissue that is further from the apex of maximal radiation damage. The



purpose of this study is to determine any outcome improvements with the use of a new scar location away from the mastectomy scar (MS).

**METHOD:** A retrospective review of one surgeon's delayed mastectomy alloplastic reconstruction patients from 2004 to 2011 was performed. One hundred eight breast reconstructions (90 patients) were included, with 46 radiated and 62 non-radiated breasts. Treatment groups were the incision used (IMF vs MS) regardless of the stage of reconstruction, and the presence or absence of radiation damage. Outcome measures were complications requiring expander/implant removal and development of a minimum Baker 2 capsular contracture. Statistical analyses were performed using crosstabs and Fisher's Exact test, and results were considered significant at  $p < 0.05$ .

**RESULTS:** Non-radiated breasts did not have any expansion failures or capsular contractures. Breasts with radiation therapy were shown to have significantly higher rates of expansion failure (10.9% vs 0%,  $p < 0.05$ ) than non-radiated breasts. Within radiated breasts, the inframammary fold incision approach had lower rates of expansion failure (IMF: 8.3% vs. MS: 14.3%,  $p = 0.7$ ) and capsular contracture (IMF: 0% vs MS: 4.8%,  $p = 0.5$ ) than the mastectomy scar approach.

**CONCLUSIONS:** The use of an IMF incision in delayed two-stage alloplastic breast reconstruction trends toward lowered rates of expansion failure and capsular contractures in radiated breasts; however, these results were not statistically significant. Selection of the best quality tissue for placement of the incision may improve patient outcomes especially in the context of radiation damage.

**Learning Objectives:**

- The participant will appreciate the possible application of the IMF incision within delayed prosthetic breast reconstruction.

# P11

## NIPPLE AREOLAR TATTOOING: WHERE ART MEETS SURGERY

**B Van Brenk, K Gutsche**

Nipple areolar tattooing is a common procedure but techniques are variable and operator dependent. We'd like to discuss the techniques and principles that have helped us achieve our success with 3-dimensional areolar nipple tattooing. In particular, we would like the opportunity to discuss the Titian Wash™ technique, which can achieve the illusion of a projecting nipple as well as effectively camouflage scars as a result of cancer surgery and breast reconstruction.

**PURPOSE:** To improve current techniques in breast reconstruction through tattooing, including scar revision, correction of skin pigmentation defects following surgery, and the simulation of the nipple-areola complex.

**METHOD:** Realistic medical tattooing relies on artistic use of light and shade, appropriate colour selection, colour layering and pigment placement to simulate 3-dimensional features. Scar revision tattooing involves dermal micro puncturing to break down scar tissue, and promote new collagen deposition and neo-vascularization of the scar. Camouflage tattooing of the scar can further break down the scar as well as colour it to match the surrounding healthy skin. These methods will be discussed in detail following breast reconstructive procedures.

**RESULTS:** A visual comparison of results and their limitations will be compared using both traditional tattooing, as well as newer tattooing techniques.

**CONCLUSIONS:** Nipple areolar tattooing offers enhancements to usual breast reconstructive procedures, by reducing the appearance of scarring and recreating the nipple areola complex. These advances lead directly to enhanced patient satisfaction.

**Learning Objectives:**

- Participants will have an awareness of the artistic schemata needed to create a 3-dimensional illusion of a projecting nipple on the breast mound.
- Participants will understand the principles of the Titian Wash™ tattoo technique that can achieve nipple areolar simulation as well as effectively camouflage scars.

# RP01

## RESIDENT POSTER CORNER

### THE 10-YEAR EXPERIENCE WITH THE BECKER 35 EXPANDABLE IMPLANT FOR DELAYED SINGLE STAGE BREAST RECONSTRUCTION: SURGICAL TECHNIQUE

**P Gdalevitch, C White, N Guay**

**PURPOSE:** The Becker 35 expander/implant has consists of a contour implant made of 35% silicone in the superior aspect and a 65% saline bladder in the inferior portion. The implant is designed to expand the inferior pole of the breast when placed correctly. We present the senior author's technique for achieving successful delayed single stage breast reconstruction with the Becker 35 expander/implant.

**METHOD:** The implant is inserted by using a dual plane technique. The superior flap remains in continuity with the pectoralis muscle and covers the implant. The inferior skin flap is dissected in the subglandular plane. The pectoralis muscle is de-inserted at its inferior medial insertion for 2-3 cm until the sternum. The implant is placed in the pocket in the anatomical orientation and the tubing is wrapped around lateral to medial.

**RESULTS:** There are many benefits to using the Becker 35 implant. A patient can have their breast reconstructed with one general anesthetic. The reconstruction is complete on average by 10 weeks compared to the typical 2-3 year process of the expander to implant reconstruction. The patients can select the final volume and participate in the final adjustments.

**CONCLUSIONS:** We recommend that correct and precise pocket dissection is paramount to the success of this technique. Unlike tissue expanders total muscle coverage is avoided to prevent malposition of the implant. The Becker 35 implant has recently become approved for use in Canada and is an efficient alternative to traditional expander to implant-based breast reconstruction.

**Learning Objectives:**

- Participants will be familiar with our technique for the Becker 35 expandable implant for delayed single stage breast reconstruction.

# RP02

## PREVENTIVE METHODS OF DONOR SEROMA FORMATION POST LATISSIMUS DORSI FLAP: A SYSTEMATIC REVIEW AND META-ANALYSIS

**Ali Izadpanah, L Xu, J Kanevsky, Arash Izadpanah, E Buchel, A Aly**

**INTRODUCTION:** Latissimus dorsi flap has been widely used for numerous reconstructive options. Seroma formation is a common associated complication which limits its use. Thus, we sought to evaluate different preventive methods utilized in the literature to determine the most effective method for prevention of this donor site common complication after latissimus dorsi flap reconstruction.

**METHODS:** All published data from 1965 to 2010 reporting different methods of seroma prevention in latissimus dorsi flap were reviewed. The PubMed database of the National Center for Biotechnology Information, National Library of Medicine (Bethesda, Md), MEDLINE, Cochrane review database, and Google Scholar were used to collect reports. All articles were reviewed for study design, reports of clinical cases, and seroma formation. Comparison between groups was performed using meta-analysis based on treatment modality and study designs.

**RESULTS:** A total of 115 studies were identified, out of which only 31 met our inclusion criteria. Six studies reported use of drain without electrocautery, six studies used drain and electrocautery, six studies reported utilizing drain, electrocautery and quilting, and the remaining studies 13 studies reported other methods of prevention. The incidence of seroma in drain group was 41%, drain with electrocautery 36%, drain with electrocautery and quilting 24%, and other studies had an overall seroma formation rate of 49%. These differences were not statistically significant ( $p = 0.326$ ).

**CONCLUSION:** In conclusion, a meta-analysis of published data on donor seroma formation of latissimus donor demonstrated the lowest incidence rate to be observed by quilting. The difference was substantial however not significant. Further studies with randomized control

studies are required.

#### Learning Objectives:

*At the end of the presentation, the participants will be able:*

- to identify the risk factors associated with seroma formation after latissimus dorsi flap.
- to compare different modalities of preventing seroma formation post latissimus dorsi flap.

#### RP03

### A SYSTEMATIC REVIEW OF THE ENDOSCOPIC MANAGEMENT OF ISOLATED ORBITAL FLOOR FRACTURES

**K Cheung, S Voineskos, R Avram, DD Sommer**

**PURPOSE:** Reconstruction of posterior orbital floor defects may be particularly challenging with traditional external approaches. Endoscopic reconstruction through a transantral or maxillary sinus approach may offer improved access and eliminate the risk of external scar and ectropion. The purpose of this study was to review the evidence of the effectiveness and safety of endoscopic reconstruction of isolated orbital floor fractures.

**METHODS:** A systematic review was performed using Cochrane, MEDLINE, and EMBASE databases. Studies investigating the reconstruction of isolated orbital floor fractures using an endoscopic approach were included. Two reviewers independently reviewed all results. Study quality was assessed using the validated MINORS scale. Primary outcomes were defined as the resolution of diplopia and enophthalmos. Secondary outcomes included post-operative complication such as blindness, parosmia, sinusitis, conversion to external approach, and need for revision surgery.

**RESULTS:** Nine studies capturing 172 patients undergoing endoscopic reconstruction of isolated orbital floor fractures met the inclusion criteria for the systematic review. Two studies were comparative and 7 were case-series. Overall, study quality was poor and lacked prospective data and reliable assessment of outcomes. Strong reviewer agreement was observed with an intraclass correlation of 83.8% (95% CI: 34.6% - 96%). Diplopia and enophthalmos resolved in 86% (102 of 118) and 95% (41 of 43) of patients, respectively. No complications of blindness, sinusitis, or conversion to external approach were reported. Thirteen patients (7.5%) had transient cheek numbness. Two patients (1.1%) required revision surgery.

**CONCLUSION:** Reconstruction of isolated orbital floor fractures through an endoscopic approach appears to be safe and effective. High level evidence, prospectively comparing endoscopic and external approaches, however, is lacking.

#### Learning Objectives:

- Understand the risks and benefits of endoscopic reconstruction of isolated orbital floor fractures
- Review the current evidence describing this technique

#### RP04

### THE ROLE OF VELOCITY OF TRAUMA IN LEFORT ONE CRANIOFACIAL FRACTURE PATTERNS

**R Ahluwalia, A Yazdani**

**PURPOSE:** This study sought to assist in the understanding of fracture patterns found in unilateral and bilateral LeFort one craniofacial trauma.

**METHOD:** A retrospective medical record review was conducted for one hundred and two patients from a consecutive cohort that were operated on by a single surgeon from 2007-2011 for craniofacial trauma. These patients represent a total of one hundred and fifty facial fractures of which twenty-seven percent were Lefort one fractures. Records were reviewed for demographics, method of trauma and velocity of impact. All fractures were then mapped by their point of entry on the lateral buttress and their point of exit on the piriform aperture using measuring tools on the post-reconstruction CT 3d images. A multivariate logistic regression model based on the variables found to be significant through univariate testing was employed. The points were expressed as ratios such that a 1.0 would represent entering and exiting at the top of the lateral buttress and piriform aperture respectively.

**RESULTS:** Our results revealed that fracture patterns differed based on the level of velocity of trauma. High velocity trauma entered the lateral buttress and exited the piriform aperture significantly higher than low velocity trauma.

**CONCLUSION:** High velocity trauma results in higher Lefort one fracture patterns as compared to low velocity trauma.

#### Learning Objective:

- Understand the pattern of lefort 1 fractures as they relate to the velocity of trauma.

#### RP05

### THE PATIENT'S PERSPECTIVE ON CARPAL TUNNEL SURGERY RELATED TO THE TYPE OF ANESTHESIA

**P Davison, T Cobb, D Lalonde**

**PURPOSE:** Patients often have the impression that being "asleep" or "sedated" is the most comfortable and convenient method to have carpal tunnel surgery. The wide awake carpal tunnel release (CTR) is done with local anesthetic only. The advantages of wide awake CTR must be counterbalanced by the concern that patients may poorly tolerate the procedure. This study will capture the patient's perspective of the anesthetic technique used during a CTR – wide awake surgery vs local anesthesia with sedation.

**METHODS:** A questionnaire was distributed approximately one week postoperatively to 100 consecutive patients in Saint John, New Brunswick and Davenport, Iowa. Patients from Saint John had a wide awake CTR. Patients from Davenport had local anesthesia with IV sedation.

**RESULTS:** For subsequent surgery, 93% of wide awake patients would prefer local anesthesia only and 93% of sedated patients would prefer sedation or general anesthesia. Preoperative EKG, chest x-ray, and/or bloodwork were done for 3% of wide awake and 48% of sedated patients. Patients' mean anxiety level (visual analog scale 0-10), was 2.3±2.68 preoperatively, 2.1±2.49 intraoperatively, and 1.4±1.12 postoperatively among wide awake patients. Sedated patients' mean anxiety was 3.4±2.81 preoperatively and 1.2±1.85 postoperatively. Postoperative nausea or vomiting was reported by 1% of wide awake and 7 % of sedated patients. Narcotics were prescribed for 5% of wide awake (Canadian) patients and 67% of sedated (American) patients. Adequate pain control was reported by 89% and 90% of patients, respectively.

**CONCLUSIONS:** Our results demonstrate that the majority of our patients who have had a wide awake CTR would prefer not to be asleep or sedated if they were to have a similar, subsequent surgery.

#### Teaching Objectives:

- Participants will accept that the wide awake CTR is very well tolerated by patients.

#### RP06

### PRIMARY BREAST AUGMENTATION WITH FORM STABLE COHESIVE GEL IMPLANTS: FATE OF THE NIPPLE-AREOLAR COMPLEX POSITION

**T Alrasheed, J Ahmad, F Lista**

**INTRODUCTION:** Breast augmentation is a treatment option for women with mild breast ptosis who desire larger breasts without the additional scarring of mastopexy surgery. It has been our observation that the nipple-areola complex appears to be elevated following subglandular breast augmentation with form stable cohesive gel implants. This study was performed to measure the position of nipple-areolar complex following insertion of a form stable cohesive gel implant in a subglandular pocket in primary breast augmentation in patients with mild ptosis.

**METHODS:** Thirty-two consecutive women (64 breasts) had photographs taken of their breasts preoperatively, one month, and at long-term follow-up. Using a standard rule, the clavicle to nipple distance was measured from these photographs. Twenty-five patients were available for long-term follow-up and these measurements were repeated.

**RESULTS:** Compared with preoperative photographs, the nipple-areola complex was located on average 0.6 cm, 0.7 cm and 0.7 cm higher at one month, one year and at three years follow-up, respectively. Nipple-areola complex elevation was noted to be higher in patients with good skin quality and small breasts ( $n=22$ ) with a mean elevation 1 cm at one year follow-up. The calculated elevation ( $e$ ) from implant height and projection [ $e = H \cdot \sqrt{(H^2 + P^2)}$ ] was an average of 1.3 cm. A correlation was noted between the calculated  $e$  and implant projection and an inverse relation with implant height.

**CONCLUSION:** In women with mild ptosis, small breasts and good skin quality undergoing subglandular breast augmentation with form stable cohesive gel implant, elevation of the nipple-areola complex is observed at long-term follow-up and appears to be related to implant height and weight.

**Learning Objective:**

- At the end of this lecture, the participants will be able to estimate the position of nipple-areolar complex following an insertion of a form stable cohesive gel implant in a subglandular pocket in primary breast augmentation in patients with mild ptosis.

**RP07**

**ENDOSCOPIC-ASSISTED OPEN RHINOPLASTY APPROACH FOR THE MANAGEMENT OF NASAL DERMOID SINUS CYSTS**

**B Thériault, J Konidis, MC Quintal, P Bortoluzzi**

**PURPOSE :** To assess the results of an endoscopic-assisted open rhinoplasty approach in treating midline nasal dermoid sinus cysts (NDSC) with extension to the cranial base.

**METHODS:** All patients referred for a midline nasal mass at the craniofacial clinic of a paediatric tertiary referral center were identified through a prospectively maintained registry of the clinic's patients from 1996 to the study date. After IRB approval, a retrospective chart review of all the patients operated for a NDSC was conducted. Demographic data, clinical presentation, pre-operative and post-operative imagery, surgical procedures, and post-operative outcomes were evaluated. The primary outcomes assessed were aesthetic results, nasal growth and rate of recurrence. Nasal growth and aesthetic results were evaluated using standardized photographs and clinical assessment. Recurrence was determined by post-operative clinical assessment and magnetic resonance imaging.

**RESULTS:** Fifty-nine patients were operated for a NDSC between November 1996 and June 2011 at our center. Thirteen of these patients with sinus extension to the cranial base were operated with an endoscopic-assisted open rhinoplasty approach, 10 of which met the inclusion criteria. The mean follow-up period was 41 months (range 8-83 months). One patient (10%) had a superficial recurrence and no patient presented a deep recurrence. There were no secondary detrimental effects of either nasal growth or facial aesthetics. No peri or post-operative complications were encountered. The mean hospital stay was 0.7 days and the mean operating time was 187 minutes.

**CONCLUSION:** The endoscopic-assisted open rhinoplasty approach is a valid approach in the surgical treatment of NDSC with cranial base extension in the pediatric population, allowing for favourable outcomes with minimal secondary scarring.

**Learning Objectives:**

- After this presentation, the participants will be able to better understand the role and potential benefits of endoscopy in the management of NDSCs with cranial base extension in the paediatric population.

**RP08**

**SURGICAL SITE INFECTIONS IN DIGITAL REPLANTATION / REVASCULARISATION. A REVIEW OF 412 CONSECUTIVE CASES**

**D Rizis, J Konidis, L Lessard, J Sampalis, Y Tahiri, A Nikolis**

**PURPOSE:** Surgical site infection rates in hand surgery have been reported to be less than 1.4% for elective cases, 5% to 15% in clean-

incised hand injuries and 5% to 25% in complex hand trauma. The Québec Provincial Replantation Program treats an average of 80 to 100 cases of digital devascularisation or amputation annually. The aim of this study is to describe the infection rates obtained within the Québec Provincial Replantation Program as well as the antibiotic prescribing practices of the participating microsurgeons.

**METHODS:** A review of all revascularized or replanted digits treated over a five-year period in a centralized provincial replantation center was conducted. Demographic data, mechanisms of trauma, ischemia time, type of surgery, pre- and post-operative antibiotic use, as well as clinical and culture-confirmed infection rates were tabulated and analyzed.

**RESULTS:** Four hundred and eleven patients with upper extremity trauma were treated with revascularization (271) or replantation (259) for a total of 760 digits referred to the program. An overall post-operative infection rate of 6.1% was obtained, defined as clinical suspicion or culture-confirmed infection prior to patient discharge. For contaminated wounds an infection rate of 5% was obtained, in contrast to a 25% infection rate for dirty wounds. Prophylactic antibiotics were used in 99.6% of cases pre-operatively and 97.6% of cases post-operatively for an average duration of seven days.

**CONCLUSION:** Rates of infection for digital replantation/revascularisation obtained within the program are at par with rates reported in the literature. Prophylactic antibiotics given both pre- and post-operatively are recommended in the setting of complex hand reconstruction; however, more clinical studies are necessary to establish treatment guidelines with better levels of evidence.

**Learning Objectives:**

- To describe infection rates in complex hand reconstruction.
- To discuss current levels of evidence for antibiotic use in the setting of hand surgery.

**RP09**

**ULNAR SUBLUXATION OF THE MEDIAN NERVE FOLLOWING CARPAL TUNNEL RELEASE: A CASE REPORT**

**A Odobescu, B L'Heureux-Lebeau, MA Danino**

**PURPOSE:** Complications of carpal tunnel release, while infrequent, include incomplete release resulting in persistent symptoms or recurrence due to postoperative scarring, as well as iatrogenic damage to nerves and vessels.

**RESULTS:** We present the case of a patient who underwent carpal tunnel release with resolution of symptoms in the immediate postoperative period. At one and a half years post release he started to experience numbness and tingling in a median nerve distribution triggered by repetitive ulnar to radial deviation of the wrist, with no symptoms at rest. Dynamic ultrasound showed a subluxation of the median nerve from one side of the palmaris longus tendon to the other. The patient's symptoms were triggered as the median nerve squeezed in between the palmaris longus and flexor digitorum superficialis tendons.

**CONCLUSIONS:** We have no reason to believe that the transverse carpal ligament has been incompletely divided, as the patient had complete relief of the symptoms postoperatively. Thus, the patient presented herein does not have persistent nor recurrent form carpal tunnel syndrome. The symptoms experienced appear to be related to a mechanical depolarization of the median nerve in the distal forearm rather than demyelination or denervation.

**Learning Objectives:**

- After viewing this poster, the learner should understand the different complications associated with carpal tunnel release, including the dynamic subluxation of the median nerve secondary to wrist movement.



### Groupe pour L'Avancement de la Microchirurgie Canada (GAM)

Abstracts presented at the 32nd Annual Meeting / 32<sup>e</sup> Reunion annuelle

June 6, 2012

**Dr Tom Hayakawa:** President / Président

**Dr Lucie Lessard:** Secretary / Secrétaire

#### 01

##### **OUTCOMES OF MIXED AND MOTOR NERVE REPAIR: SUB-GROUP ANALYSIS FROM A MULTICENTER STUDY ON PROCESSED NERVE ALLOGRAFTS**

**B Safa, G Buncke, B Parrett, R Weber, J Chao, D Brooks**

**PURPOSE:** Interest in alternatives to the classic nerve autograft exists; however, limited clinical data is available for use in mixed and motor nerve injuries. As such, a multicenter study was initiated to evaluate clinical outcomes of processed nerve allografts (Avance® Nerve Graft, AxoGen Inc.). We report a subgroup analysis of the quantitative data of observed safety and efficacy in mixed and motor nerve repairs.

**METHODS:** Twelve sites with 25 surgeons contributed a total of 132 nerve injuries over a two year period. IRB approval was obtained and standardized data reports were used to collect utilization, safety and follow-up data. Follow-up evaluations included 2-point discrimination, MRCC scale, range of motion, manual motor score, electromyography (EMG) studies, qualitative questionnaires, and adverse experiences. Demographics, outcomes and covariate analysis were performed to further characterize the sub-groups.

**RESULTS:** The sub-group analysis for mixed/motor nerves included 27 nerve repairs with sufficient recovery time for outcomes assessments. These included: median, ulnar, musculocutaneous, facial, peroneal and tibial nerves. Their mean±SD (minimum-maximum) age was 40.1±20.2 (18-86). Mean gap length was 29.1±11.8 (10-50) mm and the time to repair was 156±212 (0-725) days. Meaningful recovery (S3/M3 or greater) was observed in 77% of Mixed and 86% of Motor repairs. No adverse events were reported.

**CONCLUSION:** Careful consideration should be given to multiple factors when repairing major peripheral nerves. Processed nerve allografts were found to be a safe and effective treatment for mixed and motor nerves when an alternative to autograft was preferable. Historical control from available literature found functional outcome to compare favorably to autograft and exceed those for conduits. Continuation of this study will provide additional clinical evidence on the expanding role of processed nerve allografts.

##### **Teaching Objectives:**

- *Provide an understanding and insight into the role of processed nerve allografts for nerve reconstruction.*

#### 02

##### **FUNCTIONAL OUTCOMES IN FACIAL ANIMATION: COMPARISON OF INNERVATION SOURCES**

**A Snyder-Warwick, A Fattah, E Placheta, L Zive, G Borschel, R Zuker**

**PURPOSE:** Facial paralysis carries significant functional and psychosocial implications. Free muscle transfer to the face is the standard treatment for dynamic smile reconstruction when reinnervation of native musculature is not feasible. Transferred muscle may be neurotized via two-stage procedures utilizing a cross-face nerve graft (CFNG) from the contralateral facial nerve or a single-stage procedure utilizing the motor branch to the masseter. We compare our results utilizing these two techniques.

**METHOD:** A retrospective review of patients undergoing operative intervention for dynamic smile reconstruction at our institution over a seven-year period was performed. Intraoperative neural biopsies were

obtained for the donor nerve(s) (contralateral facial and CFNG or masseter) and compared with changes in oral commissure excursion postoperatively for each technique. Additional patient and operative factors were reviewed.

**RESULTS:** Data for intraoperative neural biopsies were available in 44 two-stage procedures and 19 single-stage procedures. No significant differences were noted between the two groups for patient age at time of muscle transplantation or weight of the muscle segment utilized. A greater percentage of congenital facial paralysis was noted within the single-stage group. For the two-stage technique, the downstream CFNG demonstrated a 73% decrease in axonal number (1705) from the donor branch of the contralateral facial nerve (6631). The motor branch to the masseter displayed 3-fold greater myelinated axons (5175) compared to the CFNG. Oral commissure excursion improved with both techniques, but postoperative commissure excursion was greater in the single-stage group.

**CONCLUSIONS:** Both single-stage and two-stage facial animation techniques are effective. The motor branch to the masseter has more axons available to power a free muscle transfer compared to a CFNG, and this correlates clinically with increased oral commissure excursion.

##### **Learning Objectives:**

- *To appreciate effects of donor axonal number and neurotization technique on oral commissure excursion in facial animation.*

#### 03

##### **AXONAL COUNTS IN FACIAL ANIMATION**

**A Snyder-Warwick, L Zive, A Fattah, W Halliday, G Borschel, R Zuker**

**PURPOSE:** Dynamic smile reconstruction in patients with facial paralysis can be achieved via single-stage procedures utilizing the motor nerve to the masseter or two-stage reconstructions utilizing a cross-face nerve graft (CFNG) from the contralateral facial nerve to innervate a free muscle transfer. We describe the differences in axonal counts between these two techniques in our practice.

**METHOD:** A retrospective review of patients undergoing dynamic smile reconstruction at our institution was performed over a seven-year period. Intraoperative nerve biopsies were obtained for morphometric analysis. For 2-staged reconstructions, biopsies were taken from the donor facial nerve during the first stage and the downstream CFNG and the nerve to the gracilis at the second stage. Biopsies of the motor branch to the masseter and the nerve to the gracilis were performed for the single-stage reconstructions. Axon counts represent myelinated fibers.

**RESULTS:** Intraoperative nerve biopsies were performed during 83 procedures in 48 patients undergoing dynamic smile reconstruction during the study period. Complete information was available for analysis in 63 procedures. For 2-staged reconstructions, average axon counts in the donor branch of the facial nerve were 6631. At the second stage, CFNG demonstrated an average of 1705 axons. For single-stage reconstructions, the motor branch to the masseter contained 5175 fibers. For all procedures, the nerve to the gracilis averaged 5764 axons.

**CONCLUSIONS:** The motor branch to the masseter contains greater numbers of axonal fibers compared to the downstream CFNG. The donor branch of the facial nerve, the motor branch to the masseter, and the nerve to the gracilis have similar axonal counts.

These data suggest that the motor branch to the masseter provides a more robust innervation source for dynamic smile reconstruction utilizing free muscle transfer.

**Learning Objectives:**

- To appreciate differences in smile reconstruction options from an axonal perspective.

**04**

**STATISTICAL MEASUREMENT OF QUANTITATIVE FLUORESCENCE PERFORMANCE: 4301 READINGS. NEGATIVE TESTS SIGNAL THE SURGEON TO SLEEP SOUNDLY**

**R Buntic, B Safa, B Parret, D Brooks, G Buncke**

**PURPOSE:** To precisely define the utility of quantitative fluorescence as a monitor in microsurgery using statistical measurements of performance.

**METHODS:** All patients admitted to our microsurgical service from March 2010 to July 2010 were enrolled. Quantitative fluorescence measurements were made every two hours for the first 24-48 hours following admission after microsurgical replantation or flap coverage with a skin or fasciocutaneous flap. Measurements were discontinued before discharge or when the clinician felt there was little chance of circulatory compromise. Binary classification of test results was performed and sensitivity, specificity, positive and negative predictive values were calculated.

**RESULTS:** A total of 4301 quantitative fluorometry readings were performed in 43 replants, five toe transplants, two radial forearm flaps, one venous flap and one revascularized ischemic finger. In both arterial and venous phase testing, quantitative fluorescence showed a high sensitivity and specificity and 100% negative predictive value. The positive predictive value was 88%.

**CONCLUSIONS:** These results demonstrate that QF is extremely sensitive, specific and has a high negative predictive value. In only 12% of patients, a positive test result was found to be false by secondary clinical evaluation. QF is indicated for use in monitoring patients during circulatory or perfusion examinations of skin or when there is a suspicion of compromised circulation. It is safe, effective and reliable. No other perfusion detection method has been found to be as sensitive, specific and with such a certain predictive value. If QF readings rise and fall, the surgeon can sleep soundly.

**05**

**BRACHIALIS TO ANTERIOR INTEROSSEOUS NERVE TRANSFER**

**K Boyd, G Dhaliwal, A Yee, S Mackinnon**

**PURPOSE:** The purpose of this study was to evaluate the anatomic feasibility of a brachialis to AIN transfer in a cadaveric model and to establish anatomical landmarks.

**METHODS:** Nine fresh frozen, cadaveric complete upper limbs were dissected. Dissection of the musculocutaneous and median nerves was conducted. The AIN branching pattern was recorded, including the total proximal "neurolysable" distance for potential transfer. The location, number, and length of the brachialis branches were recorded.

**RESULTS:** Nine arms were dissected. The AIN exited from the radial side of the median nerve in all specimens at a mean distance of  $6.1 \pm 1.5$  cm distal to the medial epicondyle. The branching pattern of the AIN was variable, with the first branch to FPL in five of nine arms. Proximal dissection of the AIN reveals that although the nerve exits the median nerve from its radial side, the fascicles take origin from the postero-medial side of the median nerve in the arm. The mean neurolysable distance above the medial epicondyle was  $13.0 \pm 2$  cm. The motor branch to the brachialis muscle, most frequently a single branch (55.6%), departs from the musculocutaneous nerve at a distance of  $11.5 \pm 1.6$  cm proximal to the medial epicondyle with the mean terminus at  $7.7 \pm 2.0$  cm. Axonal counts were 3512 for AIN and 3222 for brachialis.

**CONCLUSIONS:** The AIN exists as a neurolysable group of fibers on the postero-medial aspect of the median nerve up to 13.0 cm proximal to the medial epicondyle. The brachialis motor terminus is located 7.7 cm proximal to the medial epicondyle. Transfer between these two nerves is anatomically feasible and may provide an option for restoration of finger and thumb flexion in a lower brachial plexus injury.

**Learning Objective:**

- Participants will understand the anatomy of the AIN and brachialis nerves and recognize that nerve transfer from brachialis to AIN is feasible.

**06**

**THE FUTILITY OF MICROSURGICAL CLASSIFICATION SYSTEMS FOR RING AVULSION INJURIES**

**F Yau, R Buntic, G Buncke, B Safa, B Parrett, D Brooks**

**PURPOSE:** Ring avulsion classification systems are often cited to aid in management of these injuries. The ability of these classification systems to predict which injuries should be salvaged and which should undergo completion amputation based on survival and functional return has not been previously evaluated. We examined the unpredictability of these systems and suggest management strategies for ring avulsion injuries.

**METHOD:** Ring avulsion injuries treated at our facility between 1977 and 2000 were distributed into six previously published classification systems. The 2-sample student's test, logistic regression, linear regression and chi-squared tests were utilized to determine the ability of these individual systems to predict survival and functional outcome. Analysis included survival of the replant, grip strength and average total active motion (TAM).

**RESULTS:** Replantation was attempted in 69 cases. 85.5% were successful. Average TAM was 191 degrees and average grip strength was 71% of the uninjured hand. A decreasing TAM with increasing class was noted in all classification systems. Regardless of the classification system, no class could be identified which mandated amputation over salvage based on rate of survival or functional return. Case examples of patients are provided which illustrate an organized approach to the management of ring avulsion injuries, separate from class of injury.

**CONCLUSIONS:** Classification systems for ring avulsion injuries were developed to describe and categorize ring avulsion injuries, but not to direct management. Treatment of ring avulsion amputations should be based on an appreciation of the pattern of injury and specific interventions for that injury, not on recommendations of a particular classification system.

**Teaching Objectives:**

- Participants will identify the benefits and limitations of microsurgical classification systems for ring avulsion injury.
- Participants will learn alternatives for evaluation and treatment of ring avulsion injuries including the utilization of venous flaps.

**07**

**ANASTOMOSIS TO THE COMMON AND PROPER DIGITAL VESSELS IN FREE FLAP SOFT-TISSUE RECONSTRUCTION OF THE HAND**

**A Isur, T Hayakawa, E Buchel, R Buntic, D Brooks, B Safa**

**PURPOSE:** Free flap coverage for soft tissue defects of the hand has become increasingly common with microvascular anastomosis usually performed to the snuff-box or to the volar vessels at the distal forearm. Anastomosis at these locations has some drawbacks. The purpose of this study is to determine the viability and safety of anastomosing to proper or common digital vessels adjacent to the zone of the defect for free flap reconstruction of the hand.

**METHODS:** Retrospective review of all patients undergoing soft tissue free flap reconstruction of the hand with microvascular anastomosis to either the proper or common digital vessels was performed at two microvascular surgery centres.

**RESULTS:** Twenty-nine free flaps were performed in 28 patients. All free flaps were performed for traumatic digital or palm defects. Free flaps included: seven ALT/ALT fascial flaps, nine great toe pulp/wrap-around flaps, six second toe pulp flaps, four radial artery perforator flaps, two partial muscle flaps, and one lateral arm flap. Anastomosis was performed to proper or common digital arteries in all cases and venous anastomosis was performed to dorsal digital veins in 19 cases and volar veins in 10 cases. All free flaps survived. Five flaps were performed on a day surgery basis.

**CONCLUSIONS:** Microvascular anastomosis to the common or proper digital vessels adjacent to the site of injury represents a safe alternative to the volar wrist or dorsal snuff box with numerous advantages: short pedicle dissection therefore decreased donor site morbidity; decreased recipient site morbidity; decreased risk of pedicle kinking; quicker procedural times; and potential for outpatient procedures. Furthermore, size match between flap pedicle vessels and recipient vessels are close if a short pedicle is harvested and potential decrease in blood flow to the hand is avoided by not using the radial or ulnar artery.

#### Learning Objectives:

- The audience can identify the benefits and safety of microvascular anastomoses to the proper or common digital vessels for traumatic soft tissue free flap reconstruction

## 08

### UPDATE ON BLAST INJURIES TO THE HAND, A 33-YEAR REVIEW

**S Armstrong, W Przylecki, G Buncke, B Safa, R Buntic, D Brooks**

Hand blast injuries are not isolated wartime phenomena. They also occur with relative frequency in rural communities. We have previously described our experience with these devastating injuries. Currently we update our experience with respect to the pathomechanics of injury as well as our current approach to management over a 33-year period.

A total of 85 blast injuries to the hand were collected between 1978 and 2012. A retrospective review of patient demographics, type of explosive, injury pattern, and treatment was undertaken. Patient records and imaging studies were analyzed to document the history and define the injury pattern. The average age of our patient population was 26.5 years. The majority of these patients were male (90%). A firecracker was the most common explosive (34%). The pattern of injury was largely distributed on the radial side of the hand (52%). The most common type of injury was hyperextension and hyperabduction of the hand and digits. The most common reconstructive procedure was free tissue transfer for soft tissue coverage (23%). The most frequently used free flap was the rectus abdominis flap of which a total of 11 were performed. Nineteen patients required free great or second toe transfers. Of note, compared to our previous experience the use of partial muscle and ALT flaps increased greatly. We continued to identify a repetitive pattern of injury that was amenable to delayed reconstruction rather than microsurgical repair in the immediate setting.

Blast injuries to the hand continue to challenge the reconstructive surgeon. A spectrum of injury results characterized by acute hyperextension/hyperabduction with tearing of the skin and rupture of volar plates and ligaments to significant tissue destruction and multiple digit loss. However, recognizing predictable patterns of injury and development of reliable reconstructive algorithms enable the surgeon to successfully treat these devastating injuries.

#### Learning Objectives:

- Understand the patterns of blast injury to the hand.
- Understand patient demographics of blast injury.
- Understand the most up to date treatment algorithms for blast injuries.

## 09

### WRIST, FIRST CARPOMETACARPAL JOINT AND THUMB INTERPHALANGEAL JOINT ARTHRODESIS IN PATIENTS WITH BRACHIAL PLEXUS INJURIES

**IL Giuffre, AT Bishop, R Spinner, M Kircher, AY Shin**

**PURPOSE:** Wrist arthrodesis, first carpometacarpal joint arthrodesis and thumb interphalangeal joint arthrodesis can be used in conjunction with other reconstructive measures to improve function and grasp in patients with complete brachial plexus injuries. This study evaluates wrist arthrodesis, first carpometacarpal joint arthrodesis and thumb interphalangeal joint arthrodesis as measured by fusion rate, complications and clinical outcomes.

**METHODS:** A retrospective chart review was performed of twenty-four skeletally mature patients with brachial plexus injuries treated with wrist arthrodesis by a dorsal plating technique, first carpometacarpal joint arthrodesis by staples and interphalangeal joint arthrodesis by a tension band wiring technique. Nineteen patients were subjectively evaluated using pre and post arthrodesis DASH scores, visual analogue pain scores and a visual analogue scale assessing appearance, function, hygiene, ease of daily care, pain and overall satisfaction.

**RESULTS:** There was 100% union rate with one post-arthrodesis complication. One patient required wrist fusion-plate removal due to painful hardware. Subjective patient assessments showed a statistically significant ( $p < 0.0001$ ) improvement in DASH scores (from 51.4 to 28.4) and pain scores (from 5.3 to 3.2) pre- and post-arthrodesis. The visual analogue questionnaire revealed improvements in appearance, function, daily cares, hygiene, pain and satisfaction.

**CONCLUSION:** Wrist arthrodesis, first carpometacarpal joint arthrodesis and interphalangeal joint arthrodesis have high union rates with minimal complications. Patients benefit from the improved function of their upper extremities and are satisfied with the surgery. The use of wrist, first carpometacarpal joint and interphalangeal joint arthrodesis in combination should be considered part of the reconstructive armamentarium for patients with complete brachial plexus injuries.

#### Learning Objectives:

- The physician will consider the combination of wrist arthrodesis, first carpometacarpal joint and interphalangeal joint arthrodesis in the reconstruction of patients with complete brachial plexus injuries.

## 10

### THE BENEFIT OF HETERODIGITAL REPLANTATION IN MUTILATING HAND INJURY

**D Brooks**

Heterotopic replantation is a well described but seldom used reconstructive strategy to optimize the aesthetic and functional result after mutilating injuries to the extremities. Parts that are amputated and considered poor candidates for replantation in their original position are replanted in an alternate position. We present a series of heterodigital (finger) replants and describe our design rationale for optimization of function utilizing schematic illustrations.

Between 2006 and 2009, eight patients underwent 10 heterodigital replantations. These included index to long position (4), index to thumb position (2), and index and long to long and ring position (2). In both cases of thumb reconstruction the thumb was destroyed and the index was amputated. In all cases of index to the long position and index and long to the long and ring position destruction of various joints made heterodigital replantation advantageous with respect to potential residual total active motion (TAM). In all cases heterodigital replantation allowed overlapping tissues so that injured structures could be aggressively debrided. Average TAM of the heterodigital replants was evaluated and compared to the theoretic TAM if the digits were replanted in their original positions with fusion of the destroyed joints.

All heterodigital replants survived. Average TAM of the heterodigital replants was superior to that of the theoretic replants. All patients undergoing heterodigital replantation were satisfied with their aesthetic result.



Heterodigital replantation is an effective strategy for restoration of function without compromise of aesthetics in mutilating injury of the hand.

**Learning Objective:**

- *The participant should appreciate the functional and aesthetic utility of heterodigital replantation vs theoretic orthotopic replantation in severe injuries of the hand where orthotopic replantation would result in restoration of form over function.*

**11**

**SCRATCH COLLAPSE TEST AS AN ADJUNCT IN THE DIAGNOSIS OF TARSAL TUNNEL SYNDROME**

**K Boyd, A Nimigan, A Yee, S Mackinnon**

**BACKGROUND:** Tarsal Tunnel Syndrome typically presents with pain, paraesthesia and numbness in the distribution of the tibial nerve. Diagnosis is typically clinical, and confirmatory tests are limited. The Scratch Collapse Test has been previously described for evaluation of carpal and cubital tunnel syndrome and has been used to localize the point of maximal ulnar nerve compression in cubital tunnel syndrome.

**PURPOSE:** The purpose of this study was to describe the use of the Scratch Collapse Test as an adjunct in the diagnosis of tarsal tunnel syndrome.

**METHODS:** Consecutive patients referred for Tarsal Tunnel Syndrome between January 1, 2007 and December 31, 2009 and ultimately undergoing tarsal tunnel decompression were retrospectively reviewed. Clinical symptoms, Tinel's testing, electrodiagnostic studies, and Scratch Collapse Testing were compared.

**RESULTS:** Forty-eight undergoing 57 tarsal tunnel decompressions were identified. The Scratch Collapse Test was performed in 21 patients and was found to correlate well with Tinel's sign (85.6%) and electrodiagnostic studies (76.9%).

**CONCLUSIONS:** The Scratch Collapse Test is a reliable, reproducible and inexpensive test that can be used as an adjunct in the diagnosis of tarsal tunnel syndrome. Further investigation into the sensitivity and specificity of the Scratch Collapse Test in this setting would be beneficial.

**Learning Objectives:**

- *The participant will be aware of the SCT as a provocative test to help in the diagnosis of tarsal tunnel syndrome.*

**12**

**FREE TISSUE TRANSFER FOR NECROTIZING FASCIITIS RECONSTRUCTION: A CASE SERIES**

**T Liu, J Gawaziuk, T Hayakawa, S Logsetty**

**PURPOSE:** Necrotizing fasciitis (NF) is a life-threatening infection requiring extensive surgical debridement that may necessitate reconstruction with free tissue transfer (FTT). Our group previously presented preliminary descriptive data on our early experiences with FTT in NF; however, evidence is still lacking for outcome measures in the literature. The present study aims to further characterize the course of hospitalization in NF patients with FTT, and determine whether FTT impacts overall patient outcome.

**METHOD:** All patients admitted with the diagnosis of NF between 2005 and 2011 to our centre were retrospectively reviewed (N=225). Demographics and outcome of hospitalization in NF patients with FTT were compared with those without.

**RESULTS:** A total of 14 patients received FTT: upper extremities (8), lower extremities (4), head/neck (1) and genitalia (1). Upper extremities comprised almost 60% of the FTT patient population compared to 21% in the overall NF population. FTT occurred a mean of 11.4 days post-admission with 1.4 operations prior to FTT. Mean flap size was 213 cm<sup>2</sup> (1-1.25% TBSA). There were no flap failures and no take-back operations required for FTT. No significant difference was found in patient demographics between FTT and those without FTT: mean age of 44 years, 1.7 co-morbid conditions per patient and 3.4% TBSA affected. FTT patients had 2.6 total operations versus 2.5 (p=0.8)

operations in patients without FTT. ICU stay was 2.2 days in 35.9 days of total hospitalization in FTT patients compared to 2.4 days (p=0.586) in 34.6 days (p=0.914) in the no-FTT group.

**CONCLUSIONS:** Our results suggest that FTT provides a promising reconstructive option in the setting of NF without adversely affecting patient outcome.

**Teaching Objective:**

- *The participants will be able to consider the safety and outcomes for FTT in NF reconstructions.*

**13**

**AXILLARY NERVE INJURY: FUNCTION, AESTHETICS AND QUALITY OF LIFE**

**L Xu, J Lin**

**PURPOSE:** The axillary nerve's unique position predisposes it to injury, causing impaired shoulder function and deltoid atrophy. Although surgical treatment can result in good functional recovery, some patients continue to be dissatisfied and report feeling embarrassed by the lack of contour symmetry about the shoulder due to deltoid atrophy. This study aims to report our experience with axillary nerve reconstruction, estimate the impact of deltoid atrophy on patients' quality of life, and to suggest methods to evaluate the cosmetic defects of deltoid atrophy.

**METHODS:** A search was performed using EMBASE, MEDLINE, Current Contents and Science Citations for articles on shoulder reanimation or contouring. A review of the medical records of patients consulting for deltoid paralysis at Maisonneuve-Rosemont Hospital between 2008 and 2011 was conducted. Data extraction included: patient demographics, injury details, treatment, outcome and follow-up. The following tools were used to assess patients' shoulder function and quality of life: SF-36, American Shoulder and Elbow Surgeons' Shoulder Assessment Form, Constant Score, Disabilities of Arm, Shoulder and Hand (DASH), Simple Shoulder Test and a questionnaire on the patients' perceptions of their shoulders' appearance.

**RESULTS AND CONCLUSION:** Axillary nerve injury can result in significant disability due to paralysis of the deltoid muscle. However, even patients with satisfactory functional recovery can remain dissatisfied due to the persistent atrophy and contour deficiency of the deltoid muscle. This is an aspect of axillary nerve injured patients that had not been studied previously. We will present our methods to evaluate the impact that deltoid atrophy and shoulder function have on patients' quality of life, and investigate potential solutions for correcting the contour deficiency of these patients.

**Learning Objectives:**

- *The learner will be able to (1) describe existing shoulder reanimation and contouring options, (2) to recognize the impact of shoulder deformity on patients' quality of life.*

**14**

**MICROSURGICAL REVASCLARIZATION OF THE UPPER LIMB FOLLOWING IATROGENIC BRACHIAL ARTERY THROMBOSIS IN PRETERM, VERY LOW-BIRTH-WEIGHT INFANTS. A CASE SERIES.**

**M Laliberte, I Macarthur, G Althubaiti, E Buchel, L Ross, T Hayakawa**

**PURPOSE:** Premature, critically ill neonates frequently require prolonged intravascular catheterization for nutritional support, medications, and hemodynamic monitoring. Iatrogenic brachial arterial thrombosis in preterm, very low-birth-weight neonates is a rare complication of vascular access in the upper limb. Few data exists on the microsurgical management of iatrogenic brachial arterial thrombosis in this population.

**METHODS:** Three consecutive infants, born before 30 weeks gestation, weighing less than 1300 g, with localized brachial arterial thrombosis from vascular access within the first week of life were reviewed between 2007 and 2012 in Winnipeg, Manitoba.

**RESULTS:** Two patients had peripheral indwelling central catheter insertion at the antecubital fossa. Surgical exploration between eighteen and twenty-four hours post insertion revealed multiple puncture sites in the brachial artery with diffuse thrombosis. Following unsuccessful attempts at embolectomy, interpositional vein grafts were used to reconstruct the entire brachial artery in both patients. Two and five year follow-up demonstrate excellent functional outcome with no evidence of Volkmann's contracture, neuropathy or growth retardation. The third patient had ischemia secondary to brachial arterial line placement. Following line removal, the family refused surgical intervention and below-elbow gangrene resulted.

**CONCLUSIONS:** Brachial arterial thrombosis is a rarely reported complication of vascular access in critically ill, preterm, very-low-birth weight infants. Systemic anti-coagulation is often unavailable in this population due to the risk of cerebral hemorrhage. Revascularization is a technically feasible option requiring total brachial artery reconstruction due to multi-level injuries and diffuse thrombosis. A highly functional limb with normal growth characteristics can be restored.

#### Learning Objectives:

- *The participant will identify limb-threatening complications of vascular access in the neonatal population, describe microsurgical techniques for limb-salvage and be familiar with possible outcomes of surgical and conservative management.*

## 15

### THE BIPEDICLE DEEP INFERIOR EPIGASTRIC PERFORATOR (DIEP) FLAP: AN ALGORITHM FOR THE SELECTION OF RECIPIENT VEINS

**A O'Neill, N Ngan, J Platt, T Zhong, S Hofer**

**PURPOSE:** The bipedicle deep inferior epigastric perforator (DIEP) flap is a valuable strategy to increase the reliability of vascular perfusion across all flap zones in patients with large breast size or small abdominal pannus. The identification of appropriate recipient veins can, however, be challenging. As it was believed that the internal mammary vein (IMV) did not contain valves the second pedicle is commonly anastomosed to the caudal end of the IMV and therefore reliant on retrograde venous drainage. The demonstration of valves in the IMV has challenged this approach. We describe our experiences with the bipedicle DIEP flap with particular emphasis on selection of recipient veins that facilitate anterograde venous drainage.

**METHODS:** Retrospective chart review was performed of patients undergoing autologous breast reconstruction between January 2008 and December 2011 to identify patients in whom the bipedicle technique was used. Patient demographics, details of surgical technique and clinical outcomes were recorded.

**RESULTS:** Twenty-one patients who had undergone autologous breast reconstruction using bipedicle DIEP flaps were identified. The indications for the bipedicle technique included small abdominal pannus, large breast volume and midline laparotomy scar. The mean flap weight was 580 g (range 321 g-797 g) and flap survival was 100% in all cases. Recipient veins for the second DIEP included a second IMV, perforators of the IMV, the DIEP of the first pedicle and the caudal IMV. The surgical technique for flap harvest and algorithm for the selection of the second recipient vein are presented.

**CONCLUSIONS:** The bipedicle DIEP flap is a useful approach in patients that require increased flap volume. Careful selection of appropriate recipient veins is a critical step in ensuring flap viability.

#### Learning Objectives:

- *Demonstrate technical aspects of the bipedicle DIEP flap.*
- *Provide an algorithm for the selection of recipient veins to ensure reliable anterograde venous drainage.*

## 16

### CHALLENGES OF TRANSVERSE UPPER GRACILIS (TUG) FREE FLAP BREAST RECONSTRUCTION

**A Morritt, M Locke, T Zhong, S Hofer**

**PURPOSE:** To review our experience of using the Transverse Upper Gracilis (TUG) free flap for breast reconstruction.

**METHOD:** A retrospective series review of all TUG flap breast reconstructions over a five-year period was performed.

**RESULTS:** Sixteen TUG flaps were performed to reconstruct 15 breasts in eight patients over the five-year study period. The average follow-up was 27.5 months (range: 14-41 months). Average patient age at time of surgery was 31.6 years (range: 19-45 years). The majority of flaps (14/16; 88%) were used for breast reconstruction following mastectomy, with the remaining flaps (2/16; 12%) used to reconstruct the breast in a patient with Poland syndrome. Average flap size was 312 grams (range: 167 to 480 grams). One (6%) total flap loss occurred and this patient underwent breast reconstruction using a submuscular tissue expander which was subsequently exchanged for a breast implant. No partial flap losses occurred. Four further flaps failed in terms of the primary aim of breast reconstruction as they required additional significant reconstruction with either deep inferior epigastric perforator (DIEP) flaps (two flaps in one patient) or breast implants (two flaps in one patient). In all the remaining reconstructed breasts (11/16; 69%) deficient flap volume or contour was seen and eight of these flaps were augmented by lipofilling. Overall, each patient who underwent TUG flap reconstruction required an average of four additional procedures (not including reconstruction of NAC). Donor site complications were common (62.5% of flaps) and included poor scar requiring revision (37.5%) and medial thigh sensory disturbance (25%).

**CONCLUSIONS:** This series demonstrates a high rate of both complications and revision surgery from TUG flap breast reconstruction.

#### Learning Objective:

- *The audience will learn about the challenges and limitations of breast reconstruction with the TUG flap.*

## 17

### FLUID ADMINISTRATION IN MICROVASCULAR BREAST SURGERY

**M Lyons, T Hayakawa, E Buchel, I Sigurdson, J Bohn, DJ Funk**

**PURPOSE:** Intra-operative fluid management in the surgical patient has undergone a paradigm shift over the past decade: from "wet" to "dry" to a goal-directed approach. Historically, free flap patients have been aggressively fluid resuscitated. Our objectives were to determine if goal-directed fluid therapy, guided by an arterial pulse contour device, results in improved patient outcomes.

**METHODS:** Twenty patients undergoing microvascular breast reconstruction in a high volume microsurgery center were randomized. Each patient received peripheral CVP and intra-arterial blood pressure monitoring. Control patients had fluid administered at the discretion of the anesthesiologist. Patients in the intervention group had a baseline crystalloid infusion of 5 cc/kg/h with colloid boluses to maintain a "Stroke Volume Variation" less than 13%. Five groups of outcome variables were analyzed utilizing the Mann Whitney U test.

**RESULTS:** Fluid volume requirements were surprisingly low. The average total intra-operative fluid administration in the control group was 6.5 cc/kg (5.5 cc/kg crystalloid, 1.1 cc/kg colloid). This would amount to only 390 cc for an average 60 kg female. In the intervention group the average total intra-operative fluid requirement was 4.3 cc/kg (3.6 cc/kg crystalloid, 0.7 cc/kg colloid). There was no significant difference in intra-operative heart rate or MAP between groups. The control group had significantly lower cardiac output (CO) and stroke volume (SV), but did not require more "rescue" fluid resuscitation during the postoperative period. There were no adverse surgical outcomes in either group. The only significant difference in patient outcomes was higher antiemetic medication dose administration in the intervention group.

**CONCLUSIONS:** Fluid administration guided by cardiac output monitoring technology results in higher end operative CO and SV, but not to a significant difference in total fluid requirements or patient outcomes. In addition, the historical norm of “over-resuscitating” free flap patients appears unnecessary.

**Learning Objective:**

- To understand safe fluid volume administration parameters in microvascular breast surgery.

**18**

**ANALYSIS OF QUANTITATIVE ENDPOINTS FROM A MULTICENTER RETROSPECTIVE REGISTRY STUDY ON THE USE OF ACELLULAR NERVE GRAFTS FOR SENSORY, MIXED, AND MOTOR NERVE RECONSTRUCTIONS**

**B Parrett, D Brooks, R Weber, J Chao, B Safa, G Buncke**

**PURPOSE:** To report the outcomes data collected from an ongoing multi-center retrospective study on the use of processed nerve allograft (Avance® Nerve Graft, AxoGen, Inc).

**METHODS:** Twelve centers encompassing 25 surgeons have reported their experiences with the Avance® Nerve Graft between 2007-2010 resulting in a database of 108 subjects with 132 repairs. The outcome population currently consists of 59 subjects with 76 nerve repairs. Chart reviews were completed in a retrospective fashion to collect subject, injury and repair demographics. Follow-up data points for safety and functional outcomes were collected in an observational manner. Data points included 2-point discrimination, Semmes-Weinstein monofilament testing, electromyography, range of motion, grip/pinch strength and MRCC of recovery following nerve injury. SAS/STAT® software was utilized for the data analysis (Statistical Analysis Systems, 2011). Data was segregated to perform population analysis for utilization, safety, and efficacy outcomes. Chi-square analysis was performed to determine whether there were statistical differences between populations.

**RESULTS:** Our study contained 49 sensory, 18 mixed and 9 motor nerves treated with processed nerve allograft. Nerve graft lengths ranged from 5 mm to 50 mm with a mean of 22±11 mm. Subject age ranged from 18 to 86 years (mean of 41±16). Meaningful levels of functional recovery were achieved in 89% of sensory, 77% of mixed and 86% of motor nerve injuries. Meaningful recovery was observed regardless of type of nerve, time-to-repair (TTR), nerve gap up to 50 mm, and age. No graft related adverse experiences were reported.

**CONCLUSIONS:** Avance® Nerve Graft was shown to be safe and effective for nerve gaps 5-to-50 mm. These outcomes compare favorably with those reported in the literature for primary repair, nerve autograft and nerve conduit. This study challenges the current outcome expectations for nerve reconstructions across conventional

**Learning Objectives:**

- The participant should understand the role of nerve allograft as an alternative to autograft across traditional barriers such as gap length, patient age, mechanism of injury, and time-to-repair (TTR).
- The participant should appreciate not only the efficacy but also the safety of processed and sterilized nerve allograft in clinical applications.

**19**

**CADAVER LAB TO SPINAL CORD INJURY - THE POTENTIAL FOR DISTAL NERVE TRANSFERS TO RECOVER PINCH IN A C7 INJURY**

**K Boyd, S Mackinnon**

**BACKGROUND:** The surgical goal in the management of a patient with a spinal cord injury is to improve function. A number of techniques have been described and met with varying degrees of success. We propose an option for the restoration of pinch in a C7 level injury that arose from a cadaveric study and then its subsequent use in peripheral nerve injury patients.

**PURPOSE:** To describe the anatomical feasibility of a brachialis to anterior interosseous nerve transfer to restore pinch in a C7 spinal cord injury.

**METHODS:** Nine fresh frozen cadaveric upper limbs were dissected to determine the total proximal “neurolysable” distance and internal topography of the anterior interosseous nerve. The location, number and length of brachialis branches were also determined. Transfer of the brachialis nerve to the AIN was conducted in several peripheral nerve patients and one C7 spinal cord injury patient.

**RESULTS:** The AIN was neurolysable on the posterior-medial aspect of the median nerve in the arm for a distance of 13.0±2.4 cm. The motor branch to brachialis departs from the musculocutaneous nerve at a distance of 11.5±1.6 cm. Transfer of the brachialis nerve to AIN is anatomically feasible. The transfer was performed in several patients with peripheral nerve injuries and then in one patient with a C7 injury. That patient recovered MRC grade 3+/5 strength of the AIN. No donor deficit was identified.

**CONCLUSION:** Transfer of the brachialis branch to the AIN is anatomically feasible and meets with good success in patients presenting with peripheral nerve injuries. We present this as an option that can cautiously considered in patients with spinal cord injuries to restore pinch.

**Learning Objective:**

- Participants will be made aware of the potential to treat spinal cord injury with distal nerve transfer.



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