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Dr Edward Tredget: President/Président
Dr Howard Clarke: Vice President / Vice-président, Scientific Program Chair / Comité de programme scientifique
Dr Chris Taylor: Local Organizing Committee Chair / Président, Comité d'accueil

EYE-OPENER SESSION

00
PELVIC, PERINEAL AND VAGINAL RECONSTRUCTION

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Learning Objectives:

1. *Participants will recognize advantages and disadvantages of flap reconstruction of pelvic and perineal defects following abdominal perineal resection or pelvic exenteration.*
2. *Participants will identify strategies to reconstruct the pelvic, perineal and vaginal structures using flaps from various donor sites.*
3. *Participants will understand the advantages and disadvantages of thigh-based and abdominal-based flaps for pelvic/perineal reconstruction.*

01
AUTOLOGOUS BONE CRANIOPLASTY SAFETY AND EFFICACY: A REVIEW OF 128 CASES OVER 39 YEARS

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PURPOSE: Many cranioplasties in North America are performed with alloplastic implants because of ease of the procedure and a lack of experience related to bone harvest. Published series of alloplastic repairs have reported infection rates of 9 to 23%. The senior author has used autogenous bone of various sources for 128 calvarial defects over a 39-year period and this report will present that experience.

METHODS: A total of 134 cases met inclusion criteria (several patients had staged reconstructions). Data regarding patient demographics, underlying pathology, complications, and length of follow-up were collected.

RESULTS: Average patient age was 22, with a range of 12 months to 76 years. Causes of the cranial defects included trauma, malignancy, infection, craniosynostosis, and surgically created defects resulting from full-thickness calvarial harvest. Donor sites included calvarium (72%), rib (22%) and ilium (10 %). Eleven patients had had prior failures with alloplastic materials. Notably, there were no cases of infection, no cases requiring bone graft removal, and no significant graft resorption on follow-up. Furthermore, no complications were seen related to harvesting of the autogenous grafts.

CONCLUSIONS: This retrospective study demonstrates that autogenous bone is the ideal graft replacement for full-thickness, cranial vault defects. Absolute indications for the use of autogenous bone include defects near the paranasal sinuses, defects in growing children, previous alloplastic failures, and complex orbito-cranial defects requiring staged procedures. More emphasis should be placed on teaching plastic surgery residents how to harvest and work with bone so that alloplastic materials will not be their only recourse.

Learning Objectives:

Participants will learn the advantages of using autologous bone in cranioplasty surgery.

02
FUNCTIONAL OUTCOMES OF ENOPHTHALMOS CORRECTION

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PURPOSE: Determine functional outcomes of late post-traumatic enophthalmos repair, specifically, ocular motility, diplopia, and strabismus.

METHODS: The study series comprises 81 consecutive patients with late post-traumatic enophthalmos with functional impairment, that underwent enophthalmos repair by a single surgeon (OA) between May 2002 and April 2014. Of those, 39 patients fulfilled study inclusion and exclusion criteria. Outcomes (diplopia, limitations of ocular motility, and strabismus) were assessed independently by a single ophthalmologist who specializes in strabismus surgery (AB), and were performed preop and postop for each patient.

RESULTS: Average age was 43.1 (range 15-79) with 26 males, and 13 females. After enopthalmos correction 20 patients decreased by 1 or more grades of diplopia, while 7 patients had complete resolution. Re-operation was required in 6 patients to address inadequate correction or post-operative complication. Two patients worsened by 1 or more grades of diplopia after enophthalmos repair. Residual diplopia was treated with strabismus surgery in 10 patients. 4 patients were managed with prism glasses without further surgery. Of the 10 patients that received strabismus surgery, 6 patients improved by 1 or more grades of diplopia, 2 worsened. 34 of 39 patients presented with vertical restriction $\mu=-1.95$ ($\sigma=1.13$) was improved to $\mu=-1.21$ ($\sigma=0.98$) with enopthalmos repair and to $\mu=-1.06$ ($\sigma=0.98$) after all interventions. 18 patients presented with horizontal restriction $\mu=-0.88$ ($\sigma=0.62$). This improved to $\mu=-0.56$ ($\sigma=0.6$) after enopthalmos repair and $\mu=0.59$ ($\sigma=0.6$) after all interventions.

CONCLUSIONS: Late enopthalmos repair post orbital fracture resulted in functional improvement of diplopia, ocular restriction and strabismus in this retrospective case series.

Learning Objectives:

1. *Understand the functional sequelae of post-traumatic enopthalmos*
2. *Appreciate of the benefits and limitations of enopthalmos repair to address functional outcomes of diplopia, ocular motility, and strabismus*

03
AIRWAY MANAGEMENT IN PIERRE ROBIN SEQUENCE: THE VANCOUVER CLASSIFICATION SYSTEM

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PURPOSE: Neonates with Pierre Robin Sequence (PRS) present with airway obstruction and feeding difficulties. No current practical classification of PRS patients exists. We hereby propose a clinical classification and treatment algorithm.

METHOD: A 10-year retrospective study of all neonates diagnosed with PRS was performed. Patients with glossoptosis, retrognathia, airway obstruction ± cleft palate were included. We collected data on demographics, treatment and outcomes during the first year of life.

RESULTS: Sixty-three patients were identified; 48 managed successfully by prone positioning alone. Fifteen underwent surgical airway management, with 10 managed with a single procedure. Five needed a second surgery. The initial surgery was FMR in 7 patients, TLA in 4 patients and MDO in 4 patients. Of the 5 patients who needed multiple procedures, 2 were managed with MDO and 3 needed tracheostomies.
CONCLUSIONS: 76% of our PRS patients were managed by prone positioning alone. Based on our findings, we propose a 4-grade classification of PRS patients.
Learning Objectives:
Participants will be able to:
1. *Classify Pierre Robin Sequence (PRS) patients using a novel classification system*
2. *Plan airway management in PRS patients using our proposed algorithm*

TABLE 1
Treatment algorithm

Grade	Clinical Features	Treatment
0	Maintains oxygen saturation with prone positioning. No other co-existing airway morbidity. MMD <10mm	Prone positioning (or nasopharyngeal airway)
1	Desaturation with prone positioning. No co-existing airway morbidity. MMD <10mm	TLA or FMR
2	Desaturation with prone position. MMD ≥10 mm ± Co-existing laryngomalacia, tracheomalacia or bronchomalacia	MDO
3	Failed MDO or tongue repositioning. Multi-level airway obstruction	Tracheostomy

Classification for Airway Management in Pierre Robin Sequence. MMD: Maxillary Mandibular Discrepancy; TLA: Tongue-Lip Adhesion; FMR: Floor of Mouth Release; MDO: Mandibular Distraction Osteogenesis

04
SOLVING THE PROBLEM OF LARGE MYELOMENINGOCELE DEFECTS IN NEONATES: THE EXTENDED OBLIQUE BACK FLAP

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PURPOSE: The aim of this paper is to describe how to raise the extended transvers-oblique back (ETOB) flap in neonates to cover large back defects in neonates.We also compared the outcomes of this technique with the use of local random flap and primary closure.
METHODS: We performed a retrospective review of all new myelomeningocele (MMC) cases that were treated in our institution over 6 years stratifying the patients into 3 groups; patients who were treated with primary closure (group 1), patients who were treated with the use of random local flaps (group 2) and patients who were treated with the extended transverse oblique back flaps (group 3). This flap has a narrow base and a wider skin paddle and extends obliquely from spine to/beyond axillary line. Muscle may or may not be included in the harvest. We compared the outcomes of this technique with the other two techniques mentioned above.
RESULTS: Forty-nine patients required soft tissue coverage of myelomeningocele defects. Among those; 10 patients were closed primarily, 16 patients were closed using random local transposition or rotation flaps and 33 patients were treated with the ETOB flaps. For the groups above; the average sizes of the soft tissue defects before reconstruction were 32 cm^2, 27 cm^2 and 36 cm^2 respectively (p=0.4). All ETOB flaps survived completely except 2 flaps that developed distal tip necrosis of about 1–1.5 cm.The overall complications rate (including major and minor complications) were 50% in first groups (5/10) vs. 100% in the second group (6/6) and 36.3% in the third group (12/33).The need for reoperation was lower in the third group (2/33) vs. the second group (2/6) (P=0.04).
CONCLUSION: The extended oblique back flap is simple to design, easy to raise and teach. It is also reliable and can cover large defects. It is our flap of choice for myelomeningocele defects closure.
Learning Objectives:
1. *Participants will be able to describe the technique of raising the extended transverse-oblique back flap.*
2. *Participants will be introduced to our reported outcomes of this technique versus other techniques in closing myelomeningocele defects.*

CANADIAN EXPERT PRESENTATION

04A
SURGICAL ADVOCACY: DEVELOPING AN INITIATIVE

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As health advocates, physicians utilize their expertise and influence to work with communities or patient groups in order to improve health. The goals of advocacy are to bring exposure to issues that are under represented or not fully appreciated, to determine and understand the needs of those who they work with, to speak on behalf of others when required and to support the mobilization of resources to effect change.
Breast reconstruction is a cornerstone to many plastic surgery practices. Epidemiologic data have demonstrated that a minority of women who are candidates for reconstructive surgery undergo these procedures. This data reflects variations based on economics, social status and geographic location. Advocacy in breast reconstruction can be structured around three pillars: Access, Awareness and Education. This presentation will provide an overview of a breast reconstruction advocacy initiative that began in 2011, and is supported by the Canadian Society of Plastic Surgeons. The presenter will discuss the variety of challenges that were faced at the beginning of this initiative, how it has developed and matured, where the program exists today and plans for future development.
Learning Objectives:
1. *The participant will develop a definition for health advocacy in today's health care environment.*
2. *The participant will learn a strategy for implementing a health advocacy initiative.*

05
CALF PERFORATOR FLAPS – THE GO-TO-FLAP FOR ORAL CAVITY RECONSTRUCTION

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PURPOSE: Calf perforator flaps are emerging as a popular choice in complex head and neck reconstruction due to their favourable donor site morbidity. There are multiple source vessels in this region - the medial sural artery (MSAP) flap is the most commonly used. We set out to document our clinical experience using calf perforator flaps in oral cavity reconstruction. In addition, we performed a cadaveric dissection study to determine predictability of perforator location.
METHOD: We prospectively collected data on calf perforator flaps in oral cavity reconstruction (floor of mouth, tongue) over a 12-month period. In parallel, 20 medial calves from 10 cadavers were dissected (4 males 6 females). The position of the perforators was recorded in relation to fixed landmarks (vertical – intermuscular septum, horizontal – most proximal point on the fibula).
RESULTS: Eight calf perforator flaps (7 MSAP, 1 SAP flap) were performed over the study period (4 floor of mouth, 3 tongue, 1 buccal mucosa). Mean flap size was 9 × 5 cm. The mean flap harvest time was 73 minutes. Seven of 8 donor sites were closed directly. All flaps survived. One patient developed an early oro-cutaneous fistula, which healed spontaneously. All patients resumed a normal diet. In the cadaveric study, musculocuntaneous perforators form the MSA vessels were found in 19 of the 20 cases (mean 2.3 / limb). Perforator location ranged from 20 to 170 mm inferior to the fibular head and 0 to 45 mm medial to the septum. Septocutaneous perforators from the sural artery system were present in 10% limbs (2 of 20).
CONCLUSION: Our study suggests that the vascular anatomy of the medial calf is predictable, yielding perforator flaps that are ideal for intraoral reconstruction.

Learning Objectives:
1. *The medial calf region is rich in musculocutaneous perforators.*
2. *The medial calf perforator skin is a good match for oral cavity defects.*

06
SURGICAL PERIPHERAL NERVE DECOMPRESSION FOR THE TREATMENT OF DIABETIC NEUROPATHY IN THE FOOT

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PURPOSE: Surgical decompression of the major peripheral nerves innervating the foot has been proposed as a treatment for diabetic peripheral sensorimotor polyneuropathy (DSP). This condition is a major cause of pain and disability in diabetics, and imposes a large economic burden to the health care system. Nonoperative treatment options to date are often ineffective. Case series have demonstrated the potential for nerve release surgery to alleviate pain in these patients, but to date no blinded study has been reported. The American Academy of Neurology has cautioned that this surgery is to be considered experimental and unproven, albeit promising. We conducted a blinded, randomized study to test the null hypothesis that surgical decompression of the common peroneal, deep peroneal, and tibial nerves has no benefit in ameliorating the symptoms of DSP.
METHODS: Adult diabetics with good glycemic control, diagnosed to have DSP and no other identifiable cause of neuropathy, or other contributors to their foot pain, and an average pain score on a 10-point Likert scale 5, were eligible. Consenting subjects were allocated to a study group using a simple randomization technique. Control subjects received their standard medical care; operative subjects underwent surgical decompression. Evaluations were performed by a blinded, trained study nurse at 3, 6, 9 and 12 months for both groups.
RESULTS: The average pain scores for the operative group over time were significantly lower than the control group (p=0.04), and the null hypothesis was rejected.
CONCLUSIONS: In this blinded randomized trial, surgical decompression of the common peroneal, deep peroneal and tibial nerves significantly reduced pain for patients with DSP.
Learning Objectives:
At the end of this presentation the participant will:
1. *Understand the criteria for diagnosis of DSP*
2. *See the results of a blinded randomized study to evaluated the effectiveness of surgical nerve decompression for this condition*

07
A PATIENT-REPORTED OUTCOME MEASURE FOR PATIENTS WITH CLEFT LIP AND/OR PALATE: FIELD-TESTING THE CLEFT-Q

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PURPOSE: Patient-reported outcomes (PROs) are increasingly important in the evaluation of treatment, and scientifically sound PRO measures are required to provide meaningful measurement. The purpose of this study was to pilot field-test the CLEFT-Q, a new PRO measure for patients with cleft lip and/or palate (CLP).
METHODS: The field-test version of the CLEFT-Q was designed through a systematic review of the literature, 136 in-depth qualitative interviews with patients in six different countries, expert input, and 70 cognitive debriefing interviews. There were 14 independently functioning scales in the CLEFT-Q in the domains of appearance, speech, psychological well-being, social well-being, and physical function. In a pilot field-test at a single centre, 138 patients with CLP between 6-22 years completed the preliminary scales. Rasch analysis, a modern psychometric method, was used to identify the questions most effective in measuring the concepts of interest, and to create a "ruler" for each scale to achieve clinically meaningful measurement.
RESULTS: Patients completed the scales in a mean of 20 minutes (range 7-43 minutes). Younger children required more time, as did males compared to females. In the Rasch analysis, the appearance and physical function scales were effective. The psychological and social well-being scales showed some ceiling effects. An additional response option was added as a result. Patients did not identify with the benefit-finding scale, and this scale was dropped from future testing.
CONCLUSIONS: The pilot field-test identified early measurement characteristics of the CLEFT-Q scales. Changes to the scales were made prior to the large-scale field-test, which is now taking place in 17 sites across 6 different countries.
Learning Objectives:
The learner will understand the importance of rigorous PRO measure development, and will be able to describe the field-test process for the CLEFT-Q.

07A
EPIDERMAL OVEREXPRESSION OF CD109 REGULATES DERMAL FUNCTION THROUGH A PARACRINE MECHANISM

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BACKGROUND: Transforming Growth Factor-beta (TGF-β) is a multifunctional growth factor that is known to regulate wound healing. Excessive TGF-β signaling in the skin has been linked to fibrotic skin disorders such as hypertrophic scarring and keloids. We have discovered that CD109 is a novel co-receptor and negative regulator of TGF- β signalling. Our previous work has shown that transgenic mice overexpressing CD109 in the epidermis display reduction in dermal thickness and improved dermal architecture during wound healing in vivo. The objective of the study was to elucidate the molecular mechanisms by which CD109 expression in the epidermis regulates dermal responses.
METHODS: Epidermal explants, keratinocytes and dermal fibroblast were prepared using 8 mm punch skin biopsy from transgenic (TG) mice overexpressing CD109 and their wild-type (WT) littermates. TG and WT epidermal explants were co-cultured with WT dermal fibroblasts for 48 hrs. Alternatively, WT fibroblasts were treated for 48 hrs with conditioned media from TG and WT epidermal explants. Fibroblast cell lysates were prepared and fibronectin and α-smooth muscle actin (α-SMA) expression were determined. TGF-β signalling in TG and WT keratinocytes and fibroblasts were analyzed by determining Smad 1/5 versus Smad2/3 signalling.
RESULTS: Fibroblasts cultured with TG epidermal explants or TG explant conditioned media showed decreased levels of fibronectin and α-SMA expression, when compared to fibroblasts cultured with WT epidermal explants or conditioned media. Importantly, TG keratinocytes showed enhanced Smad1/5 signaling when compared to WT keratinocytes.
CONCLUSIONS: Our findings suggest that epidermal CD109 regulates dermal fibroblast function through a paracrine mechanism and this may involve upregulation of Smad1/5 signaling in keratinocytes. Understanding the mechanism by which CD109 exerts its anti-fibrotic action may lead to the development of a novel strategy for the treatment of fibrotic skin disorders.
Learning Objective:
Participants will understand the signalling mechanism by which CD109 regulates ECM production in the skin.

CANADIAN EXPERT

07B
NERVE TRANSFERS

L Dvali

08
PEDIATRIC SCAPHOLUNATE INJURIES

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PURPOSE: Scapholunate injury is rare in children. The standard assessments used in adults may not be as valuable in the pediatric population. The current study reports the pre-operative assessment and post-operative outcomes of scapholunate (SL) ligament injuries in children.
METHODS: An IRB approved retrospective review was performed on 21 patients with an average age of 15 years (range, 11-17 y) who presented

with dorsal wrist pain, positive Watson's test, and/or radiographs consistent with SL dissociation. Medical records were reviewed to determine preoperative signs and symptoms of injury as well as outcomes after operative intervention.

RESULTS: Fourteen females and 7 males sustained SL injuries which required operative intervention. Nineteen patients had dorsal wrist pain while only six patients had a positive Watson shift. MRI was performed in 15 patients however the radiologist interpretation only indicated an SL tear in 7 patients. Arthroscopy was performed in 18 patients. The SL injury was classified as Geissler grade II in 1 patient, III in 12 patients, and IV in 5 patients. After operative intervention and an average follow-up of 28 months, 8 patients were pain free, 7 had mild pain, and 3 endorsed moderate or greater pain. The mean wrist flexion-extension arc was 111 degrees while the mean grip strength was 81% of the unaffected side.

CONCLUSION: SL dissociation is an uncommon injury in children. Its diagnosis should be suspected in children with persistent dorsal wrist pain and/or localized tenderness over the dorsal SL joint. MRI may assist in diagnosis but is not sensitive. Arthroscopy is valuable to determine the extent of injury. A high index of suspicion is necessary to detect an SL injury in the younger age group.

Learning Objectives:

The learner will be able to understand the work-up for a pediatric SL injury as well as know the outcomes of treatment.

09

DIFFERENT METHODS IN THUMB SOFT TISSUE TIP DEFECT

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PURPOSE: Management of soft tissue defects of the thumb represents challenge for plastic surgeons regarding techniques, cosmetic and functional results, aiming at restoration of functioning thumb with non-painful, sensate and durable coverage. This study was conducted to evaluate the role of three types of local flaps used for reconstructing soft tissue defects of the volar aspect of the thumb; the volar palmar advancement flap, the heterodigital neurovascular island flap and the first dorsal metacarpal artery flap.

METHODS: 34 cases of soft tissue defects of the volar aspect of the thumb were included in the study, divided into three groups, each group representing a flap used. The 1st group represented palmar volar advancement flap reconstruction. The 2nd group represented heterodigital neurovascular island flap reconstruction and 3rd group represented 1st dorsal metacarpal flap reconstruction.

RESULTS: twelve patients (35.3% – 1st group) treated with volar advancement flap showed the best outcome both functionally and cosmetically with neither significant complications nor donor site morbidity. Eight patients (23.5% – 2nd group) treated with heterodigital neurovascular island flap showed stable coverage with good protective sensation. However the operation is lengthy with meticulous dissection. Complications included partial flap loss and donor site morbidity. Fourteen patients (41.2% – 3rd group) treated with 1st dorsal metacarpal artery flap showed stable skin covrage. Although the timing is less than 2nd group, protective sensation is poorer. Complications included partial flap loss and donor site morbidity.

CONCLUSION: volar palmar advancement flap is more superior in terms of sensation and cosmetic results for defect size of 1–2 cm. It has no significant donor site morbidity. Heterodigital neurovascular flap – although technically demanding with considerable time – is ideal in reconstructing large thumb soft tissue defects providing it with good protective sensation. First dorsal metacarpal artery flap is less favourable in terms of protective sensation and cosmetic results.

Learning Objectives:

1. *Reconstructive plastic surgeons will know that there are different options for soft tissue thumb defect.*
2. *Reconstructive plastic surgeons will be able to preform durable sensate local flap coverage for soft tissue thumb defect.*
3. *Reconstructive plastic surgeons will be able to conduct, transfer and describe administrative safe and effective way to correct soft tissue thumb defect.*

10

THE EFFECT OF DISTAL INTERPHALANGEAL JOINT STIFFNESS ON GRIP STRENGTH

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PURPOSE: Production of a functional grip pattern requires the concerted action of numerous muscles within the hand. The flexor digitorum profundas (FDP) is the only flexor that connects to the distal phalanx and the sole flexor of the DIP joint; however, the contribution of distal interphalangeal (DIP) flexion to grip strength has never previously been described.

METHODS: 50 individuals (25 men, 25 women, 100 hands) with mean age 40.6 years (range 21-79 years) were recruited. Exclusion criteria included history of previous upper limb injury, neuropathies, or systemic disease. Custom thermoplastic orthoses were used to splint participants' DIP joint in full extension simulating stiffness. Grip strength before and after splinting was measured using a calibrated Jamar dynamometer. Data were analyzed using paired and independent sample *t* tests and 2×2 repeated measures ANOVA with hand dominance and configuration (splinted or un-splinted) as within-subject factors.

RESULTS: Restriction of DIP flexion lead to an 18-21% decrease in grip strength ($p<0.001$). There was no significant difference in this decrease between dominant and non-dominant hands. Univariate analysis also demonstrated significant interaction between hand dominance and configuration that was predictive of grip strength ($F[1, 49]=7.98$; $p<0.01$). Furthermore, men had significantly stronger grip strength than women in all configurations ($p<0.001$); however, age was not correlated with grip strength.

CONCLUSIONS: Flexion at the DIP joint contributes significantly to grip strength, and stiffness at the joint may greatly impact functional capabilities of the hand. This necessitates the need for targeted rehabilitation in DIP joint injuries to minimize adverse effects on grip strength.

Learning Objectives:

1. *Describe muscle coordination required for grip production.*
2. *Distinguish DIP joint contribution to grip strength.*

11

ASSESSMENT OF THE 'TEN TEST' FOR DISCRIMINATIVE SENSIBILITY IN UPPER LIMB PERIPHERAL NERVE TRAUMA PATIENTS

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PURPOSE: To determine the validity of the 'Ten Test' (TT) for discriminative sensibility in adult peripheral nerve trauma patients of upper extremity.

METHODS: This retrospective cohort study included patients (n=60) at a tertiary peripheral nerve trauma clinic who underwent nerve conduction studies within 12 months of injury. A 'TT', which measures discriminative sensibility on a 10-point Likert Scale was performed on each patient by a plastic surgeon. The relationship between TT and amplitudes of the sensory nerve action potential (SNAP) and compound muscle action potential (CMAP) measured from the superficial radial, median and ulnar nerves was assessed with Spearman correlation coefficients. Sensitivity and specificity and area under the receiver-operating curve (AUROC) of TT were calculated using SNAP amplitude normative data as the gold standard.

RESULTS: Pooled data demonstrated moderate association for TT with SNAP ($r=0.47$, $p<0.001$) and CMAP ($r=0.62$, $p<0.0001$). Sensitivity and specificity of the TT using TT<10 as the cut-off value were 61% and 65%, respectively. Diagnostic utility was optimized for TT ≤6.75 (sensitivity=45% and specificity=90%) and AUROC=68%, meaning that 68% of patients with electrophysiological evidence of nerve injury were identified by an abnormal TT.

CONCLUSION: A moderate association between TT and SNAP, in conjunction with low sensitivity, does not provide support for TT as a useful screening test for electrophysiological sensory nerve injury. However, TT is highly specific (particularly for strongly positive tests) and displayed good diagnostic accuracy according to AUROC. Therefore, a positive TT may provide complimentary information, in combination with other manoeuvres during the physical examination of patients with suspected peripheral nerve trauma.

Learning Objectives:

1. *Describe the 'TT' for measurement of discriminative sensation.*
2. *Understand the benefits and limitations of the 'TT' for clinical assessment of discriminative sensation.*
3. *Understand optimal cut points for abnormal sensation based on the 'TT'.*

12
PREEMPTIVE ANESTHESIA IN ELECTIVE OUTPATIENT HAND SURGERY: A RANDOMIZED CONTROLLED TRIAL

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PURPOSE: Elective outpatient hand surgeries, such as carpal tunnel release, cause minimum tissue disruption and are short in duration. As a result, pre-incisional infiltration of local anesthetics becomes an important component of procedural anesthesia, as well as post-operative pain control. We therefore hypothesized that administration of a long-acting local anesthetic (bupivacaine) would provide effective preemptive anesthesia in elective hand surgery, resulting in longer postoperative pain control and decreased need for oral analgesics.

METHOD: A prospective double-blinded randomized control study was designed to compare patients' pain experience and use of oral analgesic medications after elective outpatient open carpal tunnel release, with pre-incisional infiltration of either 1% lidocaine with epinephrine or 0.5% bupivacaine with epinephrine. Patients completed pain diaries for 2 weeks following the procedure, as well as documenting their daily oral analgesics use. The pain response was quantified using a standardized 10-point Likert scale.

RESULTS: Our data revealed no difference in pain at injection, pain during, and immediately after the procedure. Not surprisingly, the lidocaine group experienced significantly more discomfort between 4 and 12 hours after the procedure, as compared to the bupivacaine group. However, there was no significant difference in the reported discomfort or analgesic usage after the bupivacaine effect dissipated (between 12-14 hours). Importantly, both groups reported relatively low levels of discomfort and limited analgesic utilization after the second post-operative day.

CONCLUSION: Our results indicate that the use of bupivacaine for carpal tunnel release provides longer duration of post-operative pain control than lidocaine, but this does not appear to result in a meaningful preemptive anesthesia.

Learning Objective:

The learner will gain better appreciation of the importance of preemptive anesthesia in elective hand surgery.

13
COMPARISON OF RECOVERY OUTCOMES BY GAP BETWEEN PROCESSED NERVE ALLOGRAFT AND TUBE CONDUITS FOR DIGITAL NERVE REPAIRS FROM A NERVE REGISTRY STUDY

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PURPOSE: Processed nerve allograft (Avance® Nerve Graft, AxoGen, Inc) and tube conduit both offer convenient options for digital nerve gap repair however no consensus exists as to the optimal treatment method across gaps lengths up to 2 cm. To evaluate for potential differences in recovery with theses repair methods, we added contemporary control cohorts to a national nerve registry. We report our finding from a comparison of outcomes across two gap lengths.

METHODS: The RANGER registry is an active database designed to collect injury, repair, safety, and outcomes data. The database was queried for digital nerve injuries with gaps up to 20 mm. The dataset was stratified into two gap groups, gaps <10 mm and 11–20 mm. Meaningful recovery was defined at S3 (MRCC). Comparisons of outcomes were completed by repair method between and across the gap length groups.

RESULTS: Thirty nine subjects with 63 injuries were included. The <10 mm gap group consisted of 20 PNA and 8 conduit repairs. The 11-20 mm gap group consisted of 20 PNA and 15 conduit repairs. Subject, medical history, and concomitant injuries were comparable between treatment groups. Overall recovery was reported in 90% for the PNA group as compared to 44% for the conduit. In the <10 mm gap group, PNA and conduit reported 100% and 75% meaningful recovery respectively with no revisions. In the 11–20 mm gap group, PNA and conduit reported 80% and 33% recovery respectively ($p<0.0132$) with four revisions reported in the conduit group.

CONCLUSION: Processed nerve allograft performed consistently well across both gap length groups exceed that of tube conduits. Conduits reported a statistically significant difference by gap length with <10 mm repairs reporting more consistent levels of recovery as compared to gaps at 11–20 mm.

Learning Objectives:

Provide an understanding of the differences in expected recovery outcomes of PNA and conduit repairs across gap lengths up to 2 cm.

14
QUANTIFYING BENEFIT IN EARLY DUPYTREN'S DISEASE WITH APPLICATION OF LOW LOAD FORCES

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PURPOSE: To objectively demonstrate changes in the degree and quality of diseased fascia in patients with early Dupytren's disease treated with therapeutic splinting and tissue mobilization.

METHODS: Ten patients with mild to moderate MCP/ PIP joint contracture s of the ring and little finger managed nonoperatively with nighttime serial static or static progressive hand-based volar extension orthosis (splint) and daytime gentle extension stretching and friction massage. Goniometric measurements of active PIP and MCP joint extension along with ultrasound imaging of the fascia was performed prior to and 6 months after initiation of therapy.

RESULTS: Improvement in active joint extension was observed over the course of the therapy (PIP=7.5 degreees; $p<0.04$, Total MCP + PIP=10 degrees; $p<0.02$). These improvements were associated with consistent decreases in the radiologic dimensions of the diseased fascia (119 mm^3; $p<0.001$) in combination with qualitative changes in the composition of the fascia as demonstrated by Elastography.

CONCLUSION: The use of simple orthosis and soft tissue mobilization techniques have a quantifiable effect on the degree of deformity and quantity and quality of contracted fascia in early Dupytren's disease These simple modalities would appear to have a role in the management of mild to moderate presentations of the disease when enzymatic or surgical interventions may not be practical.

Learning Objectives:

1. *Participants will understand the that there is measurable benefit with the use simple occupational therapy interventions in the management of mild to moderate Dupytren's disease.*
2. *Participants will be introduced to the potential of ultrasound imaging in measuring the effect of treatment of Dupytren's disease.*

CANADIAN EXPERT

14A
CRANIOFACIAL SURGERY FOR THE GENERAL PLASTIC SURGEON

L Lessard

Learning Objectives:

At the end of the presentation, the participant will be able to:

1. *Better understand the anatomy of the cranium, orbits, malar bone, nose, maxilla and mandible as it relates to the surgical treatment of plastic surgery traumas referred in a general plastic surgery practice;*
2. *Better understand the anatomy of the cranium, orbits, malar bone, nose, maxilla and mandible as it relates to the surgical treatment of facial cancer (craniofacial oncology) referred in a general plastic surgery practice; and*
3. *Integrate craniofacial knowledge into some of the surgical cases of the face seen in a regular general plastic surgery practice for optimal and safe treatment.*

TP01

FACIAL NERVE RECONSTRUCTION WITH VASCULARIZED NERVE GRAFT

R Harrop, C Schrag
Calgary, AB

Reconstruction following parotidectomy with facial nerve resection is challenging, especially when post-op radiation therapy is anticipated. We describe use of the free radial forearm flap incorporating the sensory branch of the radial nerve for simultaneous soft tissue augmentation and immediate reconstruction of the facial nerve with a vascularized nerve graft.

TP02

OBTAINING A SYMMETRICAL SCAR AND RESECTION IN BODY CONTOURING USING A BIPLANAR CARPENTRY LEVEL

A Islur
Winnipeg, MB

Preoperative marking of the incision/resection in body-contouring plays a key role in the shape and position of the resulting scar. We present the use of a biplanar carpentry level in >100 patients. It provides a quick, inexpensive, and consistent technique for reliably producing a symmetrical scar/resection.

Learning Objective:
The audience will learn a simple method for obtaining a symmetrical resection and scar in body contouring cases.

TP03

ROTATORCUFF REPAIR SUTURE RETRIEVER AS TENDON GRAFT PASSER FOR FLEXOR PULLEY RECONSTRUCTION: A COST-COMPARISON

J Lutfy, G Rockwell
Ottawa, ON

Flexor pulley reconstruction with tendon graft is frustrating and performing the multiple loopings around the phalanx requires 5–20 minutes. By using a shoulder suture retriever instrument, tendon looping requires an easy two minutes. Within three minutes of surgical time saved, total calculated operating room costs decrease and surplus is generated.

TP04

EXTENDED COMPONENTS SEPARATION FOR GIANT OMPHALOCELE AND HIGH ABDOMINAL DEFECTS

R Tse, E Miller, G Tse, A Goldin
Seattle, Washington, USA

Functional reconstruction of high abdominal defects using components separation is limited by the insertion of the rectus muscle on the chest wall. We describe a novel approach of extended components separation that dis-inserts the rectus muscle to allow midline closure and functional abdominal wall closure.

15

LATE ONSET UPPER EXTREMITY LYMPHEDEMA FOLLOWING ELECTIVE HAND SURGERY IN BREAST CANCER SURVIVORS

HL Baltzer, J Harvey, SL Moran
Rochester, Minnesota, USA

PURPOSE: To evaluate the risk of developing 'late onset' upper extremity lymphedema following elective hand surgery among breast cancer patients that had prior, ipsilateral axillary lymph node dissection (ALND), sentinel lymph node biopsy (SLNB), and/or radiation therapy (RT)

METHOD: A retrospective cohort of breast cancer patients treated with ALND, SLNB and/or RT was identified between 1997-2012. Patients with ipsilateral elective hand surgery following their breast cancer treatment were included if there was ≥2 years of follow up and no history lymphedema following breast cancer treatment. The primary outcome was documented lymphedema following hand surgery. Demographic data and clinical information pertaining to both hand surgery and breast cancer treatment and were compared between patients with and without lymphedema.

RESULTS: The analysis included 107 patients, of which five (4.7%) had documented lymphedema following hand surgery. Patient with and without lymphedema were similar in age, hand surgery procedure, and tourniquet use. Average tourniquet time was greater among women without lymphedema (23 vs. 9 minutes, p=0.02). Lymphedema was associated with a shorter interval between hand surgery and both breast cancer surgery (2.13 vs. 6.4 years, p<0.01) and RT (1.8 vs. 3.6 years, p=0.01). Late-onset lypmedema was more likely among patients that had RT and either ALND or SLNB (p=0.01).

CONCLUSIONS: Lymphedema is uncommon following elective hand surgery among breast cancer survivors. Tourniquet use does not appear to be influential; however, a shorter interval between hand surgery and breast cancer treatments (ALND/SLNB and RT) or a combination of RT and axillary surgery appear to put these women at higher risk of developing late onset lymphedema after elective hand surgery.

Learning Objective:
To address controversy of lymphedema risk following elective hand surgery among breast cancer survivors.

16

A TALE OF TWO HEALTHCARE SYSTEMS: COST-EFFECTIVENESS ANALYSIS OF OPEN CARPAL TUNNEL RELEASE IN CANADA AND THE UNITED STATES

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Boston, Massachusetts, USA

PURPOSE: There is increasing pressure to attain value-for-money in healthcare practice. Canadian healthcare is often criticized for extended wait-times, while the United States (US) suffers from increased costs. The purpose of this pilot study was to determine the cost-effectiveness of open carpal tunnel release in Canada versus the US.

METHODS: We performed a prospective cohort study of patients undergoing open carpal tunnel release at single institutions in Canada and the US. All outcomes were measured at baseline, 6 and 12 weeks post-operatively. Direct and indirect costs from a societal perspective were captured. Effectiveness was measured using validated health-related quality of life (HRQoL) scales: the EuroQol-5D and the Michigan Hand Outcome Questionnaire.

RESULTS: Twenty-one patients at the Canadian site and 8 patients at the US site met the criteria for study participation. No significant differences between Canadian and US participants emerged. Mean total costs were $1581±1965 and $2179 (range: $1421-2741) at the Canadian and US site, respectively. Wait times from referral to surgery were 214±119 and 27±10 days, respectively. HRQoL demonstrated significant improvements following surgery (p<0.05). Patient utilities pre-operatively and at 6 and 12 weeks post-operatively were 0.72±0.20, 0.86±0.11, and 0.83±0.16 at the Canadian site and 0.81±0.09, 0.86±0.10, and 0.86±0.12 at the US site. HRQoL between patients in Canada and the US was not significantly different. Incremental cost-utility ratio was $7758/QALY, thus favoring the US system.

CONCLUSIONS: Our pilot study demonstrates the feasibility of prospectively measuring the cost-effectiveness of open carpal tunnel release at institutions in Canada and the US. Preliminary results suggest that carpal tunnel surgery is more cost-effective in the US due to extended wait times in Canada.

Learning Objectives:
1. *Recognize the societal costs associated with carpal tunnel surgery.*
2. *Understand the impact of wait times on cost effectiveness.*
3. *Identify areas for improving cost effectiveness of carpal tunnel surgery.*

17

THE ROLE FOR SIMULATED TRAINING IN THE IDENTIFICATION AND MANAGEMENT OF A COMPROMISED FREE FLAP: AN EDUCATIONAL NEEDS ASSESSMENT.

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Toronto, ON

PURPOSE: The purpose of this study is to demonstrate the need for increased training focus in the identification and management of compromised free flaps (FFs).

METHOD: A questionnaire examining plastic surgeons experiences with identification and management of compromised FFs was developed and pilot tested. The questionnaire addressed previous training and clinical and teaching experience. Twenty plastic surgeons attending an international microsurgery conference were invited to complete questionnaires prior to a focus group discussion to identify and examine the potential for improvements in current training programs. Focus group transcriptions were analyzed using qualitative research methods. Questionnaires were analyzed using descriptive statistics.
RESULTS: Eleven plastic surgeons representing 9 institutions in 3 countries completed questionnaires and participated in one of two focus groups. Nine respondents felt that graduating residents were not adequately prepared to independently manage a compromised FF and 9 believed that completion of a simulation-based learning module should be mandatory in training programs. All surgeons thought that clinical exposure was the most important way to train residents. Low failure rates and limited work hours were identified as barriers to adequate exposure of trainees to FFs requiring re-exploration. All participants felt that a stepwise algorithm for re-exploration and operative management should be developed and taught using simulated scenarios.
CONCLUSION: This study highlights the importance of trainee exposure to compromised FFs while also revealing a perceived current lack of exposure. This needs assessment provides a pre-development analysis for an evidence-based training curriculum that uses simulation to improve how this crucial aspect of microsurgery is taught.
Learning Objective:
Current teaching methods are not meeting educational needs in the identification and management of compromised FFs. A simulation-based tool could enhance current clinical teaching methods.

GUEST SPEAKER

17A
ESTABLISHING A PROGRAM FOR COMPOSITE TISSUE ALLOTRANSPLANTATION

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Reconstructive transplantation is now a clinical reality with the successful transplantation of hand, face, and abdominal wall. These transplants have the possibility to change the reconstructive paradigm and truly allow the replacement of the exact tissue lost without donor site issues. The current limitations are due to the need for chronic immunosuppression and the risks associated with these powerful medications. The future of these transplants is linked to the development of protocols that limit the need for chronic immunosuppression. To successfully start a program in reconstructive transplantation there are several key issues that must be addressed including developing a screening program for potential patients, building a transplant team, deciding if you need approval from your intuitional review board (IRB), working with to develop organ retrieval protocols with your organ procurement organization (local OPO and UNOS), providing comprehensive outpatient management, managing the costs, and working to develop new protocols to limit the need for chronic immunosuppression.
Learning Objectives:
1. *To understand the unique requirements of establishing a reconstructive transplantation program.*
2. *To develop an appreciation for the immunosuppression protocols needed for current transplantation of hand, face and abdominal wall.*
3. *To learn about the development of future protocols that could limit the need for chronic immunosuppression and expand the indications for the use of these transplants.*

EYE-OPENER SESSION

17B
PIP JOINT TRAUMA

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Proximal interphalangeal (PIP) joint trauma can cause a spectrum of injuries that may result in significant impairment in finger range of motion. Distinguishing when to operate, and when not to, can be a challenge for even very experienced clinicians. This interactive, multi-case based, presentation will cover a variety of PIP joint injuries including condylar and middle phalanx base fractures, dislocations and chronic ligamentous injuries.
Learning Objectives:
At the end of the session the participant will be able to:
1. *Describe the indications for conservative management for dorsal PIP joint dislocations and fracture dislocations.*
2. *Describe the options for operative management for PIP joint fracture dislocations.*
3. *Describe a surgical approach to reconstruction for ligamentous injuries.*

18
SPLIT TURNOVER PECTORALIS MAJOR FLAP AS A RECONSTRUCTIVE OPTION FOR MEDIASTINAL WOUNDS AFTER STERNOTOMY: A PIVOTAL ADVANTAGE

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PURPOSE: A common approach to fill the defect of wide mediastinal wounds involves the use of unilateral or bilateral pectoralis major flaps. In many cases, the flap does not reach the inferior aspect of sternal wounds, and it is the most common site for complications postoperatively. In our institution, the split turnover pectoralis major flap (STPF) is the reconstructive method of choice to address this issue. The purpose of this study is to define the anatomic advantage of the STPF and review clinical outcomes of this and other reconstructive options performed at London Health Sciences Centre.
METHOD: 1) Cadaveric dissections (n=13) of pectoralis major flaps were performed. Measurements of the sternum, pectoralis major advancements and turnovers (pre and post-split) were collected and analyzed. 2) Retrospective chart review (n=61) was done of all reconstructive options used for mediastinal wounds after cardiac surgery in the last 15 years.
RESULTS: Mean vertical length of the pectoralis turnover flap before splitting was 14.0 cm (±3.02) and 22.4 cm (±3.43) after splitting ($p < 0.0001$). This provided a statistically significant increase in length of 7.5 cm (±2.04) or 35%. STPF adequately provided total coverage of the sternum in all cadavers. Clinically, there was no significant difference in complications between STPF and other reconstructive options. Most common complication was superficial wound breakdown (33.3%). There were no flap failures or donor site morbidities for the STPF.
CONCLUSIONS: STPF allows the use of a single muscle to adequately cover mediastinal wounds with no higher complication rates than other flap designs, as illustrated in cadaveric studies and retrospective review.
Learning Objectives:
Participants will be able to identify risk factors for sternal wound dehiscence, illustrate and apply the advantage of moving the pivot point in flap design, and list advantages and disadvantages of reconstructive options for mediastinal wounds.

19
TREATMENT OF PERONEAL NERVE PALSY SECONDARY TO AN INTRANEURAL GANGLION: CASE REPORT AND REVIEW

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PURPOSE: Intraneural ganglia are benign cysts that occur within the epineurium of nerves and are a rare cause of foot-drop. Uncertainty surrounds the formation of intraneural ganglion cysts. The most accepted synovial theory suggests that a pedicle connects the synovial joint to the nerve by cystic fluid infiltration along an articular nerve branch. The purpose of this

study is to describe a novel treatment of a common peroneal nerve palsy caused by an intraneural cyst.

METHOD: We present a 74-year-old female with a 5-month history of progressive pain in the superficial and deep peroneal nerve distribution and a dense foot drop requiring ankle foot orthosis. Magnetic resonance imaging demonstrates an intraneural cyst within the common peroneal nerve, electromyography demonstrates no elicitable motor units in the peroneal nerve distribution, and nerve conduction studies demonstrate nerve continuity. Foot-drop correction was obtained by ligating the articular branch of the peroneal nerve, decompressing the intraneural cyst and performing a nerve transfer in which the tibial motor nerve branch to flexor hallucis longus was transferred into the deep peroneal motor nerve branch of anterior tibialis muscle. The patient was assessed for return of ankle dorsiflexion.

RESULTS: The patient demonstrated recovery (BMRC grade 4) of ankle dorsiflexion, normal gait and no need for orthotics. Post-operative pain and dysesthesias resolved by 6 months post-operation. There were no tibial nerve deficits and no peri-operative complications.

CONCLUSIONS: Given the paucity of clinical data detailing treatment of proximal intraneural ganglia, the combination of ligating the articular branch and performing a distal nerve transfer may improve the chances of full recovery with minimal complications and donor morbidity. This case report provides a summary of the surgical technique employed, the patients' outcome to date, and a brief overview of the literature surrounding intraneural ganglia of the common peroneal nerve.

Learning Objectives:

At the end of this presentation, participants will gain exposure to current approaches and the role of nerve transfers for treating foot drop.

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CORNEAL NEUROTIZATION: A MINIMALLY INVASIVE SURGICAL APPROACH TO TREAT NEUROTROPHIC KERATOPATHY

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PURPOSE: Corneal sensation is a necessary component of corneal maintenance. Patients with corneal anesthesia are susceptible to occult injury and chronic ulceration typically leading to corneal scarring and vision loss. Standard ophthalmologic therapy fails to prevent disease progression. A novel surgical procedure to reinnervate the cornea, developed at SickKids, has demonstrated excellent results restoring protective sensation and preserving vision. Here we review the clinical results in the first ten eyes.

METHOD: A coaptation was performed from the donor supratrochlear nerve to a sural nerve graft. The graft was tunneled to the perilimbal area and draped around the cornea. Corneal anesthesia was evaluated preoperatively and postoperatively in the center and each quadrant of the cornea using Cochet-Bonnet esthesiometry.

RESULTS: Preoperatively, all corneas had sustained complications related to corneal anesthesia and lacked detectable sensation. Eight patients have undergone the procedure (aged 9-34), with two patients undergoing bilateral reconstruction for a total of ten operated eyes. Six patients have had follow-up greater than 6 months. In these patients, mean follow-up time was 15±5.7 months (range; 6–22 months) and mean corneal esthesiomtery improved to 40.8±23.1 mm (range; 5–60 mm, p=0.008). The remaining two patients have had follow-up less than 6 months; however, both have already demonstrated signs of reinnervation. Vision has either improved or stabilized in all patients and only one patient has had a recurrent corneal ulceration, which healed without subsequent scarring.

CONCLUSIONS: Corneal neurotization restores corneal sensation and may protect vision in patients with previously anesthetic corneas. This can be achieved with minimal morbidity using sural nerve grafts and avoiding cosmetically objectionable scars. Surgical reinnervation may also enable corneal transplantation in patients with irreversible corneal scarring.

Learning Objective:

Introduction to a surgical technique to reinnervate the cornea and treat patients with corneal anesthesia and neurotrophic keratopathy.

21

VOLUME RETENTION OF FAT GRAFTING USED TO CORRECT HEAD AND NECK CONTOUR DEFECTS

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PURPOSE: Autologous fat grafting is useful to improve contour defects of the head and neck. However, predicting long-term volume retention is difficult. The purpose of this study was to quantify volume retention from fat grafting in head and neck contour defects using 3D photography.

METHODS: Consecutive patients undergoing head and neck fat grafting by a single surgeon from 2012-2015 were evaluated. Fat was harvested using a modified Coleman technique, centrifuged for purity, and injected using 1cc micro-aliquots. Baseline demographics and volume of fat injected were recorded. 3-D photographs were taken pre-operatively as well as immediately, 6, and 12 weeks post-operatively. Two independent evaluators determined volume retention using 3dMDvultus software.

RESULTS: Eighteen patients (mean age=41) undergoing 20 grafting procedures were evaluated. The most common causes of prior fat loss were post-cancer extirpation (44%) and congenital syndromes. Five patients had previous radiation to the recipient site. Mean volume of fat injected per procedure was 31.5 cc (SD±13.9). Sixty percent of procedures were done under local anesthesia with the abdomen as the most common donor site (65%). The interclass correlation between evaluators was high (ICC=0.998). Six-week post-operative 3D photographs demonstrated a mean volume correction of 18cc (SD±13.5) and mean volume retention of 55% (SD±23.6) compared to twelve-week photographs, which demonstrated a mean volume correction of 12 cc (SD±8.1) and mean volume retention of 42% (SD±19.6) (p=0.001). Radiation did not affect retention volumes at 6 (p=0.25) or 12 (p=0.31) weeks.

CONCLUSIONS: Microinjection of autologous fat is an effective method of correcting contour defects of the head and neck. We demonstrated that 55% of volume injected will be retained at 6 weeks and 42% of volume injected will be retained at 12 weeks post-injection.

Learning Objectives:

Participants will be able to describe the amount of volume retained when using fat injection to correct head and neck contour defects.

22

LEVAMISOLE-ADULTERATED COCAINE INDUCED SOFT TISSUE NECROSIS – CASE PRESENTATION AND REVIEW OF THE LITERATURE

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INTRODUCTION: The prevalence of levamisole-adulterated cocaine (LAC) is rising, with potentially devastating complications. The number of cases described in the literature has significantly increased in the past four years. Most cases may be managed conservatively, infrequently requiring skin grafting. Exceedingly rare cases cause renal failure or even shock. Herein we describe the case of a patient with 70% TBSA soft tissue necrosis following use of LAC. A literature review was performed to better describe the cutaneous manifestations, serology, associated symptoms, and histopathological features of this rare condition.

METHODS: A search of the literature from January 1, 1995 until December 31, 2014 was performed for any articles that in the title/abstract contained any two of the following terms: 'levamisole', 'cocaine', 'vasculitis'. Of these, relevant articles were reviewed for inclusion.

RESULTS: The patient presented with a one-week history of malaise, fatigue, and purpuric rash beginning on the left ear, progressing to involve his chest, back, and all extremities. He presented four years previously following LAC use with arthralgia, membranous nephropathy, and cutaneous findings that resolved. On this presentation, he had profound shock with metabolic acidosis, renal failure, severe hyponatremia, decreased level of consciousness, and diffuse purpuric rash. Full thickness tissue loss was present on the upper thighs. He required emergent intubation. WBC was minimally elevated initially, but in ICU he developed profound leukopenia, and then agranulocytosis. Wounds progressed to become full thickness including soft tissue. The patient has required multiple stages of extensive debridement, allografting,

and autografting. His tissue biopsies have shown evidence of isolated thrombotic vasculopathy.

CONCLUSION: To our knowledge, this is the most extensive and severe presentation of levamisole-induced vasculitis described in the literature. Levamisole exposure should be suspected in patients with history of cocaine use, and findings such as purpura, and neutropenia. Patients will most commonly test positive for p-ANCA, but other immunological markers should also be studied. Treatment depends on the severity of presentation, and in rare cases such as this one may require debridement and staged grafting.

Learning Objectives:

1. *Participant will learn about the vasculitis reaction that is possible with levamisole adulterated cocaine exposure.*
2. *Participants will be able to identify the physical findings and laboratory abnormalities associated with levamisole exposure.*
3. *Participants will learn about management of levamisole associated vasculitis.*

23
CONSENSUS GUIDELINES FOR THE MANAGEMENT OF TOXIC EPIDERMAL NECROLYSIS

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PURPOSE: To develop a standardized set of treatment guidelines for the care of patients diagnosed with Toxic Epidermal Necrolysis (TEN).

METHODS: A structured approach to guideline development was followed and included a 10-year retrospective chart review of all patients diagnosed with SJS/TEN and treated at our hospital between 2001-2011. Guideline creation included: identification of a clinical problem, literature and chart review, appraisal of the evidence, document creation, internal review by Plastic Surgery and Dermatology, and multidisciplinary external review involving Plastic Surgery, Dermatology, General Internal Medicine, Gastroenterology, Respiratory Medicine, Intensive Care, Otolaryngology, General Surgery, Urology, Gynecology, and Ophthalmology.

RESULTS: We have created a proposed consensus guideline for the management of TEN that has been reviewed by a multidisciplinary team. Produced is a flow-chart guideline addressing the following areas: admission and disposition in hospital; calculation of TBSA and SCORTEN, involvement of sub-specialties, fluid resuscitation, nutritional support, wound care, environmental concerns, and adjuvant medications. Each step of the pathway is paired with a short explanation of the rationale behind that clinical decision.

CONCLUSIONS: Management of patients with Toxic Epidermal Necrolysis (TEN) usually requires a large team of physicians and allied health. We have created a proposed guideline accepted by a multidisciplinary team. Rigorously developed consensus guidelines for best practise have the potential to improve healthcare through assisting with clinical decision making, expediting care, ensuring comprehensive treatment of multiple issues, education, and reducing unnecessary practice and expenditures.

Learning Objectives:

1. *Participants will review a proposed consensus guideline for the management of patients with TEN.*
2. *To develop an approach for the creation of consensus guidelines.*

24
COMPARISON OF NERVE GRAFTING AND TRIPLE NERVE TRANSFER FOR RECONSTRUCTION OF UPPER TRUNK OBSTETRICAL BRACHIAL PLEXUS INJURIES

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PURPOSE: Upper trunk obstetrical brachial plexus injury (OBPI) can cause profound shoulder and elbow dysfunction. Neuroma excision with interpositional sural nerve grafting is the current gold standard surgical treatment. However, distal nerve transfers have potential advantages including reduced distance to reinnervation, motor-to-motor coaptation, and shorter recovery time. Therefore, the goal of this study is to compare the clinical outcomes and healthcare costs between nerve grafting and distal nerve transfers in children with upper trunk OBPI.

METHODS: A retrospective review of patients with upper trunk OBPI requiring surgery between 2000 and 2014 was performed. Patients underwent either sural nerve grafting or triple nerve transfers (spinal accessory to suprascapular nerve, radial to axillary nerve and ulnar to musculocutaneous nerve). Active movement scale (AMS) scores pre- and post-operatively were compared. Patients were followed for a minimum of 2 years. A direct cost analysis was also performed.

RESULTS: Twelve patients who underwent nerve grafting were compared to fourteen patients who underwent triple nerve transfers. Both procedures improved shoulder and elbow function, with the nerve transfer group displaying quicker recovery of function and statistically significantly better shoulder external rotation (mean pre-op AMS±SD vs. mean 2-year post-op AMS±SD: 1.9±1.0 vs. 4.4±1.5, $p<0.05$), elbow flexion (4.4±1.3 vs. 6.2±0.4; $p<0.05$) and forearm supination (2.3±0.9 vs. 5.6±0.7; $p<0.05$). Nerve transfer donors had no loss of strength post-operatively. The operative time, length of hospital stay and overall cost were significantly lower in the nerve transfer group.

CONCLUSIONS: Triple nerve transfer for upper trunk OBPI is a feasible option with functional outcomes at least equivalent to that of traditional nerve grafting. Furthermore, nerve transfers are significantly less expensive than nerve grafting in this patient population.

Learning Objective:

By the end of this session, the learner will appreciate the merits of using nerve transfers in upper trunk OBPI.

25
DEVELOPMENT OF A ROBOTIC APPROACH TO CLEFT PALATE REPAIR

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PURPOSE: To develop a robotic approach to cleft palate repair utilizing a phantom model, workspace analysis and validation through phantom testing.

METHOD: A high-fidelity cleft palate phantom was developed from an infant computed tomography (CT) scan. A computer model of a cleft palate, and oral cavity with palatal anatomy was produced using modeling software. A physical model was developed using 3D printers and silicone casting. A workspace analysis was performed in MATLAB® by overlapping a simulation of a three degree-of-freedom robotic manipulator with the oral cavity computer model. The phantom was pilot tested using a da Vinci® Surgical System with 5 mm EndoWrist® instruments.

RESULTS: A high-fidelity cleft palate phantom developed from a CT scan has been developed that simulates operating in the pediatric oral cavity, incising and elevating the mucosa off the hard palate and musculature, releasing the musculature from the palate and suturing the muscles and mucosa together. Workspace analysis demonstrated that a joint location proximal to the oral aperture produces a workspace with fewer collisions between the manipulator and oral aperture. Pilot testing using the da Vinci® demonstrated successful elevation of the mucosa from the hard palate and palatal musculature and suturing the muscles and mucosa together. However, frequent collisions between the patient-side-manipulators (PSMs) and between the EndoWrist® instruments and oral aperture made the procedure challenging.

CONCLUSIONS: Utilization of the da Vinci® Surgical System for cleft palate repair is feasible. However, modifications to the EndoWrist® instruments, optimization of the PSM positioning method and development of oral retractors to guide the instruments will improve the safety and efficiency of the procedure.

Learning Objectives:

At the end of this presentation the participants will have an awareness of:

1. *The process of developing a surgical simulator.*
2. *The process of developing a robotic approach to a specific surgical procedure.*

26
COMPARING DYNAMIC VS. STATIC INSTRUCTIONAL MULTIMEDIA FOR NOVICES LEARNING TO PERFORM VISUALSPATIALLY COMPLEX PLASTIC SURGERY PROCEDURES (Z-PLASTY)

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PURPOSE: Many procedures in Plastic Surgery are visualspatially complex (e.g., Z-plasty). Educational multimedia helps trainees develop a mental representation of these procedures prior to hands-on performance. Mayer's theory of multimedia learning has yet to clarify is whether it is better to present information in a static or dynamic format – an important distinction given common preparatory materials (e.g., textbook pictures vs. surgical videos). A meta-analysis in the general education literature demonstrated an advantage of dynamic multimedia for basic skills, though the few included studies reported inconsistent results.

METHODS: Using a prospective two-arm design, novice learners (n=44) were randomly assigned to one of two conditions. The dynamic video showed complete performance of a Z-plasty, whereas the static video showed key still frames from the dynamic video. Auditory information was identical in both conditions. Following the intervention (multimedia viewing, a Z-plasty pretest, and physical practice for 30 minutes), participants completed post-, retention, and transfer tests. We measured performance using a global rating scale (GRS), and analyzed those data using an analysis of covariance (ANCOVA).

RESULTS: The ANCOVA [group (dynamic, static) by test (post-test, retention); covariate: pre-test] revealed a significant interaction between group and test ($F[1, 41]=4.33$, $p=0.044$). Post-hoc tests showed the interaction arose from the dynamic group improving from post- to retention test ($p<0.05$), whereas the static group's performance deteriorated over that time ($p=0.18$). There were no significant differences for transfer testing ($p=0.45$).

CONCLUSION: Dynamic multimedia is advantageous for novice medical trainees learning to perform a Z-plasty. This benefit is small (0.25 points on a 5-point GRS) and may not be meaningful in clinical practice. Additional studies should clarify if the cost associated with dynamic multimedia is justified.

Learning Objective:

Learners will be able to evaluate the role of dynamic and static educational multimedia in plastic surgery training.

27
SYSTEMATIC REVIEW OF TECHNIQUES FOR THE CORRECTION OF SAGITTAL CRANIOSYNOSTOSIS

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PURPOSE: Multiple procedures are employed to correct scaphocephaly insagittal synostosis. We conducted a systematic review of these procedures to determine whether any technique provided superior aesthetic outcomes. Secondary outcomes included length of hospital and ICU stay, complications, and cost.

METHODS: Surgical techniques were grouped into three categories. These included endoscopic ablative procedures, open ablative procedures and cranial vault reconstructions. A multivariate analysis of covariance was used to compare improvement in cephalic index, transfusion rate, length of ICU stay, and length of hospital stay across groups of techniques. Study outcomes were weighted by number of patients. Age and pre-surgery cephalic index were included as covariates.

RESULTS: 882 articles were identified by the initial search. 56 articles met criteria for inclusion. Open ablative techniques (e.g. strip craniectomy and pi procedure) are more commonly performed (n=41) than total cranial vault reconstructions (n=17) and endoscopic techniques (n=7). There was no difference in the improvement of cephalic index after surgery ($F[2, 37]=2.364$; $p=0.109$). Similarly, there were no differences in the final cephalic index, transfusion rate, or length of ICU stay. Endoscopic treatments were associated with significantly shorter hospital stays (1.22d) than open ablative procedures (3.36d) and total vault reconstructions (3.36d) ($F[2, 17]=6.926$; $p=0.007$).

CONCLUSIONS: Aesthetic outcome as measured by cephalic index is similar, regardless of surgical technique. However, the data available for this analysis was limited to reported outcomes, which are inconsistent. A national prospective treatment registry for sagittal craniosynostosis would allow for the development of practice consensus.

Learning Objectives:

1. *Participants will be informed of the treatment options for sagittal craniosynostosis.*
2. *Participants will appreciate the need for prospective data collection to allow for meaningful practice change and national practice consensus.*

28
LONG TERM FOLLOW-UP OF OSSEOINTEGRATED ORBITAL RECONSTRUCTION

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PURPOSE: Osseointegrated implants were first used for craniofacial prosthetic reconstruction in 1979 and have since been used for prosthetic rehabilitation of a variety of facial defects. The authors sought to review long-term results of osseointegrated orbital reconstruction at the Institute for Reconstructive Sciences in Medicine (iRSM).

METHOD: Twenty-nine patients have undergone osseointegrated orbital reconstruction at the iRSM since 1990. 10 patients are deceased; thus, 19 patients were included. A retrospective chart review was performed to determine demographics, skin reactions and complications. Patient satisfaction was assessed through a questionnaire used in previous osseointegration studies. Multivariate binary linear logistic regression analysis will be performed to assess the relationship between smoking, age, gender, prior radiation treatment and implant location with the occurrence of a skin reaction.

RESULTS: The most common indication for reconstruction was oncologic, followed by traumatic and congenital. The survey was sent to 13 patients and will be sent to the remaining 6 patients upon ethics approval. Responses were received from 8 of the 13 patients. 63% patients rated their prosthesis as comfortable, 88% reported good self-confidence with the prosthesis compared to 50% of patients reporting very poor self-confidence without the prosthesis. Overall, 75% of patients were satisfied with their prosthesis, 88% would undergo the procedure again given what they know now despite 63% of patients who felt they had had a skin reaction.

CONCLUSIONS: Prosthetic orbital reconstruction using osseointegrated implants is a good option for reconstruction of the orbit. Patients find the prosthesis comfortable to wear, report increased self-confidence with the prosthesis and are happy with their choice to have undergone reconstruction.

Learning Objectives:

1. *Long term patient satisfaction following reconstruction.*
2. *Relationship between smoking, age, and gender with the occurrence of a skin reaction at the orbital implant site.*
3. *Importance of implant placement location and prior radiation therapy on treatment results.*

29
A 10-YEAR REVIEW OF MAXILLECTOMIES PERFORMED AT ST JOSEPH'S HOSPITAL, HAMILTON, ONTARIO

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PURPOSE: Maxillectomy is a complex surgical procedure requiring postresection reconstruction to minimize patient morbidity. There exists no consensus regarding classification and optimal reconstruction of these defects. The purpose of this study is to identify the types of maxillectomies performed at our institution and their chosen reconstructions. We compare our practices to the widely referenced Cordeiro classification of maxillectomy defects.

METHOD: A chart review of maxillectomies from January 1, 2003 to December 31, 2013 was performed. Data extracted included patient demographics, pathology, origin of tumor, type of maxillectomy performed and reconstructive approach.

RESULTS: One hundred and fourteen cases were identified. Based on the Cordeiro classification system, we had forty-seven type I (41%), fifty six type II (49%), seven type IIIa (5%), four type IIIb (4%) and zero type IV

defects (0%). Type I defects were managed with primary closure/packing (51%). Type II defects were addressed variably with prosthesis and skin graft as most popular (48%). Majority of type III defects required free flap (91%). Possible choices for flap included radial forearm (53%), rectus abdominus (13%), fibular (13%) and other (12%).

CONCLUSIONS: Our findings demonstrate that Type II defects are most commonly seen. Albeit managed primarily with primary closure (type I) or prosthesis (type II) in our practice, Cordeiro preferentially recommends reconstruction with free flap for both such defects. Further, when flaps are used at our center, a greater variability of free flaps are employed than is recommended in Cordeiro's report. Reconstructive management of type IIIa and IIIb defects were largely managed in accordance with Cordeiro's recommendations.

Learning Objectives:

Participants will be able to:

1. *Describe the Cordeiro classification for maxillectomy defects.*
2. *Identify the variety of available for post-maxillectomy reconstruction.*

30

CORRELATION OF PREDICTION AND ACTUAL OUTCOME OF THREE-DIMENSIONAL SIMULATION IN BREAST AUGMENTATION USING A CLOUD BASED PROGRAM

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PURPOSE: Breast augmentation is among the most frequently performed surgeries. Providing patients with "realistic" 3D simulations of breast augmentation outcomes is becoming increasingly common. Until recently, such programs were costly, and required significant equipment, training, and office space. New simple, user-friendly cloud based programs have been developed, but to date there remains a paucity of objective evidence correlating these 3D simulations with the post-operative outcomes.

METHOD: A retrospective review of patients receiving bilateral breast augmentation was conducted comparing 6-month post-operative outcomes with 3D simulation using Crisalix software (Crisalix Virtual Aesthetics, Switzerland). 11 patients were included in this pilot study. Post-operative and simulated images were compared by four plastic surgeons using a series of parameters scored from 0 (different) to 100 (identical) on a visual analogue scale. An overall score was also given to assess whether the six-month post-operative outcome was better (+1), the same (0), or worse (−1) than the simulated image.

RESULTS: Assessment of the images reveals good correlation between the 3D simulation and six-month post-operative images for overall appearance (75.6±12.2), breast height (79.2±13.6), breast width (77.6±15.6), and nipple correction (82.4±15.1). Less correlation was found for breast projection (70.2±17.4) and breast volume (72.9±18.9). On average, the operative outcome was similar between the surgery and the simulation (average score=0.26).

CONCLUSIONS: Our preliminary data suggest that Crisalix offers a good overall 3D simulated image of post-operative breast augmentation outcomes. Improvements to the correlation of the post-operative volume and projection would result in greater predictive capabilities of Crisalix. On average, the panel of surgeons rated the 3D simulation to be similar to the post-operative result.

Learning Objectives:

1. *Participants will be able to describe the strengths and weaknesses of Crisalix software.*
2. *Participants will be able to evaluate the suitability of Crisalix for their practice.*

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RECTUS-FACIA TURNOVER FLAP

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PURPOSE: The inframammary fold (IMF) is one of the most important aspects of an aesthetically pleasing breast. Disruption of the IMF during breast augmentation or reconstruction can yield unacceptable aesthetic results including a "double-bubble" deformity or implant prolapse. Previous techniques for correcting IMF deformities may result in further external scarring and carry a significant risk for recurrent "bottoming out", ptosis or inferior displacement of the reconstructed IMF. Use of alloplastic materials such as dermis or mesh adds considerable expense and increased risk of infection. The authors report a new technique with clinical outcomes for reconstruction of the IMF in both cosmetic and breast reconstruction patients using a rectus-fascia turnover (RFT) flap, which is both durable and aesthetically pleasing.

METHODS: A retrospective case-report on 20 patients who underwent inframammary fold reconstruction between 2012 and 2014 by the editing author was performed. Demographics, perioperative complications, patient satisfaction and aesthetic results were recorded. A cadaver dissection was performed to illustrate the gross anatomy.

RESULTS: Mean follow-up was 17 weeks. Postoperative complications were limited to postoperative discomfort at the surgical site. There was a single case of hematoma. One patient developed recurrent ptosis requiring reoperation. There were no cases of infection, implant malpositioning, or capsular contracture. All patients reported that they were pleased with their results.

CONCLUSION: The rectus fascial turnover flap is a cost-effective and reliable surgical technique for reconstruction of the inframammary fold in both cosmetic and reconstructive surgery.

Learning Objectives:

Participants will be able to describe an autologous approach to IMF reconstruction in both cosmetic and reconstructive breast surgery. The participants will be able to describe the advantages of using the RFT flap.

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ENHANCED RECOVERY AND SAME-DAY DISCHARGE ACHIEVED FOR MASTECTOMY WITH IMPLANT RECONSTRUCTION PATIENTS USING AN ENHANCED CARE PATHWAY

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PURPOSE: To compare enhanced recovery after surgery (ERAS) vs. traditional recovery after surgery (TRAS) for mastectomy with implant reconstruction.

METHOD: Prospective study with two cohorts (ERAS/TRAS). ERAS patients were recruited during preoperative consultation, booked as day surgery, and provided with standardized perioperative education and multimodal analgesia. TRAS patients received current standard of care (admission, narcotics). ERAS patients were phoned postoperative days one/two and completed a questionnaire validated to assess quality of life after ambulatory surgery (also completed by TRAS inpatients). Results were statistically analyzed (T-test/Chi-square).

RESULTS: The ERAS and TRAS cohorts comprised 30 and 11 patients, respectively. Average length of stay was significantly shorter in ERAS group (0.1d, 1.6d, $p<0.001$), with 91% same-day discharge. No significant differences present in age (52.3y, 45.8y, $p=0.16$), or proportion of direct-to-implant (67%, 64%, $p>0.05$) or bilateral surgery cases (83%, 91%, $p>0.05$) between ERAS and TRAS groups, respectively. ERAS patients had significantly less nausea (7.6, 4.7, $p=0.005$) and severe pain (8.1, 5.5, $p=0.01$), better enjoyed food (8.1, 3.5, $p<0.001$), and felt more rested (6.2, 3.7, $p=0.004$) than TRAS counterparts. The groups felt comparably supported (9.7, 9.5, $p=0.44$) and in control (7.3, 6.0, $p=0.16$). No significant differences in complications requiring surgery within 30 days (cellulitis±seroma [16.7%, 18%; $p>0.05$], hematoma [3.3%, 9%, $p>0.05$]) between groups. In the ERAS group, these complications occurred five days (readmission would have also been necessary if TRAS). All ERAS patients stated that they would choose this pathway again.

CONCLUSIONS: An enhanced recovery protocol developed in Calgary for mastectomy + implant reconstruction treated 30 patients safely with high patient satisfaction and same-day discharge.

Learning Objective:

To appreciate the utility of an enhanced recovery protocol to significantly enhance quality of patient recovery following mastectomy + implant reconstruction.

33
FACTORS INFLUENCING POSTOPERATIVE PAIN IN PATIENTS UNDERGOING AUTOLOGOUS BREAST RECONSTRUCTION IN AN AMBULATORY SETTING

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PURPOSE: An increasingly complex and diverse number of procedures are performed in an ambulatory setting. Appropriate postoperative pain management is critical to preventing unnecessary readmissions and improving patient-reported satisfaction and postoperative quality of recovery. This study assesses factors that influence postoperative pain in patients undergoing autologous breast reconstruction in an ambulatory setting.

METHOD: This study performs a secondary analysis of data collected in a prospective autologous breast reconstruction cohort at Women's College Hospital. Postoperative pain was reported using a 1-10 numeric pain rating scale on postoperative day (POD) 1, 2, 4 and 7. Forty patients (160 observations) were included in this study. A sample size of 40 patients with 4 clusters of observations and an estimated within cluster correlation coefficient of 0.6 allows for up to 5 independent variables to be included within the panel analysis. Progression of univariate followed by multivariate analysis was applied to evaluate the impact of the 6 selected covariates on postoperative pain scores. A final multivariate panel analysis using a generalized estimating equation was selected based on quasi-AIC (QIC) scores.

RESULTS: Pain scores improved over the postoperative period. The following variables were including in the multivariate panel analysis: type of surgery, current use of anxiolytics and/or antidepressants, total in-hospital postoperative opioid use, and preoperative pain score. Patients who underwent a pedicled latissimus dorsi flap breast reconstruction reported higher postoperative pain scores than patients who underwent a pedicled transverse rectus abdominis flap breast reconstruction (p=0.05). Patients currently using anxiolytics and/or antidepressants reported higher postoperative pain scores (p=0.03).

CONCLUSIONS: Several predictive factors of postoperative pain after ambulatory autologous breast reconstruction were identified in this study. These factors should be considered both in preoperative planning and in strategies for postoperative analgesia.

Learning Objectives:
The participant will be able to describe patient and procedure factors that influence postoperative pain after autologous breast reconstruction in an ambulatory setting.

34
COMPLICATIONS FOLLOWING IMMEDIATE VERSUS DELAYED BREAST RECONSTRUCTION: AN OUTCOMES ANALYSIS OF THE AMERICAN COLLEGE OF SURGEONS NATIONAL SURGICAL QUALITY IMPROVEMENT PROGRAM

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PURPOSE: Rates of immediate breast reconstruction (IBR) are increasing in patients undergoing therapeutic and prophylactic mastectomies. There is, however, a paucity of large multicentre studies that compare differences in rates of morbidity following immediate versus delayed breast reconstruction (DBR). The aim of this study was to use the National Surgical Quality Improvement Program (ACS-NSQIP), which is the largest and most current database of postmastectomy breast reconstruction, to compare the rates of major complications following IBR and DBR.

METHODS: The ACS-NSQIP database from 2005 to 2012 was reviewed and 21,398 cases of IBR and 3438 cases of DBR were identified. Bivariate analysis was used to identify significant risk factors associated with complications following any type of reconstruction. After we stratified reconstructions by modality (implant-based vs autologous), we then compared rates of complications between IBR and DBR in the initial 30 postoperative days in a multivariable model while controlling for the other significant risk factors.

RESULTS: Bivariate analysis revealed that patients with complications were significantly older, had higher BMIs, higher rates of diabetes, ASA class 3 or 4, chronic obstructive pulmonary disease, hypertension, bleeding disorder, and were more likely to have received chemotherapy or radiation preoperatively. There was no difference in timing of reconstruction for implant-based or autologous reconstruction with respect to rates of major complications including infectious, respiratory, bleeding, thromboembolic, renal or cardiac complications. However, in implant reconstruction, immediate reconstruction was associated with significantly higher overall rate of 30-day complications (including both minor and major complications).

CONCLUSION: Although immediate reconstruction was associated with higher overall and wound-related complications in implant-based reconstruction, there is no difference in major complication rates for implant or autologous reconstruction.

Learning Objective:
The audience will be able to identify complications associated with timing of breast reconstruction to help guide reconstructive choice by surgeons and patients.

35
INHIBITION OF RHAMM- HYALURONIC ACID INTERACTION BY PEPTIDE B PRODUCES SUBCUTANEOUS FAT PROLIFERATION IN THE RAT MODEL

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PURPOSE: Fat grafting has gained popularity, and an ability to locally augment the subcutaneous fat layer would be valuable. The "receptor for hyaluronan mediated motility" (RHAMM) is a cell surface receptor for hyaluronic acid (HA) that assists in the regulation of proliferation and differentiation of fibroblasts into adipocytes. The purpose of our study was to examine the effect of competitive inhibition of HA binding to the RHAMM receptor on the subcutaneous fat layer in a rat model.

METHODS: Ten Lewis rats were given standardized injections of a RHAMM competitive inhibitor protein (Peptide B) into the subcutaneous fat layer. Controls were injected with a collagen gel. Seven days post-injection rats were euthanized, and skin and fat at injection sites was excised. Increases in fat pad size were measured as: 1. Change in surface area of the fat pad and 2. Change in cross-sectional surface area of transverse histological sections through the fat pad. Changes in the size of the fat pad were calculated using a digital photography analysis program (Image J) utilizing standardized photographs of the deep surface of gross specimens and of transverse histological sections.

RESULTS: Local injection of Peptide B increased subcutaneous adipogenesis when compared with controls. The increase in the subcutaneous fat layer was statistically significant in gross pathological specimens, with an increase in average surface area from 75 mm^2 in controls to 225 mm^2 in experimental rats (p=0.005). The area of the histological sections representing fat pad thickness increased from 4500 to 8000 standardized units (p=0.001).

CONCLUSIONS: Inhibiting the HA-RHAMM interaction with Peptide B resulted in a local increase in the subcutaneous fat layer that was statistically significant in both surface area and thickness.

Learning Objective:
Participants will understand the potential role of RHAMM inhibition in producing local adipocyte proliferation and thereby fat augmentation.

36
COMPARING QUANTITATIVE SENSORY TESTING WITH PRESSURE THRESHOLD AND SPATIAL DISCRIMINATION: ADVANCING THE DIAGNOSIS OF SENSORY PERIPHERAL NERVE TRANSECTION INJURY

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PURPOSE: To compare the diagnostic accuracies of monofilament testing (SWMT), spatial discrimination (2PD), and quantitative sensory testing (QST) in detecting digital nerve transection based on receiver-operator-curve (ROC) analysis. This will provide the rationale to support the selection of a single test, or combination of tests, that will maximize diagnostic precision and avoid unnecessary surgery.

METHOD: Subjects with suspected digital nerve transection were recruited from the University of Alberta. After enrollment, pre-operative sensory

testing at a neuro-rehabilitation facility was conducted using SWMT, 2PD and QST (cold (C), warm (W) and heat pain (HP) detection thresholds (DT)). The reference standard was established by direct inspection under loupe magnification in the operating room. Nerve injuries were classified as either lacerated or intact. Non-parametric ROC area-under-curve (AUC) values and Youden (J) index were compared between tests.

RESULTS: Sixty subjects were recruited from July 2011 to June 2012. All tests were performed with no missing values. Subject demographics between diseased and non-diseased groups were not statistically different. When looking at the ROC AUCs, QST HPDT was the highest at 0.812(±0.067). Non-parametric bootstrapping computed this AUC to be significantly higher than those from CDT and WDT (p=0.023, 0.040 respectively). When comparing the (J) index, HPDT also scored highest at 0.55 (with sensitivity 90% and specificity 65%). WDT had 100% sensitivity across all observed cut offs.

CONCLUSIONS: QST HPDT is the single best test to detect complete digital nerve transection. However, with 90% sensitivity, 1/10 patients would have a false negative. Given that a missed transaction is unacceptable, we propose using WDT (100% sensitivity, 37% specificity) as a screening tool to reduce the number of operative explorations. Furthermore, a tiered-algorithmic testing scheme (combining SWMT and s2PD) would increase the rate of spared surgery to 53%.

Learning Objective:

Attendees will be introduced to a novel testing algorithm for detecting sensory nerve injury.

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GROUP CONSULTATION MODEL FOR INFORMED CONSENT IN CARPAL TUNNEL RELEASE SURGERY DOES NOT DECREASE RISK RECALL

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PURPOSE: Long wait times for surgery are a problem across Canada, including the Maritimes. Group consultation provides a means to reduce wait times for standard procedures by increasing patient volume in clinics. A similar practice has recently been implemented in Toronto for post-mastectomy breast reconstruction. Using carpal tunnel release (CTR) as our model, we hypothesized that group consultation for informed consent would not reduce patients' ability to recall risks of surgery compared to standard individual consultation.

METHODS: Carpal tunnel release (CTR) surgery was chosen as our model since it is a procedure commonly performed by plastic surgeons and has well-established risks and complications. In addition, it is considered a disease with minimal stigma attached. Based on a power calculation for non-inferiority, we recruited 70 consecutive patients referred to our center for open CTR. Patients were assigned to receive a standard informed consent discussion individually, or this same discussion as part of a group. Between their initial consultation and surgery, all patients were contacted to assess the number of risks of CTR surgery they were able to recall.

RESULTS: Group characteristics were equal between groups. There was no significant difference between the number of risks recalled between the individual consult and group consult groups (p=0.46, group consult n=37, individual n=27). Overall recall was poor in both groups, but participants in the group arm remembered infection as a risk significantly more than their counterparts in the individual arm (p=0.007). Very few participants in either arm remembered Complex Regional Pain Syndrome as a risk. Six patients were not contactable by phone to complete the study.

CONCLUSIONS: The group consultation format provides a model for large-volume, low-variation, low-urgency surgery without reducing ability to recall risks of surgery, and a trend towards improving recall. Additional research into improving discussion to promote recall of serious risks should be addressed in the future.

Learning Objective:

To consider the implementation of group consultation as an effective time and cost saving practice for standard surgical procedures.

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AN EDUCATIONAL INTERVENTION TO IMPROVE SPLINTING OF COMMON HAND INJURIES

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PURPOSE: Hand trauma is among the top presenting complaints to hospital emergency rooms (ER), and can become costly if not treated effectively. The cornerstone for initial management of the traumatized hand is splint application. Improving splinting practice could thus produce tangible benefits in terms of quality of care and costs to society.

METHODS: We employed a prospective cohort with educational intervention study design. In the pre-intervention phase patients referred to the hand clinic from the ER were assessed for injury and splint type. Splinting appropriateness was evaluated according to a predetermined hand surgeon's expert consensus. Next an educational intervention was targeted at all ER staff involved with hand splinting. It consisted of didactic lectures, strategically placed posters and educational pocket cards. Post-intervention all patients referred from the ER were again evaluated for splint appropriateness. Finally a follow up evaluation was performed at one year to see the long-term effect of the intervention.

RESULTS: Based on power calculations from pilot study data 49 patients were enrolled pre educational intervention and 54 post-intervention. The most common mechanism of injury was falling (35%) and the most frequent injury was metacarpal fractures (40%). Following the educational intervention splint appropriateness improved significantly from 49% to 79% (p=0.04). Follow-up after one year found splinting appropriateness remained high at 75% (p=0.04).

CONCLUSIONS: Appropriate hand splinting practice is essential for hand trauma management. Our results show that an educational intervention can be successful in improving splinting practice and thus the standard of care at our institution. This quality of care initiative was low cost and effective in improving care even after long-term follow-up.

Learning Objectives:

1. *Participants will learn appropriate splinting of common hand injuries.*
2. *Participants will be able to describe an educational intervention.*
3. *Participants will consider how an educational intervention could be used at their institution.*

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ARE THERE DIFFERENCES IN COMPUTED TOMOGRAPHY ARTICULAR SURFACE GEOMETRY OF MALE VERSUS FEMALE THUMB CARPOMETACARPAL JOINTS?

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PURPOSE: Given the predilection of first CMC joint OA in women compared to men, we aim to determine if there are any underlying sex differences between young, healthy male and female first carpometacarpal joint surface geometry and joint congruence using 3D CT scan data.

METHODS: Wrist computed tomography (CT) scan data of eleven men and eleven women between the ages of 20-35 were imported into software programs. The first metacarpal and trapezium were aligned in a standardized position according to landmarks at key points on Gaussian and Maximum curvature maps. Measurements of joint congruence and surface geometry were analyzed, including joint space volume, distance between the bones at the articular surface edges, area of the joint space and radii of curvature in the radial-ulnar and volar-dorsal planes.

RESULTS: The mean age of males was 28.0±4.4 years (n=11) and females was 30.2±4.2 years (n=11). The mean thumb CMC articular space volume was 104.02±30.96 mm^3 for females and 138.63±50.36 mm^3 for males (p=0.066). The mean first metacarpal articular surface area was 144.9±10.9 mm^3 for females and 175.4±25.3 mm^3 for males (p=0.0015) and the mean two-dimensional joint space surface area was 102.8±10.9 mm^2 for females and 125.3±14.6 mm^2 for males (p=0.0006). After normalizing for size, the mean thumb carpometacarpal articular space volume was 119.4±24.6 mm^3 for females and 117.86±28.5 mm^3 for males (p=0.90). After normalizing for size, mean distances at the articular surface volar, dorsal, radial and ulnar edges, mean area between the first metacarpal and

trapezium articular space, and mean radii of curvature of the first metacarpal and trapezium along the volar-dorsal and radial-ulnar planes were all not statistically significant between males and females.

CONCLUSIONS: This study found that there are sex differences in the first CMC joint articular volume, however, there are no sex differences in curvature characteristics and joint congruence of young, healthy patients.

Learning Objectives:

1. *Participants will be able to describe the curvature characteristics and relationship between the first metacarpal and trapezium of the first carpometacarpal joint.*
2. *Participants will learn how 3D analysis of CT scans can demonstrate surface geometry and congruence of a joint.*

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PERI-OPERATIVE OUTCOMES COMPARISON OF GENERAL ANESTHESIA AND BRACHIAL PLEXUS BLOCK FOR OPEN REDUCTION INTERNAL FIXATION OF METACARPAL FRACTURES

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PURPOSE: Brachial plexus blockade (BPB) is a procedure of growing popularity amongst surgeons and anesthesiologists involved with upper limb surgery. The purpose of this study is to examine the peri-operative effectiveness of BPB compared with general anesthesia used in hand surgery.

METHOD: A retrospective chart review was performed examining all open reduction internal fixation of metacarpal fractures from January 2010 - December 2012 at two local hospitals. In total, fifty-four cases with general anesthesia and forty-eight cases with brachial plexus block were identified. Intraoperative and post-operative medications, and timings during the perioperative period were collected. Statistical significance was set at $p<0.05$ with 95% confidence interval. One-way ANOVA was used to compare between group differences and chi square analysis performed for variables of frequency.

RESULTS: The average total time from entering the operating theater to discharge was 245±72 minutes in general anesthetic group and 195±54 minutes in BPB group ($p<0.001$). Of those who had a general anesthetic, 47/54 patients required analgesia post operatively versus 12/48 in the BPB group ($p<0.001$). 25/54 and 5/48 patients required anti-emetics post operatively in the general anesthetic and BPB groups respectively ($p<0.001$). An overall need for parenteral medication was significantly less in the BPB group ($p<0.001$).

CONCLUSIONS: This is the first study to specifically examine the utility of BPB for open reduction internal fixation of hand fractures. The perioperative time, need for post-operative analgesic, anti-emetic, and requirement of a parenterally delivered medication are significantly reduced when a brachial plexus block is utilized.

Learning Objectives:

1. *Familiarize with an alternative method of anesthesia in hand surgery.*
2. *Recognize differences in peri-operative outcomes when brachial plexus blockade is utilized.*

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ACHIEVING THE OPTIMAL EPINEPHRINE EFFECT WITH LOCAL ANESTHESIA IN HAND SURGERY

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PURPOSE: The optimal epinephrine effect from local anesthesia – producing maximal vasoconstriction and prime visualization – is achieved by waiting significantly longer than the traditionally quoted 7 minutes from the time of injection for procedures on the human hand. Achieving the optimal epinephrine effect is a crucial component of wide awake local anesthesia & no tourniquet (WALANT) hand surgery.

METHODS: In this level 2 evidence, prospective comparative study, patients undergoing unilateral carpal tunnel surgery waited either 7 minutes versus 33 minutes - between the time of injection of 1% lidocaine with 1:100,000 epinephrine, and the time of incision. A standardized incision was made through dermis and into the subcutaneous tissue followed by exactly 60 seconds of measuring the quantity of blood loss using sterile micropipettes.

RESULTS: There was a statistically significant reduction in the mean quantity of bleeding in the group that waited a mean of 33 minutes after injection and before incision compared to the group that waited only 7 minutes (95% CI 0.06±0.03 mL/cm, vs. 0.17±0.08 mL/cm, respectively) ($p=0.03$).

CONCLUSIONS: Waiting roughly 33 minutes for the optimal epinephrine effect will result in less intraoperative bleeding than the traditionally quoted 7 minutes for all hand surgery procedures. Obtaining the optimal epinephrine effect is a crucial component of WALANT hand surgery. The benefits of WALANT include: intraoperative active movement examinations, as well as a reduction in the cost, waste, and complications associated with the main operating room and general anesthesia.

Learning Objectives:

1. *Participants will be able to consider the optimal time to wait after injection of lidocaine with epinephrine in order to achieve the lowest cutaneous bleeding & therefore excellent visualization – making it possible to perform WALANT hand surgery.*
2. *Participants will be given practical tips on how to incorporate the early timing of injection into clinical practice without wasting the surgeon's valuable time.*

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UPDATES IN TARGETED SENSORY REINNERVATION FOR UPPER LIMB AMPUTATION

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PURPOSE: Advanced robotic devices have raised the enticing prospect of replacing the lost intricate functions of the arm following upper limb amputation. However, a large gap still exists in the application of this technology. In particular, the ability to provide physiologically relevant sensory feedback - to have the amputee feel the prosthetic hand as their own - has not yet been achieved.

METHOD: We will review the approaches that have been used for targeted sensory reinnervation (TSR) and compare their outcomes and potential functional utility.

RESULTS: There has been an evolution of three main techniques: 1. Traditional targeted reinnervation: The skin overlying the amputated stump is thinned of subcutaneous tissue, resulting in local denervation of the skin. This then allows for competitive reinnervation of afferent nerve fibers. 2. Cutaneous nerve end-to-side TSR: Two sensory nerve transfers are performed. For example, for a transhumeral amputee, the supraclavicular nerve is coapted to the ulnar nerve and the intercostobrachial nerve is coapted to the median nerve. 3. Sensory fascicle end-to-end TSR: This technique, developed by the authors, uses intra-operative somatosensory evoked potentials to identify fascicles with high sensory content from the median and ulnar nerves. Once a predominantly sensory fascicle is identified and coapted to a sensory target nerve, the remainder of the main nerve is directed to the motor branch of the target muscle.

CONCLUSIONS: With traditional reinnervation and end-to-side coaptations, there is little control over which afferent fibers regenerate from the transferred nerves. In contrast, with the fascicular end-to-end technique, two spatially separated areas with discrete sensation for individual digits in the two nerve territories are created. We were able to demonstrate potential functional relevance by having the subject utilize this sensory feedback to execute tasks while operating a myoelectric training tool, without having to rely on visual guidance or auditory cues.

Learning Objectives:

1. *Participants will be able to describe the techniques available for TSR.*
2. *Participants will be able to list the benefits of sensory fascicle end-to-end coaptation techniques.*

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DEVELOPMENT OF AN OBJECTIVE SURGICAL EVALUATION TOOL IN PLASTIC SURGERY

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PURPOSE: Residents' surgical skills are learned and practiced in the operating room and evaluated in the same setting under the subjective eye of an attending surgeon. These observations are then recalled to complete

the resident's end-of-rotation evaluation. We developed an objective method to evaluate plastic surgery residents' technical skills in carrying out a digital nerve repair.

METHODS: Eight microsurgical experts determined the critical steps comprising an adequate digital nerve repair. A Delphi method was used to reach a consensus. Residents from different levels of training were videotaped performing a digital nerve repair on a cadaveric model. The evaluation tool was tested for feasibility by two plastic surgeons who evaluated randomly chosen videotapes.

RESULTS: We developed a 16-step evaluation tool specific to digital nerve repairs. This type of assessment tool was chosen because it combines the high scientific value of global rating scales with the advantage of checklists to identify steps at which a candidate shows weakness. Each step was evaluated using a 6-point continuous Likert scale, with the 0 mark attributed if the step was not completed, and 5 if it was completed in the manner of an expert. Behavioral anchors were added to the Likert scale as objective benchmarks to guide examiners. Once the two evaluators had used the tool to assess videotaped surgeries, the feedback was used to adjust the evaluation tool.

CONCLUSION: We have developed an evaluation tool for digital nerve repairs, which was tested to ensure that it was easy and straightforward to use. In the future, the tool's validity and reliability will be assessed before implementation.

Learning Objectives:

1. *Participants will learn assessment methods of technical skills in surgical residencies.*
2. *Participants will learn how to develop objective evaluation methods.*

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POSTOPERATIVE ANTITHROMBOTIC USE IN FREE FLAP SURGERY: A SYSTEMATIC LITERATURE REVIEW

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INTRODUCTION: Free flap surgery is a reliable and versatile method for reconstructing complex defects. While flap survival rates now approach 95%, flap loss causes significant morbidity. To minimize flap failure, many microsurgeons use antithrombotics postoperatively. It is unclear, however, if these agents are of any benefit, or if there is superiority of one agent, dose, or duration of administration over another. The study purpose was to systematically review the literature and determine the effect of postoperative antithrombotics on flap loss and other objective outcomes.

METHODS: A comprehensive literature search was conducted in MEDLINE, EMBASE, HealthSTAR, and Cochrane databases (up to July 2014). Studies were selected by two independent assessors if the studies investigated the use of postoperative antithrombotics and were comparative by design. Outcomes of interest were rates of flap failure, re-operation, arterial or venous thrombosis, local or systemic complications, length of hospital stay, and death.

RESULTS: Twelve studies were included, 11 which were retrospective cohort studies. There was significant variation in the agents used (low molecular weight heparin, heparin, low molecular weight dextran, aspirin, and ketorolac) as well as their dosing and duration of administration. Low molecular weight heparin and dextran-40 were most commonly studied. Flap failure rates did not differ when agents were compared with each other or with no antithrombotic use at all. Postoperative aspirin did not seem to confer a greater risk of bleeding. Postoperative dextran-40 seemed to confer a greater risk of medical complications.

CONCLUSIONS: Based on largely retrospective data, flap loss rates did not differ between, or seem to be influenced by, different postoperative antithrombotic agents. Prospective high quality data remains lacking. Use of dextran-40 is not advised given the increased risk of medical complications.

Learning Objectives:

Readers will review the highest-quality evidence surrounding the use of postoperative antithrombotics in free flap surgery.

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THE PROTECTIVE EFFECT OF ABDOMINAL SCARS ON DIEP FLAPS AND MOTOR NERVE PRESERVATION

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PURPOSE: To evaluate the effect of previous abdominal scarring on the number of perforators taken and rate of intercostal nerve sacrifice during DIEP flap harvest.

METHODS: This study was a subset analysis of "A Randomized Clinical Trial Comparing the Breast and Abdominal Related Morbidity of DIEP and SIEA Flaps". A standardized set of intra-operative anatomical and surgical variables were prospectively recorded on 88 DIEP flaps. SIEA flaps were excluded. Template data included abdominal scar type and location; the ize, number, and location of perforators harvested; and the number of intercostal nerves sacrificed.

RESULTS: Fifty-four of 88 patients had abdominal scars, from 1–5 in number. The need to harvest more than one perforator was significantly higher in abdomens without scars (44.1%) compared to abdomens with scars (11.5%). The prevalence of nerve damage was significantly lower in scarred abdomens (20.4%) compared to abdomens without scars (44.1%). There was no statistical difference in BMI, smoking, age, preoperative breast size, or co-morbidities.

CONCLUSIONS: Preexisting scars confer a protective effect towards lower numbers of perforators harvested and thus the likelihood of intercostal nerve damage. Previous scars appear to invoke a delay phenomenon and cause the abdomen to undergo ischemic preconditioning likely resulting in dilation of choke vessels and larger angiosomes increasing the ability of a single perforator to support the flap. This decreases the amount of dissection required and number of perforators harvested, likely decreasing rates of nerve damage. These findings challenge the assumption that abdominal scars contraindicate use of the DIEP flap.

Learning Objectives:

To learn about the delay phenomenon seen in DIEP flaps with pre-existing abdominal scars. To encourage the listener to re-consider use of the DIEP flap in patients with pre-existing abdominal scars.

46

RESTORATION OF ANTERIOR INTEROSSEOUS NERVE FUNCTION USING A NOVEL SUPERCHARGE-END-TO-SIDE NERVE TRANSFER: A CASE SERIES

R Chambers, K Boyd, G Wolff
Ottawa, ON

PURPOSE: Nerve transfers have expanded the armamentarium of surgical options for e-establishing hand and upper limb function in post-traumatic patients. We describe 5 cases of supercharge-end-to-side (SETS) extensor carpi radialis brevis (ECRB) to anterior interossious nerve (AIN) transfer as a novel method to restore pinch earlier while still allowing for potential spontaneous recovery.

METHODS: A retrospective chart review of all nerve transfers conducted at the Ottawa Hospital between 2011 and 2015 was performed. Inclusion criteria were patients with AIN palsy demonstrating no recovery on serial clinical examination and electrodiagnostic studies by 6 months who were treated with SETS ECRB to AIN nerve transfer.

RESULTS: Five transfers were identified in four patients. Three were diagnosed with neuralgic amyotrophy (NA), also known as Parsonage Turner Syndrome. One of these patients had bilateral palsies. The remaining patient sustained a traumatic high median nerve injury treated with cable grafting. Follow up ranged from 4.5 to 13 months. In 4 of 5 patients, MRC grade 4/5 function has been re-established in FPL and FDP to index. The remaining patient is only 4.5 months post surgery and has achieved MRC 3/5 in FDP, but has not yet recovered FPL. All patients self reported a high level of satisfaction with their results. No donor deficits were identified.

CONCLUSION: Here we present 5 procedures in 4 patients of a novel SETS nerve transfer of ECRB to AIN to restore pinch. Four of these cases are believed to have been caused by a rare condition called NA, which has a predilection for the AIN. All patients showed evidence of meaningful recovery. SETS ECRB to AIN is a viable option for nerve transfer to restore pinch

earlier without compromising any possible recovery of the native innervation in the future.

Learning Objectives:

1. *Participants will gain a better understanding of supercharged end to side nerve transfers in nerves with a chance of possible spontaneous recovery.*
2. *Participants will gain a better understanding of the rare post-operative complication neuraligic amyotrophy.*
3. *Participants will learn about a novel SETS ECRB to AIN nerve transfer.*

47
INCREASED ARTERIAL COMPLICATIONS IN SIEA VERSUS DIEP FLAPS: A COHORT STUDY

C Coroneos, A Heller, S Voineskos, R Avram
Hamilton, ON

PURPOSE: The objective of this study was to analyze arterial complications in patients undergoing breast reconstruction with SIEA flaps, compared to DIEP. The variability, calibre, and angiosome of the SIEA are cited as limitations. Previous studies were performed by specialized centers dedicated to breast reconstruction, with careful selection of SIEA caliber, introducing bias. Outcomes from these previous studies were reported without stratification of arterial complications.

METHODS: This is a retrospective cohort study. Consecutive flaps for breast reconstruction from the initial seven years of a single microsurgeon's practice (2007-2013) were reviewed. The centre does not utilize preoperative imaging. Consistent intraoperative criteria for SIEA flap selection were used. All complications were abstracted in duplicate using a standardized form, and a priori criteria.

RESULTS: Overall, 169 (44 SIEA, 125 DIEP) flaps were performed on 112 patients. Significantly more SIEA flaps required re-exploration versus DIEP (20% vs. 7%; p=0.03). Arterial insufficiency was significantly higher among SIEA flaps (14% vs. 1%; p=0.001). There was no difference in venous insufficiency (p=0.92). Significantly more SIEA flaps had necrosis requiring intervention (p=0.03). Ultimately, significantly more SIEA flaps completely failed (14% vs. 2%; p<0.01). All SIEA failures were due to arterial thrombosis. No learning curve was demonstrated.

CONCLUSIONS: This is the first comparative study to analyze SIEA arterial complications, the critical limitation of SIEA flaps versus DIEP. Compared to DIEP, SIEA flaps have significantly higher proportions of re-exploration, arterial complication, necrosis and failure. No difference in venous complications was found. DIEP outcomes agree with existing literature from specialized centres. Complications and failures in SIEA flaps are attributed to arterial thrombosis. Given our practice setting, SIEA flaps are no longer performed.

Learning Objectives:

1. *Participants will identify arterial limitations of the SIEA flap.*
2. *New microsurgeons will recognize the clinical utility of SIEA flaps in a consistent approach to breast reconstruction.*

48
WHAT IS THE BEST WAY TO TRACK SURGICAL COMPLICATIONS? COMPARING ACS-NSQIP VS TRADITIONAL M&M ROUNDS

D Song, JX Zhang, J Bedford, DJ Courtemanche, J Arneja
Vancouver, BC

PURPOSE: M&M rounds have played a traditional role in tracking complications. In recent years, ACS-NSQIP has gained popularity as a risk-adjusted means to address quality assurance/improvement. Herein, we report an analysis of the two methodologies for plastic surgery to determine the best way to manage quality.

METHODS: With IRB approval, ACS-NSQIP and M&M data were extracted for 2012 and 2013 at a quaternary care institution. We analyzed raw complication rates and an equivalent comparison of rates after removing NSQIP-ineligible cases. We determined the concordance and discordance rate of both methodologies and classified complications by severity and type. Statistical analysis was performed on all samples.

RESULTS: 1261 plastic surgery procedures were performed in the study period. Only 51.4% of cases were NSQIP-eligible. The overall complication rates of ACS-NSQIP (6.62%) and M&M (6.11%) were similar (p=0.662). Comparing the two systems for ACS-NSQIP-eligible cases also yielded a similar rate (6.62% vs. 5.71%; p=0.503). Although ACS-NSQIP and M&M track different types of occurrences, the concordance rate for M&M and ACS-NSQIP was 35.1% and 32.5% respectively and consisted mostly of major complications.

CONCLUSION: ACS-NSQIP is able to accurately track complications at a similar rate to M&M, although it samples only half of all procedures. Differences in definitions and purpose exist for each system, leading to low concordance rates. Although both systems offer value, both also have limitations. Due to the rigor of ACS-NSQIP, we recommend expansion of ACS-NSQIP to include currently excluded cases and an extension of the ACS-NSQIP study interval.

Learning Objective:

The audience will gain an understanding of the problems and comprehensiveness of tracking surgical complications. The information will provide an accurate forum for implementation of practice change management.

49
SYSTEMATIC REVIEW OF UNINTENTIONAL INTRA-OPERATIVE HYPOTHERMIA IN PLASTIC SURGERY

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Toronto, ON

PURPOSE: To perform a systematic review of the consequences of unintentional intra-operative hypothermia(UIH) in plastic surgery.

METHOD: A systematic review using PRISMA guidelines was performed to identify the sequelae of UIH in the plastic surgery literature, using MEDLINE, EMBASE, and Cochrane databases (1960 to 2014). Two independent reviewers completed the screening and data extraction processes, recording the domain of plastic surgery (Sears et al 2007 classification), country of origin, date and journal of publication, hypothermia definition, and impact of UIH post-operatively.

RESULTS: Ten studies encompassing 1140 patients met inclusion criteria. Articles were classified as aesthetic surgery/body contouring, generalized cutaneous disorders/burns, facial/head and neck reconstruction, and breast, lower extremity, and 'multiple' surgical areas. No standard definition of hypothermia was used (range 34°C-36°C). All articles showed that UIH contributes negatively to post-operative outcomes. In aesthetic surgery, increased rates of seroma formation, blood loss, need for transfusion, and increased recovery time were noted. In burns, increased rates of haemorrhage and acute lung injury were reported. In breast surgery, UIH resulted in increased rates of flap necrosis. In cases of head and neck reconstruction, an overall increased complication rate related to flap loss, dehiscence, and fistula formation were noted. An increased infection rate occurred in lower extremity free flap reconstruction. Surprisingly, even short periods of UIH, rather than UIH duration, was found to negatively influence the postoperative course.

CONCLUSIONS: UIH leads to deleterious post-operative outcomes in all plastic surgery domains studied. This systematic review emphasizes the importance of implementing strategies to prevent UIH.

Learning Objectives:

1. *Participants will recognize the susceptibility of patients undergoing plastic surgery of developing UIH.*
2. *Participants will appreciate the sequelae of IUH on post-operative outcomes.*
3. *Participants will consider the importance and relative efficacy of preventative strategies in their practice.*

50
IMPACT OF NECROTIZING FASCIITIS ON QUALITY OF LIFE

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Winnipeg, MB

PURPOSE: Improved management of necrotizing fasciitis (NF) has resulted in prolonged survival. However long-term outcomes in survivors of NF are not well understood. The goal of this study is to assess self-reported mental and physical health, and appearance in NF patients using existing survey instruments.

METHODS: This prospective study used Short Form (SF)-36 which examines physical (PCS) and mental well-being (MCS) and Derriford Appearance Scale (DAS)-24 for concern of appearance. Following ethics

approval, surveys were mailed to NF patients who survived discharge from our hospital between 2004-2014 (n=200).
RESULTS: 26 male, 19 female completed the study. Participant age was 46.8±14.2 yr, TBSA was 6±7.6%, number of surgeries was 2.8±1.3, length of hospital stay (LOS) 40±48 days, and days since NF was 1945±933. Overall, patients had worse PCS 36.3 versus MCS 46.6, both worse than the normative data for age 45-54 (PCS 49.62, MCS 50.54). Mean DAS-24 score of 43±18 indicates distress over appearance. Age was inversely correlated with DAS-24 score (p=0.03) and MCS (p=0.003), but not PCS (p=0.55). There was a significant difference between men and women (p=0.01) for MCS, but not PCS (p=0.50). PCS was negatively correlated with both %TBSA (p<0.001) and LOS (p=0.02), whereas MCS was not (p=0.77 and p=0.33 respectively).
CONCLUSIONS: We show that NF impacts long-term mental and physical health, and distress regarding self-perceived appearance. Compared to older, younger patients have worse mental well-being, although better physical. Severity related factors, %TBSA and LOS, are related to worse physical well-being but surprisingly not a worse mental well-being.
Learning Objective:
This study highlights the need for a holistic approach for NF rehabilitation irrespective of disease severity, taking into account age and both mental and physical health of the NF patient.

A.W. FARMER LECTURE

50A
INNOVATION IN PLASTIC SURGERY
G Gurtner
Stanford University School of Medicine, Stanford, CA

PANEL 1
KEEPING PLASTIC SURGERY COMPETITIVE
Moderator: W Bryan Callaghan

PANEL 2
COMPLEX ABDOMINAL AND TRUNK RECONSTRUCTION
Moderator: E Buchel

PANEL 03
PARTIAL MASTECTOMY DEFECTS: THE NEXT CHALLENGE
Moderator: P Lennox

C Temple-Oberle
Patterns of partial mastectomy use across Canada and beyond
K Boyd
Oncoplastic surgery and prevention of defects

PANEL 4
CONTROVERSIES IN BODY CONTOURING
Chairs: N Carr, M Evans
Panelists:
1. **ABDOMINOPLASTY:** Lipoabdominoplasty – do the South Americans know something we don't?
   R Bendor Samuel
2. **LIPOSUCTION:** Is there a need for energy devices?
   M Mosher
3. **BRACHIOPLASTY:** Does it have a role in non MWL patients?
   N Carr
4. **BREAST AUGMENTATION:** Textured or Smooth implants?
   P Lennox
5. **MWL SURGERY:** Does contour trump scars?
   J Toy
6. **SAFETY:** When should we use anti-coagulants?
   K Smith

Learning Objectives:
Upon attending the Panel "Controversies in Body Contouring" the attendee will:
1. *Have an understanding of experts' views on current controversies in the area of aesthetic body contouring*
2. *Have an understanding of the importance of an informed approach to the role of perioperative anticoagulation as it relates to aesthetic body contouring*

CANADIAN EXPERT

50B
NASAL RECONSTRUCTION : KEY POINTS TO MAXIMIZING OUTCOMES
Dr Stefan Hofer
Learning Objectives:
At the end of the presentation the learner :
1. *Will be able to design a paramedian forehead flap.*
2. *Will be have an understanding of inner lining reconstruction for the nose.*
3. *Will know how to provide structural support to a nasal reconstruction.*

51
PEDIATRIC MELANOMA IN BRITISH COLUMBIA
P Dean, M Bucevska, C Strahlendorf, C Verchere
Vancouver, BC
PURPOSE: Pediatric melanoma is a rare neoplasm in the pediatric population (1%-4% of melanoma cases occur in this age group). Controversy exists regarding the natural history, presentation and surgical approach in pediatric patients. Recent studies indicate an increase of incidence over the last few decades. The purpose of this study was to analyze the pediatric patients with a diagnosis of malignant melanoma in the last 35 years in BC and discover trends in incidence.
METHOD: Eligible patients were identified by using the inclusion criteria of: diagnosis of melanoma, age <18 years at time of diagnosis, diagnosed in BC from May 1, 1979 until April 30, 2014. Patient data was collected and cross-referenced from the BC Cancer Agency database, the BC Children's Hospital (BCCH) Oncology database, and the BCCH Discharge database. Data analysis was performed using descriptive statistics.
RESULTS: 78 subjects were included in the study; the population of BC averaged 3,721,842 in the 35-year time frame. Patients were equally distributed by gender (38 male vs 40 female). 61(78%) of the subjects were diagnosed in the post-pubertal age (≥12 years old). The most common sites of occurrence were the extremities (n=33) and the trunk (n=27), with the location of the trunk showing the highest mortality rate (22%). All patients were surgically treated and some had additional chemotherapy (12) and/or radiotherapy (12). Fatal outcome was recorded in 12 out of the 78 subjects, ten of which had been diagnosed with melanoma in the post-pubertal age.
CONCLUSIONS: Pediatric melanoma has a better prognosis in the early years of childhood and poorer prognosis in the post-pubertal age group. Those diagnosed and surgically treated early tend to have positive outcomes.
Learning Objective:
Participants will manifest concern regarding the appropriate and timely treatment necessary to improve prognosis for pediatric melanoma.

52
CHRONIC OTITIS MEDIA WITH EFFUSION IS ASSOCIATED WITH INCREASED RISK OF SECONDARY SPEECH SURGERY
M Bezuhly, A Murphy, J Hatchette, R Delorey, P Hong, L Hanes
Halifax, NS
BACKGROUND: Children with repaired cleft palate can experience secondary velopharyngeal insufficiency (VPI) and chronic otitis media with effusion (OME). These complications can be attributed to persistent abnormalities in the levator and tensor veli palatini muscles, respectively. The purpose of this case-control study was to examine the association between OME requiring myringotomy tubes and the need for secondary speech surgery.
METHODS: Records of patients who underwent primary palatoplasty at our institution from between 1990 and 2006 were reviewed. Data included age at primary palatoplasty, gender, Veau classification, surgeon, number of

post-palatoplasty myringotomy tube procedures, hearing loss, 22q deletion syndrome diagnosis, and fistula. The primary outcome was need for secondary speech surgery.

RESULTS: A total of 249 patients met study inclusion criteria. Forty-four patients (17.7 percent) had secondary speech surgery recommended or performed. Univariate analysis revealed a significant association between Veau classification, 22q deletion syndrome diagnosis, and two or more myringotomy tube procedures with secondary speech surgery. Adjusting for multiple covariates, children requiring two or more myringotomy tubes were 2.39 times more likely to require secondary speech surgery than patients who required one or fewer sets of myringotomy tubes (95% CI 1.49-6.74; p=0.015).

CONCLUSIONS: Adjusting for multiple variables, the authors demonstrate that chronic OME requiring two or more myringotomy tube procedures is associated with a significantly increased likelihood of requiring secondary speech surgery. Using OME as a clinical predictor for secondary VPI could allow for early identification of at-risk patients in need of intensive speech therapy and timely secondary speech surgery.

Learning Objectives:

To assess the impact of patient factors (including chronic otitis media with effusion) on the need for secondary speech surgery post cleft palate repair. To recognize the utility of recurrent otitis media with effusion as a clinical predictor for secondary speech surgery.

53

FUNCTIONAL OUTCOMES FOLLOWING SINGLE-ROOT RECONSTRUCTION OF THE UPPER TRUNK IN ERB'S PALSY

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Toronto, ON

BACKGROUND: Avulsion of C5 or C6 is rare in obstetric brachial plexus palsy (OBPP), but means that only one cervical root remains available for grafting to the upper trunk. The purpose of this study was to determine the functional outcome of patients with OBPP, who required single-root reconstruction of the upper trunk.

METHODS: We performed a retrospective cohort study of patients with isolated upper trunk injuries undergoing a primary nerve operation for OBPP between 1993 and 2009. All data were collected prospectively. Patients with avulsion of either the C5 or C6 nerve root (n=10) were then compared to those where both the C5 and C6 roots were available for upper trunk reconstruction (n=15). Surgical reconstruction in all patients entailed neuroma resection and interpositional nerve grafting, with or without at spinal accessory to suprascapular nerve transfer. Functional outcome was assessed using the Active Movement Scale (AMS) at 4 years follow-up. Between-group comparisons were performed using the Wilcoxon rank-sum test.

RESULTS: Avulsion of the C5 or C6 roots was identified in 1 and 9 patients, respectively. There were no baseline differences in reported birth history or demographics between study groups. In patients with a root avulsion, average postoperative scores for elbow flexion, shoulder abduction, and forearm supination were 6.8±0.4, 6.0±1.7, and 5.8±1.9, respectively. These scores did not differ significantly from patients undergoing two-root reconstruction of the upper trunk. Active external rotation of the shoulder was the most difficult motion to achieve postoperatively in both groups.

CONCLUSIONS: Reconstruction of the upper trunk via interpositional nerve grafting from a single nerve root for C5 or C6 avulsions can restore excellent elbow flexion and shoulder function. Functional recovery in this patient group is similar to that which can be achieved when two donor nerve roots are available for grafting.

Learning Objective:

To determine the outcome of patients with Erb's palsy undergoing single-root reconstruction of the upper trunk.

54

PAIN IN CHILDREN FOLLOWING MICROSURGICAL RECONSTRUCTION FOR OBSTETRICAL BRACHIAL PLEXUS PALSY

ES Ho, CG Curtis, HM Clarke

Toronto, ON

PURPOSE: To determine the prevalence and characteristics of pain experienced by children who have had microsurgical reconstruction for obstetrical brachial plexus palsy (OBPP).

METHOD: A prospective case series study of 65 children between 6 to 18 years with a diagnosis of OBPP and who had microsurgery at less than 12 months of age with nerve grafting or transfer was conducted. Twenty-eight patients (43%) had upper OBPP and 37 (57%) had total OBPP. Pain was evaluated using the Faces Pain Scale – Revised and the Adolescent Pediatric Pain Tool. Sensory symptoms in the affected limb were also collected. The mean age was 11.0±3.3 years.

RESULTS: Sixty-five children were evaluated. The point prevalence of pain was 25%. The reported lifetime prevalence of pain was 66%. Seventy-one percent reported that their affected extremity felt different at least once in their lifetime. The average intensity of those with pain (n=43) was 40±19 mm on a 100 mm visual analogue scale. Seventy percent of children reported that symptoms occurred every day or at least once a week. The anatomical distribution of the pain was throughout the affected upper extremity irrespective of the severity of injury, with the exception of children with upper plexus injuries who did not report pain in their hand. Both words typically used to describe neuropathic or musculoskeletal symptoms were chosen by the children to represent their pain.

CONCLUSIONS: Children with OBPP who had microsurgical reconstruction commonly reported pain. These symptoms were typically frequent, but episodic and low in intensity. The descriptions of the type of pain include terms typical of both neuropathic and musculoskeletal origins.

Learning Objective:

Participants will be able to describe the prevalence of pain in patients who underwent microsurgical reconstruction of the brachial plexus in infancy.

54A

A CANADIAN IN BALTIMORE: VIRTUAL SURGERY AND FACIAL TRANSPLANTATION

D Borsuk

Montréal, QC

INTRODUCTION: The Ross Tilley fellowship program was founded with a mission to assist a graduating Canadian plastic surgery resident pursue sup-specialty training abroad. The recipient of the award is encouraged to learn from leaders in plastic surgery and acquire new skills and knowledge that may be brought back to Canada to better serve our patients.

METHODS: In 2011, with the assistance of the Ross Tilley award, I studied and worked at The Johns Hopkins Hospital and University of Maryland R Adams Cowley Shock Trauma Center. Dr Eduardo Rodriguez, Paul Manson, and Richard Redett undertook the teaching and mentoring responsibilities for the duration of the fellowship. The fellowship focused on adult and pediatric cranio-maxillofacial surgery, microsurgery, and vascularized composite allotransplantation. The use of virtual surgical planning for orthognathic surgery, free tissue transfers, cranial vault remodeling, and facial transplantation was extensively employed during the fellowship.

RESULTS: Over the year, 713 surgeries were performed, including over 40 free tissue transfers, 30 pediatric cranial vault remodeling procedures, 60 cleft lip/palate procedures and over 20 orthognathic procedures. On March 20, 2012 after 8 months of rigorous planning and preparation, I participated in the most extensive vascularized composite facial allotransplantation performed to date. Since my return to the University of Montreal hospitals three years ago, I have regularly employed virtual surgical planning to all othognathic and free tissue reconstructions of the facial skeleton.

CONCLUSION: The experience that I was afforded through the Ross Tilley award at the Johns Hopkins/University of Maryland craniofacial fellowship greatly enriched my ability to care for and treat children and adults in Montreal. The Ross Tilley fellowship is an important program and deserves the full support from the members of the Canadian Society of Plastic Surgeons.

Learning Objectives:

1. *The audience will become familiar with the Johns Hopkins/University of Maryland Craniofacial Fellowship.*
2. *The audience will understand the importance of the Ross Tilley Fellowship Program.*
3. *The audience will learn about the details of a vascularized composite facial allotransplant.*

55

GENERAL SURGEONS' ATTITUDES TOWARDS BREAST RECONSTRUCTION IN THE PROVINCE OF QUÉBEC

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Montréal, QC

INTRODUCTION: Breast reconstruction after mastectomy is associated with psychological, social and sexual benefits. However, less than 7% of eligible Canadian women undergo breast reconstruction after mastectomy. Surgeons' attitude and practice factors affect referrals to plastic surgeons. We sought to examine further these issues in the province of Québec.

METHODS: Québec's attending general surgeons, involved in the treatment of breast cancer patients, were mailed self-administered questionnaires. The gathered information included demographics, practice patterns, questions evaluating knowledge and perception on breast reconstruction. The surgeons reported the proportion of their mastectomy patients who they referred to plastic surgeons. Referral patterns were divided into 3 categories. A univariate analysis was conducted in order to identify factors influencing referral rates.

RESULTS: A total of a 112 surgeons completed the questionnaire. The response rate was of 33.7%. Only 11.11% of surgeons referred more than 75% of their patients to plastic surgeons prior to surgery. 22.58% did not offer immediate breast reconstruction. 25 % believed that autologous flaps would prevent the detection of recurrences. 52.69% were worried that breast reconstruction has a high morbidity. 53.76% would rather avoid breast reconstruction if an adjuvant treatment is needed. 44.47% did not have access to a plastic surgeon for an immediate breast reconstruction. High referral rates were associated with surgeons who worked in urban regions; in an academic setting; with a high breast surgery volume and who attended multidisciplinary team meetings ($p<0.05$).

CONCLUSIONS: Most general surgeons do not refer breast cancer patients to a plastic surgeon before surgical treatment. The adoption of a multidisciplinary approach to breast cancer patient management should be emphasized. Further development in Patient decision aids and better population awareness are required in order to reduce the inequality of information received by patients.

Learning Objectives:

1. *Participant will be able to identify factors related to general surgeon's perception and attitude that affect referrals to plastic surgeons.*
2. *Participant will understand the importance of conducting a breast reconstruction awareness campaign in his own community.*
3. *Participant will understand the importance of patient's management through a multidisciplinary team model.*

56

COULD RADIOTHERAPY INTERFERE WITH THE BENEFITS OF TEXTURED IMPLANT IN BREAST RECONSTRUCTION BY ALTERING PERIPROSTHETIC CAPSULE ULTRASTRUCTURE? A SCANNING ELECTRON MICROSCOPY ANALYSIS

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Montréal, QC

PURPOSE: Radiotherapy induces a strong soft tissue fibrotic response and impacts the quality of implant-based breast reconstruction. Periprosthetic capsular contracture is well documented; however, the precise three-dimensional response to textured implants has not yet been elucidated. We compared the capsular ultrastructural response to Allergan Biocell® textured breast implants in both irradiated and non-irradiated breasts.

METHODS: Twenty-seven women (41 breasts) diagnosed with breast cancer and undergoing two- staged implant-based breast reconstruction following mastectomy were included in this study. Capsule samples were biopsied during removal of the expander prosthesis. Using scanning electron microscopy (SEM), ultrastructural capsule characteristics of irradiated samples (n=25) and non-irradiated samples (n=77) were analyzed. Following SEM observational analysis, the samples were stratified into 3 groups: mirror image of breast implant texture, smooth capsule and granulomatous capsule.

RESULTS: The breasts were irradiated on average 6.2 years before expander insertion. Eleven capsules (8.0% of irradiated and 11.7% of non-irradiated samples) with granulomatous ultrastructure were excluded for subsequent analyses because of the substantial ultrastructural differences with other capsules. The non-irradiated capsules were significantly more textured than the irradiated capsules (Mann-Whitney $p=0.0178$). The incidence of double capsule formation was significantly higher in non-irradiated breasts (Fischer $p=0.0321$). An increase in texturation mirroring the implant surface was observed in double capsule samples compared to single capsule cases (ANOVA $p<0.001$).

CONCLUSIONS: Radiation therapy induces profound alterations in collagenous architecture, leading to a reduction in the capacity of the breast capsule to mirror prosthesis texture. The associated decreased texturation also indicates reduced capsular adherence to the implant surface. We also observed a lower incidence of double capsule in irradiated samples, which further suggests a mechanical etiology in double capsule development.

Learning Objective:

Participants will be able to describe the differences in periprosthetic capsular ultrastructure in irradiated versus non-irradiated breasts.

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INNOVATIVE MODEL TO OPTIMIZE RESOURCE UTILIZATION AND IMPROVE ACCESS TO CARE FOR HIGH-RISK/BRCA+ BREAST CANCER PATIENTS

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Ottawa, ON

PURPOSE: Bilateral Prophylactic Mastectomy (BPM) has demonstrated survival benefit in high-risk/BRCA+ patients. However, priority of active cancers coupled with inefficient use of operating room (OR) resources presents challenges in offering BPM to patients in a timely manner. To address these challenges, a Rapid Access Prophylactic Mastectomy and Immediate Reconstruction (RAPMIR) program was innovated. The purpose of this study is to describe and evaluate this program with regards to efficiency and access to care.

METHODS: A retrospective review was performed of all high-risk/BRCA+ patients having had BPM from September 2012 to August 2014. Patients were divided into two groups: those managed through the traditional model (Group-A) and those managed through the RAPMIR model (Group-B). RAPMIR eligibility included: (i) high-risk/BRCA+, (ii) BPM with immediate reconstruction, and (iii) day-surgery candidacy. Wait times, case volumes, and billings were measured and compared.

RESULTS: RAPMIR runs two ORs concurrently with Surgical Oncology (SOnc) and Plastic Surgery (PS) alternating rooms. Once SOnc completes the first BPM, PS begins reconstruction. During reconstruction, SOnc begins the next BPM in the second OR – continuation of this pattern makes 3 BPMs possible. SOnc and PS each complete one independent case in the remaining time, for a daily total of 5 patients. There were 14 Group-A patients and 11 Group-B patients. Mean wait time (days) for Group-A was 293.6 compared with 104.2 for Group-B ($p=0.002$). Mean number of PS cases for Group-A operative days were 1.8 (billings = $2,328.61) compared with 3.7 for Group-B (billings = $3,567.85) ($p=0.001$, $p=0.031$).

CONCLUSIONS: RAPMIR had significantly shorter wait times and greater surgeon productivity. A multidisciplinary model with optimized OR-scheduling has the potential to improve access to care and optimize resource utilization.

Learning Objective:

To learn an innovative model for high-risk/BRCA+ breast cancer patients.

58
QUALITY OF LIFE AND PATIENT-REPORTED OUTCOMES IN BREAST CANCER SURVIVORS: A MULTI-CENTER COMPARISON OF FOUR ABDOMINALLY-BASED AUTOLOGOUS RECONSTRUCTION METHODS

S Macadam, T Zhong, P Lennox, D Vidal, A Hazen, A Pusic
Vancouver, BC

BACKGROUND: Of women who undergo breast reconstruction approximately 20% choose autologous reconstruction with the most common donor site being the abdomen. An increasing proportion of women are seeking muscle-sparing procedures but the benefit remains unclear. The potential benefits need to be quantified: if patients that undergo these procedures have better outcomes the longer operative times and increased costs may be justified.

METHODS: This is a multi-center, cross-sectional design. Patients were eligible if they completed reconstruction using the deep inferior epigastric artery perforator (DIEP), muscle-sparing free transverse abdominis myocutaneous (msf-TRAM), free transverse abdominis myocutaneous (f-TRAM), or pedicled transverse abdominis myocutaneous flap (p-TRAM) and were at least one year post-surgery. Patients were contacted by mail: the BREAST-Q©, a contact letter, and a gift-card were included. Demographics and complications were collected by chart review. BREAST-Q© scores were compared between responder groups.

RESULTS: 1790 charts were analyzed representing 670 DIEP, 293 msf-TRAM, 683 p-TRAM, and 144 f-TRAM patients. Average follow up time was 5.5 years. The rate of flap loss was low and did not differ by flap type. Partial flap loss and fat necrosis differed and were highest in the pTRAM ($p<0.001$). Rates of hernia/bulge and hernia/bulge requiring surgery were significantly different with p-TRAM displaying the highest rates ($p<0.001$). 943 patients responded to the BREASTQ© for a response rate of 53%. Satisfaction with outcome and physical well-being (abdomen) differed significantly with the highest scores in the DIEP group ($p<0.001$). These findings remained after controlling for age, time since surgery, BMI, laterality, and mesh.

CONCLUSION: We have shown that complication profiles and patient-reported outcomes differ by flap type when comparing the four most common abdominally-based breast reconstruction techniques. Our results favour the DIEP flap when choosing between the four studied techniques as it is associated with the highest patient-reported satisfaction as well as the lowest rate of abdominal wall morbidity.

Learning Objectives:

1. *Participants will become familiar with the differences in complications and donor site morbidity associated with the four most common abdominally-based breast reconstruction techniques.*
2. *Participants will become familiar with the differences in patient-reported outcomes between the four most common abdominally-based breast reconstruction techniques.*
3. *Participants will be able to identify the abdominally-based breast reconstruction technique with the lowest rate of complications and highest patient satisfaction.*

CANADIAN EXPERT

58A
THE FUTURE OF CLEFT LIP AND PALATE SURGERY

D Courtemanche
Vancouver, BC

This presentation will focus on cleft lip repair, cleft palate repair, secondary speech surgery and alveolar bone graft. I will review the five most referenced papers in the literature regarding the principles and outcomes of operations for these four areas of cleft operative management. I will also talk about the emerging research inpatient and parent reported outcome measures and how this should direct our attention.

Learning Objectives:

1. *Understand the principles and objectives of cleft lip repair.*
2. *Understand the principles and objectives of cleft palate repair.*
3. *Understand the principles and objectives of secondary speech surgery.*
4. *Understand the principles and objectives of alveolar bone grafting.*
5. *Understand the input of patient and parent reported outcomes in decision making in cleft surgery.*

59
THE ROLE OF AUTOPHAGY AND SENESCENCE IN THE PATHOPHYSIOLOGY OF RADIOTHERAPY-INDUCED TISSUE FIBROSIS

M El-Diwany, JP Giot, M Bernard, N Nizard, MJ Hébert, MA Danino
Montréal, QC

PURPOSE: Mammary reconstruction complication rates are four to ten times greater with radiotherapy. Autophagy and senescence of endothelial cells and fibroblasts may be central effectors of fibrosis. The objective of this study is to identify the pathophysiological mechanism of tissue fibrosis in capsular retraction of mammary reconstruction associated with radiotherapy.

METHODS: Autophagy was induced in Wi 38 lung fibroblasts through serum starvation in vitro. Senescence was induced through different irradiation doses (0.5 to 10Gy) and cells were harvested 10 days post irradiation to insure a senescent phenotype. Western blots were used to measure p62 for autophagy, p16 and p21 for senescence, and alpha smooth muscle actin (αSMA) for fibrosis. Tubulin was used as a loading control.

RESULTS: Serum starved fibroblasts exhibit a decrease in p62 consistent with autophagy. Serum starvation increased senescence markers, and induced myofibroblastic differentiation. Irradiated fibroblasts also exhibited a decrease in p62 and increased levels of p16 and p21. Fibroblasts subjected to 10Gy irradiation underwent less differentiation compared to lower does of irradiation. Increased cellular confluence induced contact inhibition with increased levels of p16 and p21 but had no effect on αSMA levels.

CONCLUSION: Serum starvation and irradiation of Wi38 fibroblasts both induce autophagy and senescence. Serum starved fibroblasts undergo myofibroblastic differentiation. This is also present in irradiated fibroblasts especially with does ranging from 2 to 8Gy. Fibroblasts subjected to 10Gy irradiation displayed less αSMAexpression possibly due to severe senescence. These results confirm the role of autophagy as an inducer of fibrosis and present senescence as a potential fibrosis inhibitor. In the future we will characterize autophagy, senescence and fibrosis in periprothetic capsules obtained from patients undergoing implant-based mammary reconstruction.

Learning Objectives:

The audience will learn the physiopathology of tissue fibrosis, the role radiotherapy in its development, and potential treatments under study.

60
PREOPERATIVE RISK FACTORS AND COMPLICATION RATES IN ABDOMINOPLASTY: ANALYSIS OF 25,478 CASES

J Winocour, V Gupta, R Ramirez, RB Shack, JC Grotting, KK Higdon
Nashville, Tennessee, USA

PURPOSE: Abdominoplasties performed in North America have steadily increased over the last decade. Among aesthetic surgery procedures, abdominoplasty has been associated with a higher complication rate, but previous studies are limited by small sample sizes or single institution experience. This study analyzed the risk factors and significant complications after abdominoplasty, alone and in combined procedures.

METHOD: A cohort of patients who underwent abdominoplasty between 2008 and 2013 was identified from the CosmetAssureTM database. Major complications were recorded. Univariate and multivariate analysis was performed looking at risk factors including age, smoking, BMI, gender, diabetes, type of surgical facility, and combined procedures.

RESULTS: 25,478 abdominoplasties were identified from 183,914 procedures in the database. 8,975 patients (35.2%) had abdominoplasty alone while 16,503 (64.8%) underwent additional procedures. 1,012 complications were recorded (4.0% overall rate vs. 1.4% in other aesthetic surgery procedures). Of these, 31.5% were hematomas, 27.2% infections, 20.2% suspected or confirmed venous thromboembolism and 7.0% pulmonary dysfunction. On multivariate analysis significant risk factors ($p<0.05$) included male gender (RR 1.8), age 55 (RR 1.4), BMI 30 (RR 1.3), multiple procedures (RR 1.5) and procedure performance in a hospital

or surgical center vs. office-based surgical suite (RR 1.6). Diabetes and smoking were not found to be significant risk factors. Combined procedures increased the risk of complication (abdominoplasty alone 3.1%, combined with liposuction 3.8%, breast procedure 4.3%, liposuction and breast procedure 4.6%, body-contouring procedure 6.8%, liposuction and body-contouring procedure 10.4%).

CONCLUSIONS: Abdominoplasty is associated with a higher complication rate compared to other aesthetic procedures. Combined procedures can significantly increase complication rates and should be considered carefully in higher risk patients.

Learning Objectives:

1. *Participants will be able to describe significant risk factors associated with major complications in abdominoplasty.*
2. *Participants will be able to describe the effect of combined cosmetic procedures on complication rates.*

61
MANUFACTURING AN INEXPENSIVE PULLULAN-BASED SKIN SUBSTITUTE FOR SKIN REGENERATION

M Nicholas, M Jeschke, S Amini-Nik
Toronto, ON

PURPOSE: Skin substitutes significantly reduce burn injury mortality and morbidity. However, current skin substitutes have numerous disadvantages related to high costs and inadequate skin regeneration. Thus, new skin substitutes are needed. We have created a novel scaffold using pullulan, an inexpensive polysaccharide, to be used as a skin substitute. This project aimed to optimize our pullulan-based scaffold to create ideal mechanical characteristics for use as a skin substitute. This project then aimed to assess the skin substitute's cell viability, proliferation, and differentiation in vitro and to demonstrate its skin regenerative properties in vivo.

METHODS: Pullulan-based scaffolds were created using a modified solvent casting/particulate leaching and freeze-drying methodology. Mechanical characteristics of the modified scaffold (SG-2) were evaluated. Human fibroblasts and keratinocytes were seeded using a multi-step protocol. Live-dead assays, BrdU proliferation assays, and confocal microscopy of cell markers were completed. The skin substitute was evaluated in vivo by grafting it onto a mouse excisional skin biopsy. Trichrome and immunohistochemical stainings were performed to analyze newly-formed skin and trace the fate of grafted cells.

RESULTS: SG-2 had significantly increased porosity with an ideal elastic modulus and swelling behavior for use as a scaffold for manufacturing skin substitutes. Significant increases in cell viability (>90%), proliferation, and keratinocyte differentiation were visualized. Trichrome staining and immunohistochemical staining of HLA revealed thicker newly-formed skin incorporated with human cells 14 days post-biopsy.

CONCLUSIONS: SG-2 provides an ideal microenvironment for cell viability, proliferation, and differentiation. In vivo evidence shows that this skin substitute contributes to skin regeneration.

Learning Objectives:

After this presentation, participants will be able to:

1. *Understand the key properties of effective skin substitutes for burn injuries.*
2. *Identify at least two challenges current skin substitutes face and potential approaches to overcoming them.*
3. *Describe the advantages of cellular skin substitutes over currently-used acellular skin substitutes.*

GENERAL POSTER SESSION

GP01
A NOVEL MAMMOPLASTY PART-TASK TRAINER FOR PLASTIC SURGERY: DESCRIPTION AND EVALUATION

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Montréal, QC

PURPOSE: Following the implementation of the New Accreditation System, the Accreditation Council for Graduate Medical Education classified simulators as most desirable tools for evaluating medical skills. Within plastic surgery training however, such simulation has not been exploited sufficiently. The purpose of this study is to develop a prototype surgical part-task trainer dedicated to train residents on mammoplasty procedures.

METHODS: The mammoplasty part-task trainer (MPT) was developed using casting and molding techniques and various materials. Each material was chosen to best mimic texture and appearance of anatomical structures of the thorax. The MPT was evaluated by four independent plastic surgeons. Participants were asked to perform an augmentation mammoplasty procedure on the MPT and then complete an evaluation form. The latter consisted of 16 items divided in 7 main domains.

RESULTS: All four surgeons completed the simulation task successfully. Based on the results of their evaluation (scale of 0–5), domains that scored the highest were 'value' as a training tool, 'relevance to practice' and 'physical attributes' with mean values of 4.5, 4.3 and 4.1, respectively. The other evaluated domains 'realism of material', 'ability to perform tasks' and 'realism of material' were scored at 3.9, 3.8 and 3.7, respectively. The observed average of 'global assessment' scored 4.3, which falls between two scaling criteria of 'having some relevance' (score 4) and having 'great deal of relevance' (score 5).

CONCLUSIONS: This preliminary work represents the creation of a novel mammoplasty part-task trainer that was highly valued by expert plastic surgeons as a training tool.

Learning Objectives:

At the end of this presentation, the learner will be able to value the need for simulators in plastic surgery and to acknowledge the development of an early training and assessment tool for augmentation mammoplasty procedure, which was highly evaluated by expert plastic surgeons.

GP02
COMPLICATIONS IN PANNICULECTOMY/ABDOMINOPLASTY – IMPLICATIONS FOR AMBULATORY CARE

K Chung, H Grant, D McKay, J Davidson
Kingston, ON

PURPOSE: Optimizing patient selection is necessary for the performance of safe ambulatory surgical procedures. Post-operative complications in patients undergoing panniculectomy/abdominoplasty were evaluated in an ambulatory care setting to identify risk factors and parameters that would define patients best suited for these procedures.

METHODS: This was an IRB-approved retrospective chart review of 128 consecutive cases between 2008-2013. Demographic data and adverse outcomes were defined, documented and compared. A number of statistical models (one-way ANOVA, Kruskal-Wallis test, Chi-squared) were applied to evaluate variables between patients who experienced major complications, minor complications and no complications. Significance was set at $p<0.05$.

RESULTS: Major complications involving a return to the OR or transfer to a regional hospital occurred in 5% (n=7) of cases.. Risk factors associated with these major complications were smoking (RR=25.1, p=0.01) and history of malignancy (RR=6.1, p=0.01). Minor complications were observed in up to 56% of patients and were associated with risk factors such as increased ASA scores (p=0.01), age (42.8 years versus 46.9; p=0.04), hypertension (RR=1.4; p=0.01) and morbid obesity (RR=1.6; p=0.01).

CONCLUSIONS: Complications in this series are comparable to those reported in the literature and reflective of the inherent morbidity of the procedure. Nonetheless there is an increased imperative to perform these procedure safely in an ambulatory setting, particularly with increased regulatory oversight of Out of Hospital Premises and reduced institutional resources to manage major complications. Patients likely to do well are young, normotensive, non-smokers who are not morbidly obese. Patients who smoke and have a history of malignancy are at significant risk for a major complication.

Learning Objectives:

Participants will be able to identify patient parameters to aid in the selection of those best suited for body contouring surgery in an ambulatory setting.

GP03

BREAST INDEPENDENCE IN BILATERAL CASES: EVALUATING STATISTICAL METHODOLOGY IN PLASTIC SURGERY BREAST RESEARCH

P Gdalevitch, P Brasher
Vancouver, BC

PURPOSE: To evaluate whether the assumption of breast independence in bilateral cases leads to increased type 1 error in current plastic surgery breast research.

METHODS: This is a retrospective review of all breast-related studies published over a two-year period (2013-2014) in the *Plastic and Reconstructive Surgery* journal. Journal articles were classified by type and level of evidence. Articles that included each breast as an independent outcome in bilateral cases were reviewed. A demonstrative article was selected for a revised statistical analysis using a within-patient correlation for bilateral outcomes and compared to the original statistical findings.

RESULTS: One hundred sixty-nine breast-related articles were identified. Level 1 evidence articles comprised 1.8% of studies, while 10.7% were level 2, 33.7% level 3, 27.2% level 4, 5.3% level 5 and 21.3% were not evidence rated. The most common type of study was a retrospective cohort design (46.7%) followed by prospective cohort (13%). Randomized controlled trials accounted for only 2.4% of studies. There were 41 articles that included each breast as an independent outcome for statistical purposes. Of these, 40 (97.6%) violated the principle of statistical independence. Only 1 study mentioned a modification to their statistical methodology to account for correlation of data in bilateral cases.

CONCLUSION: Violation of statistical independence in breast research can result in type I error and should be avoided. Data dependency within a subject for breast outcomes in bilateral cases needs to be considered. A statistical solution for within-patient correlation is presented.

Learning Objectives:

1. *The learner will be able to define statistical conditions necessary for common statistical analyses.*
2. *The learner will understand the potential biases and types of statistical error when violations of these conditions occur.*
3. *The learner will be able to identify a possible solution for statistical analysis of bilateral breast cases.*

GP04

A REVIEW OF POST-MASTECTOMY IRRADIATION IN TWO-STAGE TISSUE EXPANDER/IMPLANT IMMEDIATE BREAST RECONSTRUCTION WITH ACELLULAR DERMAL MATRIX

AL Ho, G Gao, SA Macadam, S Tyldesley, P Lennox
Vancouver, BC

PURPOSE: Acellular dermal matrix (ADM) is increasingly being used in patients undergoing immediate two-stage tissue expander/implant (TE/I) breast reconstruction with post-mastectomy radiation (PMRT) because it may decrease complication rates and mitigate radiation sequelae. The objective of this study was to compare the outcomes of irradiated immediate two-stage TE/I reconstruction with ADM to a group without ADM.

METHODS: A retrospective review of patient records undergoing immediate two-stage TE/I reconstruction between January 1998 and December 2013 was performed. Patients reconstructed with ADM and no-ADM at the time of TE placement were identified. Demographic, major complications, capsular contracture, and revision surgery of the ADM group were compared to a group without ADM.

RESULTS: 34 patients who received ADM were compared to 113 patients who did not receive ADM. Demographic and clinical characteristics between these two groups were comparable. There was no significant difference in the overall rate of complications in the ADM group (41.2%) and non-ADM group (38.9%) after controlling for age, BMI, smoking status, mastectomy weight, TE type, tumour pathology, chemotherapy status, and plastic surgeon (odds ratio 0.69 [95% CI 0.26 to 1.84]; P=0.46). There was no difference in the proportion of patients who successfully received a permanent implant. We found a decrease in capsular contracture (Grade II-IV) in the ADM group compared to the non-ADM group.

CONCLUSIONS: The outcomes of this study demonstrate that the use of ADM in the setting of immediate two-stage TE/I reconstruction with PMRT may not confer the much anticipated benefits. Nevertheless, ADM may lead to an improvement in clinically significant capsular contracture that warrants further study.

Learning Objectives:

1. *To learn about the advantages of using acellular dermal matrix in the setting of two-stage TE/implant breast reconstruction.*
2. *To learn about the complication profile in irradiated two-stage TE/implant breast reconstruction patients who receive acellular dermal matrix as part of their treatment.*

GP05

FIRST NATIONS WOMEN RECEPTIVE TO BREAST RECONSTRUCTION SURGERY

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Calgary, AB

PURPOSE: Published guidelines state all women who face mastectomy should receive breast reconstruction (BR) consultation if desired, yet consistent referral for BR consultation is lacking. With regards to First Nations (FN) women, research identifies effects of colonization, racism, family abandonment and addictions as having a detrimental impact on their breast cancer care. This qualitative study explored perceptions, and/or barriers encountered by FN women deciding to pursue BR.

METHOD: This study utilized one-on-one semi-structured interviews and a sharing circle. Recruitment involved purposeful and snowball sampling via Aboriginal health and community organizations, breast and plastic surgeons, an Aboriginal health liaison and a FN elder. Transcripts were subjected to thematic analysis.

RESULTS: Nine semi-structured interviews were conducted. Four (45%) of the women were offered and pursued BR. Five (55%) were not offered BR and of these two stated no interest in BR. The higher than Alberta average rate of BR represented is likely due to the purposeful sampling. All informants reported that accessible, appropriate and timely breast reconstruction information was lacking. Living on reserves exacerbated lack of access to health services. Although the informants acknowledged their own and their community's fear of cancer and uncertainty regarding Western medicine, cultural beliefs did not influence their perceptions of or decision to pursue BR. The study concluded with a sharing circle that corroborated themes identified in the interviews.

CONCLUSION: This study confirmed existing research that health care providers do not consistently offer all women BR. When offered, FN women are receptive to pursuing BR.

Learning Objectives:

Understand importance of providing the option of breast reconstruction to all women that have had breast cancer surgery regardless of their cultural background.

GP06

COMPUTER-GENERATED MATHEMATICAL MODELS FOR PREOPERATIVE DESIGN AND DIMENSION PLANNING

NA Gaid, M Tenenhaus, HO Rennekampff, J Hall, K Walsh, P Smith
San Diego, California, USA

PURPOSE: Rotation flaps are among the most common and useful procedures in the armamentarium of the reconstructive surgeon by mobilizing large areas of tissue around a rotation point. Critical design and dimension planning ensure appropriate vascularity while minimizing donor morbidity. Preoperative assessments can be challenging given inherent wound site limitations, anatomical constraints and surgical experience. To mitigate inherent risks and optimize precision planning, we propose a computer-generated mathematical model for the preoperative planning and surgical design of wound closure.

METHOD: Homotopic techniques were used to develop a mathematical model of rotation flap procedures, designed to measure skin displacement using various incision lengths and angles. Slider bars allow surgeons to configure the demonstration reflecting wound characteristics, dimensions as well as incision length and angle. The 'perform the procedure' bar slides to visualize how the parameters affect skin displacement. Ahuja's modified

rotation flap was objectively compared to a proposed flap modification evaluating how various lengths and angles affect skin displacement using MATLAB implementation.

RESULTS: When compared to standard procedure, maximum and average displacements with a one-inch incision increment at all 30, 50 and 60-degree angles were lower for the proposed Arrowhead method. Furthermore, the modified flap resulted in a percentage reduction in total displacement of 27.08%, 36.71% and 38.63% at 30-, 50- and 60-degree angles, respectively.

CONCLUSIONS: Computer-based tools can enable surgeons to individualize their surgical plans based on individual patient wound characteristics. Based on ongoing evolution efforts, we anticipate that these modalities will enable surgeons to gain a visual representation of patient-specific characteristics and limitations that influence flap design, thereby minimizing operative time and complications while facilitating surgical success and optimizing patient health outcomes.

Learning Objectives:

1. *Improve preoperative design and dimension planning of surgical procedures*
2. *Facilitate resident education.*
3. *Provide a tool to optimize surgical success and health outcomes.*

GP07

MINIMALLY INVASIVE CUBITAL RELEASE: TECHNIQUE AND OUTCOMES

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Vancouver, BC

PURPOSE: Although there are several methods of treating cubital tunnel, systematic reviews have shown no superiority between these. The purpose of this study was to (1) describe a minimally invasive cubital tunnel release and (2) report the outcomes.

METHOD: We used photographs and video to demonstrate a minimally invasive cubital tunnel release. Demographics and outcomes collected included: type of anesthetic, use of a tourniquet, presence anomalous musculature, surgical time, post-operative pain, return to work, resolution of symptoms and complications.

RESULTS: Videography and slides demonstrate the use of local anesthetic with epinephrine, specialized patient position, and a small curved retractor allow for a complete cubital tunnel release through a 1-3 cm incision. Data was collected on thirty patients, two of whom underwent bilateral cubital tunnel release at a single sitting. The majority of patients underwent surgery under local anesthetic without the use of a tourniquet. The average surgical time was 12 minutes, the average time to return to work was 7 days, more than 90% of patients had resolution of their symptoms.

CONCLUSION: Minimally invasive cubital tunnel release can be performed under local anesthesia without the use of a tourniquet. Studies confirm there is no superiority between the various methods used to treat cubital tunnel. However, large operations may be associated with greater risks and longer recovery periods. The procedure presented here is well tolerated even when performed bilaterally. It can safely be done under local anesthetic. Finally, the recovery period may be much shorter than traditional cubital tunnel release procedures.

Learning Objectives:

Participants will learn how to perform a minimally invasive cubital tunnel release. In addition, they will be made aware of the advantages and disadvantages of the procedure.

GP08

PATIENT-REPORTED OUTCOME MEASURES IN ADULTS WITH TRAUMATIC HAND INJURY: A SYSTEMATIC REVIEW

DA Waltho, ME Gedye, MN Kaur, A Thoma
Toronto, ON

PURPOSE: Hand-related injuries are common. Several measures may be used for clinical assessment of these injuries. The purpose of this study was to identify patient-reported outcome measures (PROMs) germane to traumatic hand injury, and to synthesise evidence on their respective psychometric properties.

METHOD: A systematic review was performed using a standard search strategy on publications from January, 1990 to May, 2013 from MEDLINE, CINAHL, Cochrane Library, Pubmed Clinical Queries, Scopus and Web of Science. Data extraction, critical appraisal, and synthesis was conducted therein.

RESULTS: In total, 52 outcome measures applied to patients with traumatic hand injury were identified. Disability of the Arm, Shoulder and Hand (DASH) Questionnaire was the most frequently used in this population. 5 of the 52 outcome measures have been validated thus far. Of these, Cold Intolerance Symptom Severity questionnaire, Cold Sensitivity Severity questionnaire, Patient Work Exposure Scale, DASH and Michigan Hand Questionnaire (MHQ) have been validated in patients with traumatic hand injury. Of these validated outcome measures, the MHQ appears to have the strongest evidence for validity, reliability and responsiveness (Spearman's coefficient = 0.81–0.97, Cronbach's alpha = 0.86–0.97, effect size=0.84). However, no questionnaire appears to address all constructs needed to sufficiently assess patients with hand trauma, including pain, disability and psychosocial issues, both in the acute and chronic setting.

CONCLUSIONS: Further studies are required to assess PROMs specific to traumatic hand injury; it is apparent that none of the available outcome measures adequately addresses all factors related to these injuries. In particular, attention to important psychosocial factors in hand trauma is indicated moving forward.

Learning Objectives:

After this presentation, the audience should recognise paucities in knowledge with respect to PROMs for hand trauma, how these gaps might influence clinical practice, and the need for further research. The audience should identify current validated measures and their clinical application in hand trauma.

GP09

BLOOD LOSS AND PERIOPERATIVE FLUID MANAGEMENT IN CRANIOSYNOSTOSIS SURGERY

R Skocylas, M Bucevska, M Cassidy, D Courtemanche
Vancouver, BC

PURPOSE: To identify individual patient and perioperative factors that influence blood loss in craniosynostosis surgery.

METHODS: A retrospective chart review of all patients undergoing surgery for primary craniosynostosis between the period of May 2004-April 2014 at BC Children's Hospital was performed. Demographic and perioperative data from hospital charts and electronic records were collected and analyzed.

RESULTS: A total of 57 eligible patients were identified, of which 24 (42%) required a blood transfusion. No significant differences in the age, weight, sex or preoperative hemoglobin were found between the transfused versus non-transfused group. Patients receiving a transfusion experienced greater drops in hemoglobin during the first 2 hours of surgery, corresponding to the time where there is greatest risk of blood loss. Highest transfusion rates were found in patients undergoing correction of multisuture synostosis, followed by metopic, bicoronal and unicoronal synostosis. Use of antifibrinolytic drug tranexamic acid was not found to reduce transfusion rates or the amount of packed red blood cells required.

CONCLUSIONS: Transfusion rates did not appear to be influenced by individual patient factors; they were however correlated with the affected suture. This suggests that surgical technique and the operation itself are likely playing a significant role in influencing blood loss. Overall transfusion rates and volume of packed red blood cells transfused were found to be lower than what has been reported by other centers. This is suspected to be due to both an acceptance of lower postoperative hemoglobin levels as well as the use of a dedicated team to perform all craniosynostosis corrections. The lack of efficacy of tranexamic acid is likely due to variability in administration protocols. This suggests a potential for transfusion rates to be reduced if formal guidelines for its use are established.

Learning Objectives:

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

1. *Identify factors that influence blood loss in craniosynostosis surgery.*
2. *Understand ways that blood transfusion rates in craniosynostosis surgery can be reduced.*

GP10

SPONTANEOUSLY RESOLVED MACROCYSTIC LYMPHATIC MALFORMATIONS

M Phang, M Bucevska, C Malic, DJ Courtemanche, J Arneja
Vancouver, BC

PURPOSE: Lymphatic malformations are benign, low-flow vascular malformations that typically present at or near birth. Due to morbidity associated with operative treatment, non-operative treatment with injection of sclerosant has become the mainstay of therapy. Over the past 15 years, several patients at our centre with macrocystic (>2 cm cyst size) lymphatic malformations have seen their lesions resolve spontaneously whilst awaiting treatment. Herein we review features of these patients that may contribute to spontaneous resolution.

METHOD: A retrospective chart review was conducted from our Vascular Anomalies Clinic database (1999-2014) of all macrocystic lymphatic malformations; characteristics of patients with spontaneous resolution were reviewed.

RESULTS: Of 61 patients with macrocystic lymphatic malformations, seven cases (11.5%; four female, three male) resolved spontaneously. Median age at malformation appearance was 2 years (range 0 – 6.5 years), with median age at resolution at 4 years (range 10 months – 7 years). Median time from appearance to resolution was 24 months (range 3 – 43 months). All but one case was associated with local or upper respiratory tract infection antecedent to resolution. Six of seven lesions were located in the neck.

CONCLUSION: This series revealed a theme of upper respiratory tract/local infection antecedent to spontaneous resolution of macrocystic lymphatic malformation. Furthermore, the proportion of neck lesions was higher in this series versus literature, suggesting that neck lesions may have greater likelihood of spontaneous resolution - perhaps due to proximity to upper respiratory tract infection. It may be reasonable to observe these lesions up to 24 months before treatment if the lesion does not impair function and disfigurement is not considerable, particularly if the lesion is located in the neck.

Learning Objectives:

The findings of this study will help clinicians recognize cases where possibility of spontaneous resolution exists, and will help guide their recommendations to patients.

GP11

INVESTIGATION OF THE ANTIPLATELET AGENT TICAGRELOR AS A TREATMENT FOR BREAST CANCER METASTASIS

C Brien, S Gebremeskel, B Johnston, M Bezuhly
Halifax, NS

PURPOSE: Current evidence shows that platelets support tumour metastasis. Within the circulatory system, platelets guard tumour cells from immune elimination and promote their arrest at the endothelium, supporting the establishment of secondary lesions. Ticagrelor, currently in use for prevention of further thrombotic events following acute coronary syndrome and ischaemic stroke, is a novel P2Y12 antagonist that restricts the propagation of activated platelets.

METHOD: Here we propose the use of ticagrelor as a means to inhibit breast cancer metastasis in the 4T1 murine breast tumour resection and experimental metastasis model. As well, platelet interactions with breast cancer cells will be examined in the presence of ticagrelor.

RESULTS: Compared to control, ticagrelor significantly ($p<0.001$) reduces 4T1 colony forming units in the lungs of mice. Also, ticagrelor results in a significant ($p<0.01$) increase in overall survival of mice in a 4T1 breast tumour resection model.

CONCLUSIONS: Ticagrelor is an antiplatelet agent that demonstrates a promising role as a treatment for metastatic breast cancer in mice, which has potential to translate clinically.

Learning Objectives:

The objectives are to demonstrate that platelets play an important role in breast cancer metastasis; that ticagrelor can serve to reduce experimental breast cancer metastasis in an orthotopic mouse model; and given that ticagrelor is currently in clinical use, it serves as a good candidate for clinical trials in human breast cancer patients.

GP12

IS IT SAFE TO RE-ACCESS SODIUM BICARBONATE BOTTLES FOR USE IN MINOR SURGERY?

L Bjornson, M Bucevska, P Tilley, C Verchere
Kingston, ON

PURPOSE: Sodium bicarbonate ($NaHCO_3$) is a common alkalizing agent added to lidocaine at 1mL:10mL in order to reduce pain upon injection. In Canada, it is currently only available in vials that exceed 100-fold the volume of a single injection. These vials are for single-use only and disposed of after one needle access; this produces significant waste. Some surgeons re-use $NaHCO_3$ vials to reduce waste. The purpose of this study was to review the safety of $NaHCO_3$ and to assess alternatives to current practice.

METHOD: Strains of *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa* and *Burkholderia cepacia* were used to assess bacterial growth in 50 mL single-dose vials of 8.4% $NaHCO_3$ (Hospira, Inc Montreal, Canada). Each pathogen was inoculated into a 50 mL single-dose $NaHCO_3$ vial for 14 days at room temperature; sampled at 0 hours, 4 hours, 24 hours, 48 hours, 4 days, 7 days, and 14 days; and plated in triplicate. After incubation, colony counts for each time point were averaged and plotted onto a logarithmic graph.

RESULTS: The colony counts of *S. epidermidis* and *P. aeruginosa* fell below the threshold of observation after 7 days of exposure to $NaHCO_3$. *S. aureus* counts increased initially but also fell below the threshold by day 7. Those of *B. cepacia* fell below the threshold by day 4.

CONCLUSIONS: Although all bacterial strains were reduced by day 7, it is clear that bacteria can survive in $NaHCO_3$ vials for several days; there is risk of transmission during that time. Therefore, $NaHCO_3$ should continue to be treated as a single-dose vial, as indicated by the manufacturers. Surgeons can use $NaHCO_3$ more efficiently to decrease the wastefulness in different ways. The preferred option is pre-alkalization of lidocaine by the hospital pharmacy.

Learning Objective:

Participants will understand safe surgical practices.

RESIDENTS POSTER COMPETITION

RP01

FREE DIEP AFTER ABDOMINAL LIPOSUCTION: RECONSIDERING A CONTRAINDICATION

J Kanevsky, P Mankowski, T Zadeh
Montréal, QC

INTRODUCTION: Autologous breast reconstruction with perforators has been previously avoided in tissues that have undergone liposuction. We present a case series and literature review of breast reconstruction with a deep inferior epigastric perforator (DIEP) flap after abdominal wall liposuction.

METHODS: A Medline search was performed for all relevant articles describing the breast reconstruction with DIEP flap technique following abdominal wall liposuction. This study includes all published data on the topic from 1965 to December 2014 using the PubMed database of the National Center for Biotechnology Information, National Library of Medicine (Bethesda, Md). All articles were reviewed for reports of clinical cases, complications, age, liposuction amount, time since liposuction and number of perforators. We have also presented 2 patients who underwent a DIEP procedure with a previous history of liposuction.

RESULTS: Eight cases of autologous breast reconstruction using DIEP flap after liposuction were identified in the literature review. The preoperative and post-operative course was uneventful in all cases except one patient who had a mild cellulitis that resolved with appropriate therapy without flap compromise. The average age was 52.2±6.1 years old, one perforator was used in all cases except one where two were used. The average amount of liposuction was 1,084 mL. No major complications were reported.

CONCLUSION: Previous liposuction is not an absolute contraindication for free-flap breast reconstruction. Pre-operative management should include evaluation of suitable perforators by duplex ultrasound or CT angiography.

Learning Objectives:

1. *Participants will be able to critique the DIEP flap harvest contraindication in the context of prior abdominal liposuction.*

2. *Participants will develop an appreciation of the risks associated with DIEP harvesting after previous abdominal liposuction.*
3. *Participants will be able to list current preoperative evaluation techniques for DIEP flap harvest in post liposuction patients.*

RP02
BLINDNESS AS A CONSEQUENCE OF BURN FLUID OVERRESUSCITATION

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PURPOSE: Post-burn fluid overresuscitation results in adverse sequelae including orbital compartment syndrome (OCS). OCS occurs when an acute rise in intraorbital pressure causes tissue ischemia. Left untreated even for as little as 100 minutes, OCS may cause permanent blindness. At many centers, no guidelines exist for routine intraocular pressure measurements in high-risk patients. We present a case of blindness following a 65% total-body-surface-area (TBSA) burn. This report adds to an existing body of evidence calling for judicious use of intravenous fluids.

METHODS: This is a retrospective review of a single case treated at the University of Alberta burn centre. The chart was reviewed for intravenous fluid volume input, urinary output and positioning during surgery within the first 96 hours post-burn. Values obtained were compared to those predicted by the Parkland's formula. Informed consent was obtained. Literature was reviewed for "orbital compartment syndrome".

RESULTS: 41L (144 % predicted) of crystalloids were administered within the first 24 hours with an average urinary output of 0.83 mL/kg/hr (151-252% predicted). The fluid balance was +38474, +50617, +54056, and +61774 at 24, 48, 72, and 96 hours post-burn, respectively. The patient recalls having normal vision immediately post injury with onset of complete blindness at the 72-96 hour mark. At no point were intraocular pressure measurements taken. There has been no recovery at 12-month follow-up.

CONCLUSIONS: Blindness is a documented consequence of fluid overresuscitation. Fluid volume should be cautiously titrated to prevent negative sequelae of not only underresuscitation but also its excess. With no existing guidelines in place to prevent orbital compartment syndrome, there is pressing need for re-evaluation of current practice.

Learning Objectives:

Audience will identify high-risk patients for OCS and recognize the need for early diagnosis and treatment.

RP03
DOES CHOICE OF PEDICLE INFLUENCE RESULTANT NIPPLE SENSATION IN REDUCTION MAMMAPLASTY? A SYSTEMATIC REVIEW AND META-ANALYSIS.

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PURPOSE: Many authors have claimed that use of one pedicle or another tends to preserve sensation to the nipple areolar complex (NAC) following reduction mammaplasty. This systematic review and meta-analysis summarizes the evidence in the plastic surgery literature with respect to preservation of sensation of the NAC following reduction mammaplasty with various pedicles.

METHODS: A literature search was performed via EMBASE, Medline and the Cochrane Central Register of Controlled Trials databases. Only comparative studies of different pedicle techniques which reported on post-operative nipple sensation were selected. A meta-analysis of the comparative studies was performed using both fixed and random effects models to report a pooled effect estimate from weighted odds ratio calculations. Heterogeneity among studies was quantified using the I2 method.

RESULTS: Our initial search yielded 330 search results. Of these, 18 comparative studies were found. These 18 studies were narrowed down to 8, which were of sufficient quality for inclusion in the meta-analysis. When a fixed effects model was used there was less loss of nipple sensation with inferior (vs. superior) pedicles (p=0.02), and for inferior pedicles vs. all other pedicles (p=0.006). When a random effects model was used to take into account the heterogeneity between the studies there was no difference found between any pedicle technique.

CONCLUSIONS: When comparative studies in the literature are analyzed it is apparent that there is a large degree of heterogeneity with regards to outcomes for nipple sensation following reduction mammaplasty. When this heterogeneity is taken into account there is no demonstrable difference in outcomes for post-operative nipple sensation using different pedicle techniques.

Learning Objectives:

1. *The attendee will appreciate the different pedicle techniques used in breast reduction surgery.*
2. *The attendee will appreciate the data available in our literature regarding NAC sensation outcomes after reduction mammaplasty.*

RP04
BEYOND THE BRUNER: THE VOLAR OBLIQUE INCISION FOR HAND SURGERY

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BACKGROUND: The surgical approach to the volar structures in the digits must be designed to provide adequate exposure of tendons, vessels, and nerves but also in a way that prevents flexion contracture of the digit as the scar contracts. This is traditionally done using a zig-zag "Bruner" incision, first described by Dr Julian M. Bruner in 1967. In this paper, we describe an alternative approach, the Volar Oblique incision, and present a single institutional prospective cohort of patients who have undergone procedures beginning with this approach.

METHODS: A prospective cohort study was performed on eight cases that involved a Bruner incision and eight similar cases that involved a volar oblique incision. Patients were asked to return to clinic post-operatively for scar assessment using the Patient and Observer Scar Assessment Scale (POSAS). While in clinic, standard joint measurements were taken to assess for any proximal interphalangeal (PIP) joint contracture.

RESULTS: The average POSAS observer score was significantly higher in the volar oblique group compared to the Bruner group ($p<0.05$). A trend toward significance was seen in POSAS patient scores ($p>0.1$). No significant differences were seen in flexion contracture between the two groups ($p>0.1$).

CONCLUSIONS: The volar oblique incision appears to be satisfactory alternative to the classic Bruner incision in hand surgery that requires volar exposure of the digits. Future studies are needed to assess the validity of these findings on a larger scale.

Learning Objectives:

1. *Identify alternative approaches to expose the volar surface of the hand.*
2. *Evaluate the effectiveness of the volar oblique incision in hand surgery.*

RP05
VARIATIONS IN THE ANATOMICAL STRUCTURES OF GUYON'S CANAL

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PURPOSE: Several anatomical variations of structures related to Guyon's canal have been reported in the literature. A thorough knowledge of the normal contents of Guyon's canal is essential during surgery and exploration. This allows the surgeon to avoid potential complications and ensure optimum surgical planning. The aim of this paper is to review the recognized anatomical variations within and around Guyon's canal.

METHODS: This study is a narrative review in which relevant papers, clinical and anatomical studies, were selected by searching the electronic database of PubMed. Relevant articles published from the year 1861 up to 2014 were reviewed. Extensive manual review of references of the included studies was performed.

RESULTS: This study identified several variations in the anatomical structures of Guyon's canal reported in the literature. Variations of the ulnar nerve involved its course, branching pattern, deep motor branch, superficial sensory branch, dorsal cutaneous branch and the communication with the median nerve. Ulnar artery variations involved its course, branching pattern, the superficial ulnar artery and the dorsal perforating artery. Aberrant muscles crossing Guyon's canal were found to originate from either the

antebrachial fascia, flexor carpi radialis, flexor carpi ulnaris, or palmaris longus; these muscles may insert into the common origin of the flexor digiti minimi and abductor digiti minimi muscles or blend with one or more of the hypothenar muscles.

CONCLUSION: Several variations in the anatomical structures of Guyon's canal have been described in the literature. Taking these variations into consideration may prevent inaccurate clinical interpretation and allows for better surgical planning.

Learning Objectives:

Reviewing the normal anatomy of Guyon's canal and recognizing the anatomical variations affecting the course and branches of the ulnar nerve and artery, in addition to the muscles of the same region.

RP06

CANADIAN POSTOPERATIVE DEPENDENCY PROTOCOLS FOLLOWING LOWER-LIMB MICROVASCULAR RECONSTRUCTION: A NATIONAL SURVEY AND LITERATURE REVIEW

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PURPOSE: Microsurgical free tissue transfer for reconstruction of lower-limb defects present unique challenges in the post-operative period when compared with other body regions. Management of flap oedema, venous congestion, ischemic conditioning, and patient mobilization are critical for flap survival. Unfortunately, there is little evidence to guide post-operative protocols. Many surgeons employ specific post-operative dependency or "dangle" protocols, but there is no consensus. The goal of this study was to describe current trends for post-operative dependency protocols by surveying Canadian microsurgeons.

METHODS: Plastic surgeons currently performing lower-limb microvascular reconstruction at FRCSC approved teaching institutions were administered a 17 question survey electronically. Data was collected and analysed anonymously. In addition, a systematic literature review was conducted to identify all articles describing published protocols and consenus opinions in other jurisdictions.

RESULTS: Preliminary responses suggest that there is no consensus for post-operative dependency protocols. Each surgeon respondent employs a different technique, but there are some similarities: Dependency was initiated between post-operative days 3-7 (MEAN 5.6) for intervals of 5-15 minutes; post-operative flap monitoring was continued an average of 5 days (RANGE 3-9). Respondents were divided equally on dependency wrapping and the mean length of hospital stay was 10.6 days (RANGE 6-15). There was no consistency for interval frequency, progression, or initiation of weight-bearing. Despite these variations, flap success rates are consistently 90-100%.

CONCLUSION: While flap success rates across the country are similar, there appears to be no consensus for post-operative dependency protocols amongst Canadian microsurgeons. Given limited resources and restricted budgets, further prospective randomised controlled trials are warranted to evaluate early aggressive dependency protocols in order to reduce length of stay and costs.

Learning Objectives:

1. *Participants will understand the current role and variations in dependency protocols.*
2. *Participants will understand the limited scientific data currently available to support dependency protocols.*

RP07

MOBILE PHONE BASED MINI-SPECTROMETER FOR RAPID DETECTION OF CUTANEOUS LESIONS

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PURPOSE: Various cutaneous lesions are clinically indistinguishable from one another and present a diagnostic dilemma to the plastic surgeon. The decision to biopsy may expose patients to unnecessary risks of scarring and infection and diagnostic results may take up to 6 weeks to obtain. Currently, early diagnosis of cutaneous lesions including malignancies largely depends on visual cues and may be aided by dermatoscopy. Light-induced autofluorescence spectroscopy is a very attractive tool for early diagnosis of skin cancer due to its high sensitivity, non-invasive and easy-to-use rapid technique.

METHOD: We demonstrate a cost-effective and highly sensitive mobile phone based fluorescence spectrometer that has potential to detect various cutaneous lesions in a rapid, non-invasive manner. Resolutions of about 10 nm can be achieved. Data collection and analysis is simplified using the built in audio/video interfaces and logical control on the smart phone. Furthermore, by utilizing an external sensor, the mobile phone camera can be used in conjunction with spectral measurements.

RESULTS: UV excitation of the skin results in a unique emission spectrum represented as a specific graphic waveform. These spectral properties are related to the biochemical content, pigmentation, and morphology of the tissue. Our preliminary results show strong emission spectra in response to normal skin tissue. Prior studies show significant differences between normal and abnormal skin fluorescence spectra. We hope to reproduce these prior results with our mobile unit.

CONCLUSIONS: Incorporating the utility of a standard dermatoscope, the additional spectroscopy feature shows promise for improved diagnostic accuracy in ambiguous cases and earlier detection of lesions.

Learning Objectives:

1. *Participants will be able to identify ambiguous skin lesions as an opportunity for additional diagnostic support.*
2. *Participants will be able to describe how the use of autofluorescence spectroscopy can be used as a tool for early diagnosis of skin cancer and other cutaneous lesions.*

RP08

A SYSTEMATIC REVIEW OF THE EFFECTIVENESS OF TONGUE LIP ADHESION IN IMPROVING AIRWAY OBSTRUCTION IN CHILDREN WITH PIERRE ROBIN SEQUENCE

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BACKGROUND: Tongue Lip Adhesion (TLA) involves surgically tethering the tongue forward to the lower lip and is described as a technique to relieve airway obstruction caused by glossoptosis or retrognathia.

METHOD: A comprehensive literature review was performed. Inclusion criteria were studies involving patients with PRS who underwent tongue lip adhesion as a treatment. Exclusion criteria were studies that included patients who received other procedures or those that excluded airway outcome measures.

RESULTS: 12 studies met the inclusion criteria, resulting in 213 patients with craniofacial malformations involving the PRS who underwent TLA. Mean age at the time of the procedure was 31 days. The most common diagnoses were isolated PRS (69.4%), Stickler syndrome (12.2%), and other syndromic forms of PRS (18.4%). In 77% of cases, TLA was found to be successful in the treatment of airway obstruction as demonstrated by either complete resolution of airway symptoms or no further requirement for airway interventions. 20.7% of patients had some form of persistent obstruction and 9.9% required further airway intervention. A 14.6% overall complication rate was noted. The mean time of follow-up was 4.7 years. Syndromic patients experienced lower success rates (76.7%) than patients with isolated PRS (85%).

CONCLUSIONS: The present study represents the first systematic review of the effectiveness of TLA for airway obstruction in PRS using airway measures. The results build on existing data and confirm that the success rate of TLA is higher in non-syndromic patients (85%) than in syndromic patients (76%). TLA is an effective procedure in properly selected patients with fewer complications than other treatment modalities. It should be considered for first line treatment in non-syndromic PRS patients with mild/moderate airway obstruction.

Learning Objective:

The learner will be able to describe the effectiveness of tongue lip adhesion for the treatment of airway obstruction in children with PRS.

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

Abstracts presented at the 35th Annual Meeting / 35e Réunion annuelle

Dr Sheina Macadam: President / Présidente
Dr Edward W Buchel: Secretary / Secrétaire

01
EYE-TRACKING – A NEW OBJECTIVE TOOL IN DESCRIBING MICROSURGICAL EXPERIENCE

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PURPOSE: The shift towards competency based microsurgical education calls for increased frequency of skill assessment. Current forms of assessment include surgical checklist or structured scoring systems which lack support from psychomotor evidence. Moreover, they require a large time commitment for staff surgeons. Research in laparoscopic surgery shows the potential of eye metrics as an objective and automated assessment of surgical skills. Our study is the first description of gaze pattern analysis showing differences in novices and trained residents in a dynamic microsurgical environment.

METHODS: Five medical clerks and five residents in plastic surgery, whom have completed the microsurgical training course at the University of Alberta, were recruited to observe a video of vessel dissection and anastomosis performed by an expert microsurgeon. Eye gaze data was collected while participants watched the video using a Tobii X2-60TM eye-tracker. Eye gaze pattern metrics were calculated and compared using a Student's t-test.

RESULTS: Medical students showed a significant (p=0.040) lower overall gaze overlap of 20.06% (95% CI 9.07 to 32.13%) compared to residents, 44.65% (95% CI 21.12 to 68.18%). During vessel inspection, in which adventia was caught by an adjacent suture, residents displayed a higher total fixation duration (3.415 vs 0.753 seconds; p=0.042).

CONCLUSION: Residents with experience in microsurgery display more consistent gaze patterns and high visual attention. There is a measurable change in search patterns that develop following training in microsurgery. This is the first study to show eye gaze pattern differences in a microsurgical environment and opens a new area of investigation for objective measurements of microsurgical experience.

Learning Objectives:
Participants will be able to describe the:
1. *Current tools for microsurgical assessment.*
2. *Importance of psychomotor evidence in surgical skill assessment.*
3. *Novel use of eye tracking technology in microsurgical education.*

02
OPERATIVE TIME AND VENOUS COMPLICATIONS WITH ANASTOMOTIC COUPLING DEVICE VERSUS HAND-SEWN ANASTOMOSES: A COHORT STUDY

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PURPOSE: The objective was to analyze operative time and venous complications in free flaps with venous anastomoses performed with an anastomotic coupling device (ACD) versus hand-sewn. ACDs have gained broad acceptance. However, no cohort study has reported operative times, included consecutive patients, or used a matched comparison group. Previous studies were potentially biased; they were completed by specialized centres, with careful selection of vessels to perform ACD anastomoses.

METHODS: This is a retrospective cohort study. Consecutive free flaps were reviewed; outcomes for hand-sewn veins (2007-2010) were compared to ACD (2010-2013). Cases were matched for reconstruction type: breast, head and neck, lower extremity trauma, and extremity tumour. Re-explorations and complications were abstracted for all flaps in duplicate using a standardized form, and criteria defined a priori. Operative times for ACD versus hand-sewn were compared for matched unilateral DIEP breast reconstruction.

RESULTS: Overall, 291 free flaps were included; 145 ACD and 146 hand-sewn venous anastomoses. Among all flaps, there was no difference in re-exploration for venous congestion (4% vs 7%, p=0.32), or overall re-exploration (7% vs 10%; p=0.43). There was no difference in venous thrombosis (1% vs 3%, p=0.21); all thromboses were salvaged. One flap in each group was re-explored for a vein mechanical 'kink'; both were salvaged. Among unilateral DIEPs, ACD operative times were significantly shorter (383 vs 448 minutes; p=0.01).

CONCLUSIONS: Compared to hand-sewn veins, using an ACD significantly shortens operative time for unilateral DIEP in matched cases. No difference in overall flap, or specific venous complications was found. This study addresses a gap in the ACD literature, with the first comparison of operative times, a consecutive sample, and a matched comparison group.

Learning Objectives:
1. *Participants will recognize sources of bias in cohort studies and case series.*
2. *Participants will identify advantages of ACD use in free flap reconstruction.*

03
ECONOMICS OF THE MICROVASCULAR ANASTOMOTIC COUPLER

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PURPOSE: Compared with hand-sewn anastomoses, microvascular anastomotic coupling devices (MACD) provide equivalent flap survival and reduced operative time. To date, an economic analysis of MACDs has not been reported. The objective of this study was to evaluate the economics of a venous anastomosis performed using a coupling device compared with a hand-sewn anastomosis.

METHODS: Economics were modeled for a single free tissue transfer requiring one venous anastomosis performed with either hand-sewn sutures or with the GEM Microvascular Anastomotic Coupler System (Synovis Micro Companies Alliance Incorporated). The economic variables analyzed included: (i) disposable costs, (ii) capital expenditure of the device, and (iii) fixed and variable operating room (OR) costs. Price lists were retrieved from suppliers to quantify disposable costs and capital expenditures. Fixed and variable OR costs were identified using activity-based cost analysis. The reported reduction in operative time with coupler-assisted anastomoses and the reported microsurgical OR costs were determined through comprehensive literature reviews.

RESULTS: Compared with hand-sewn sutures, use of a MACD increased disposable costs by C$199.12 for each venous anastomosis (cost of coupler ring less cost of unused suture). The inflation-adjusted variable and fixed costs of OR time (includes labor, supplies, overhead; excludes physicians fees) was C$33.61 per minute. Coupler-assisted anastomosis reduced operating time by 18 minutes, which decreased OR costs by C$566.29. The total savings for each coupler-assisted anastomosis was C$367.17; savings generated from each anastomosis payback the device's capital expenditure after 9 uses.

CONCLUSIONS: Compared with hand-sewn venous anastomosis, a MACD produces savings with each case and quickly recoups the device's capital expenditure – if the MACD is used greater than 9 times over its lifespan, the device provides economic benefit to the institution.

Learning Objective:
Identify the economic benefits of anastomosis performed using a MACD compared with hand-sewn sutures.

04
THE POPLITEAL ARTERY PERFORATOR FLAP: THREE-DIMENSIONAL PERFORATOR ANALYSIS & VASCULAR TERRITORY MAPPING

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PURPOSE: The "popliteo-posterior thigh" fasciocutaneous flap, based on a perforator of the Popliteal Artery (PA), was first described for the reconstruction of knee defects and amputation stumps in the 1980s. This pedicled flap is based on an axial network of perforating vessels directly from the PA or Profunda Femoris Artery (PFA); however, to date there has been no accurate anatomical study of the perforator distribution and vascular territory.

METHOD: Eight cadavers were injected with a modified lead oxide/gelatin mixture. Two cadavers were selected for three-dimensional reconstruction using contrast-enhanced spiral CT angiography. We combined 3D digital imaging and angiography, to produce a digitized model of the posterior thigh to determine the anatomical relationships of perforators in each zone. Dissection and photography of each layer was performed to outline the course of the popliteal perforators. The area of the vascular territory supplied by each source vessel was calculated. Surface areas were measured using Scion Image software.

RESULTS: In all 15 limbs studied, the PA provides several consistent perforators that ascend from the popliteal fossa and anastomose with PFA perforators in the midline posterior thigh. In this study (n=15), the PA supplies approximately 7% of the thigh integument (average 99±27 cm^2) with 8±3 perforators. The average diameter for these perforators is 1±0.7 mm and the average pedicle length is 83±33 mm.

CONCLUSIONS: Perforators directly from the PA supply a substantial cutaneous territory on the distal aspect of the midline posterior thigh. This is the first study to accurately characterize this region and provides additional useful information for planning and designing distally-based posterior thigh perforator flaps for reconstruction around the knee.

Learning Objectives:

1. *Participants will be able to visualize the anatomical relationship of PA and PFA perforators in the posterior thigh.*
2. *Participants will be able to plan and design a distally-based posterior thigh flap.*

05
THE "CUTANEOUS UPPER THIGH" FREE FLAP: A NEW DIRECT CUTANEOUS FREE FLAP

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PURPOSE: The anterior /upper thigh has provided a number of new soft tissue free flaps over the past 2 decades, including the ALT, medial thigh, TUG, and most recently the PAP flap. The purpose of this study is to describe a new soft tissue free flap of the upper thigh: the "Cutaneous Upper Thigh (CUT)" free flap.

METHODS: During medial dissections of ALT free flap skin paddle, a consistent vessel was observed in the upper portion of the thigh arising from under the lateral portion of the Sartorius muscle. Cadaveric dissection to identify pedicle characteristics and clinical cases were then performed to determine CUT free flap utility.

RESULTS: Eight cadaveric legs were dissected. A consistent direct cutaneous vessel was identified arising from under the lateral aspect of the Sartorius muscle. Cutaneous entrance of the vessel was 8-10 cm below the ASIS and 4 cm medial to a line drawn from the ASIS to the lateral patella. Vessel pedicle length was 7-8.5 cm. Artery diameter at measured 1.2-1.5 mm while accompanying venae commitantes measured 1.9-2.2 mm. The pedicle was a direct cutaneous vessel arising from the lateral aspect of the common femoral prior to its bifurcation. Five clinical cases were performed: 4 hand cases and 1 lower extremity reconstruction case. Three free flaps survived completely, 1 underwent partial flap necrosis proximal to the entrance of the pedicle, and 1 flap was lost due to arterial insufficiency 3 weeks post operatively. Flap dimensions ranged from 4X4 cm to 8 cm × 15 cm.

CONCLUSIONS: The CUT flap represents a new flap in the armamentarium of the microsurgeon for small to medium sized soft tissue defects. It can be harvested as a free flap or potentially pedicled for groin reconstruction. Further perfusion studies are underway.

Learning Objective:

The audience will learn about a newly described free flap of the upper thigh.

06
PREOPERATIVE IMAGING FOR FREE FIBULA FLAP HARVEST: A SYSTEMATIC REVIEW OF THE LITERATURE

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PURPOSE: To conduct a systematic review that would determine if preoperative angiography of the lower extremity is necessary to detect abnormalities that may alter operative planning prior to harvest of a free fibula flap. Our secondary objective is to determine whether conducting a physical examination alone is sufficient to predict such abnormalities.

METHODS: Two independent reviewers conducted an electronic literature search (MEDLINE, CINAHL, CENTRAL and Embase) with predetermined search terms. Studies were selected for inclusion if they included patients undergoing free fibula flaps with preoperative imaging, with or without physical examination data. Outcomes of interest included number of operative plan changes and level of agreement between physical examination and imaging. Methodological quality was assessed using the MINORS scale. Inter-rater reliability was calculated using Cohen's Kappa. Descriptive statistics were used to define patient populations and study outcomes.

RESULTS: Of 337 potentially eligible studies, 11 were included for analysis. The studies had a mean sample size of 36 patients (min=5, max=118). The majority of studies were of moderate methodological quality. Imaging included Doppler ultrasonography, angiography, CT angiography and MR angiography. The surgical plan was altered based on preoperative imaging in 26.6% (106/398) of cases. Of the 5 studies which also reported physical examination findings, 62.5% (15/24) of cases requiring change of operative plans were missed by physical examination findings alone.

CONCLUSIONS: There is low quality evidence suggesting a necessity for routine preoperative angiography of the lower extremity for all patients being evaluated for free fibula flaps. Physical examination alone is not sufficient in detecting vascular abnormalities that may result in limb compromise or an inability to use the fibula free flap.

Learning Objectives:

Participants will learn the role of preoperative clinical examination and lower extremity imaging in free fibula flaps and review the evidence surrounding this topic.

07
POOR RESULTS AFTER NERVE TRANSFER FOR PERONEAL NERVE PALSY: A RE-LEARNING PROBLEM, NOT AN AXON PROBLEM

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INTRODUCTION: Results of peroneal nerve repair with long grafts (> 6 cm) have been poor. Therefore, nerve transfers post-peroneal nerve trauma are an attractive option. Such nerve transfers require: (i) successful re-innervation of the target muscle (tibialis anterior [TA])) and (ii) sufficient cortical reorganization to adapt the activation of a plantar flexor donor nerve to perform dorsiflexion. We present the 2 year follow up of a case cohort of 6 cases following nerve transfer.

METHODS: Six consecutive cases of severe peroneal nerve trauma requiring reconstructive nerve surgery were reviewed utilizing prospectively gathered data. Demographics including type of injury, time from injury to repair and time from repair to followup were gathered. Measured outcomes included clinical MRC power, requirement for orthoses, and electromyographic data.

RESULTS: All patients were young (mean 22.4 years) males with a traumatic dislocation of the knee requiring multi-ligamentous orthopedic reconstruction. Mean time from injury to repair was 7.6 (range 6-12) months and mean followup was 22 months (range 9-25). Nerve transfer was performed using two branches supplying the lateral gastrocnemius transferred to TA and peroneus longus , extended by short sural nerve grafts (mean 4.5 cm). Only three subjects regained purposeful, antigravity

dorsiflexion. Three of the 6 patients utilized orthoses and one went onto tendon transfer. Significant reinnervation in 4 patients was demonstrated by nascent potentials in TA while 'firing' the donor nerve with plantarflexion. However, cortical relearning was too difficult to translate into functional dorsiflexion for most patients.

CONCLUSION: Outcomes following nerve transfer using an ankle plantar flexor donor in peroneal nerve palsy are generally poor despite evidence of reinnervation. Our results suggest the hurdle of cortical reorganization may be as an important a factor as 'axon number' in these cases.

Learning Objectives:

Participants will understand options for reconstruction of peroneal nerve injuries and the outcomes of nerve transfers.

08

COMPARISON OF ULNAR INTRINSIC FUNCTION FOLLOWING SUPERCHARGED END-TO-SIDE AIN TRANSFER TO ULNAR MOTOR NERVE: A MATCHED COHORT OF STUDY HIGH ULNAR NERVE INJURY PATIENTS

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PURPOSE: To review our preliminary experience with high ulnar nerve injuries treated with a supercharge end-to-side anterior interosseous to ulnar motor nerve (SETS) transfer and conventional surgical intervention and compare return of ulnar intrinsic function to a matched cohort of high ulnar nerve injuries that did not have a SETS transfer.

METHODS: A retrospective matched-cohort study identified all patients that underwent the SETS transfer between 2000-2014 and a second cohort of ulnar nerve injury patients that did not have the transfer, matched based on age, level and mechanism of injury. The primary outcome was ulnar intrinsic function improvement, which included evidence of reinnervation on clinical/electromyographic examination. Dichotomous and continuous variables were compared with Fisher's exact and Student T-tests, respectively.

RESULTS: Thirteen SETS patients with appropriate follow-up were identified. The average age at surgery for SETS patients and the matched cohort was 35 (±14) and 35 (±16) years, respectively. Eleven SETS transfer patients (84%) had evidence of intinsic function compared with five (38%) patients that did not have the SETS transfer ($p<0.05$). Following ulnar nerve transection, greater intrinsic function return was demonstrated following the SETS transfer (85% vs. 14%, $p=0.03$), while compressive injuries had comparable intrinsic function return between groups (67%). Nerve transection repairs augmented with a SETS transfer demonstrated ulnar intrinsic recovery on average at 3.4 months (±1.7), while recovery occured closer to a year or not at all with repair alone ($p>0.05$).

CONCLUSION: This matched cohort study demonstrates that the SETS transfer results in increased ulnar intrinsic reinnervation following high ulnar nerve injury. From both a frequency and timing of recovery standpoint, this finding appears to be most relevant among patients with transection compared to compressive type injuries.

Learning Objective:

To demonstrate an approach to improving function after devastating ulnar nerve injuries.

09

A COMPARISON OF OUTCOMES OF TRICEPS MOTOR BRANCH TO AXILLARY NERVE TRANSFER OR SURAL NERVE INTERPOSITIONAL GRAFTING FOR ISOLATED AXILLARY NERVE INJURY

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PURPOSE: There is currently no consensus on whether triceps motor branch transfer or an interpositional graft results in superior deltoid function following isolated axillary nerve injury. The purpose of this study is to compare functional outcomes, including deltoid strength between these two deltoid reinnervation procedures.

METHODS: Twenty-nine isolated axillary nerve injury adult patients that had either interpositional nerve grafting or triceps motor branch transfer, with at least 1 year of follow-up between 2002-2013, were retrospectively reviewed. Functional outcomes of deltoid reinnervation included clinical evidence of deltoid recovery graded by the medical research council (MRC) system, EMG evidence of recovery and shoulder abduction and forward flexion. Postoperative disability of the arm, shoulder and hand (DASH) scores were also compared. Continuous and categorical data were compared with Student's T-tests and Fisher's Exact tests, respectively. Effect size (Cohen d) was also calculated for continuous variable comparisons.

RESULTS: Twenty-one isolated axillary nerve patients had a triceps motor transfer and 8 had interpositional nerve grafting. The two groups were similar with respect to clinical and demographic factors. At a mean follow-up time of 22 months, average postoperative MRC scores were significantly greater in the grafting group compared to the nerve transfer group (4.3 vs 3.05, $p<0.05$, $d=1.4$) and more graft patients achieved useful deltoid function (MRC≥3) recovery (100% vs. 62%, $p<0.05$). DASH scores were significantly lower following interpositional grafting compared with nerve transfer (4 versus 22, $p<0.05$, $d=1.2$).

CONCLUSIONS: This retrospective comparison demonstrates that interpositional nerve grafting results in superior deltoid strength and better patient reported outcomes following isolated axillary nerve injury. Our findings support interpositional nerve grafting as the first choice for isolated axillary nerve injuries when possible.

Learning Objective:

To describe options for deltoid reinnervation following isolated axillary nerve injury.

10

PERFORATOR FLAP RECONSTRUCTION OF NIPPLE-SPARING MASTECTOMIES VIA THE INFRAMAMMARY APPROACH: TECHNIQUE CHANGES FACILITATING MICROVASCULAR RECONSTRUCTION

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PURPOSE: To detail the evolution of surgical techniques that facilitate the microsurgical reconstruction of nipple-sparing mastectomies through an infra-mammary fold (IMF) approach.

METHODS: A retrospective review of the first 20 nipple-sparing mastectomies reconstructed with perforator flaps using an (IMF) approach. Intraoperative decisions regarding flap choice, perforator selection and pedicle length were recorded. The costal cartilage level required to best access the internal mammary vessels was recorded. Width of the IMF incision and flap positioning with respect to facilitating the microsurgical anastomosis was evaluated. Outcome measures included flap complications, and nipple viability. The results demonstrate that with experience, an evolution in technique lead to a reduction in complications, anastomosis difficulty, and in-setting.

RESULTS: Nipples were viable in all but one case. The IMF incision length evolved from 6 cm initially, to utilizing almost the entire IMF. The Internal mammary vessels were best approached via 4th or 5th costal cartilage removal. A technique to overcome the 5th costal cartilage synchondrosis to the 6th was developed. A small elliptical patch of flap skin was left exposed at the IMF for monitoring, to reduce tension on the mastectomy skin flaps, and prevent the necessity of implantable dopplers.

CONCLUSION: The IMF can be the best aesthetic scar for mastectomies. It also provides one of the best approaches to maintain vascularity to the nipple and areolar complex. Solutions to the technical challenges of the IMF approach for microvascular reconstructions have been described so that more patients can benefit from this technique.

Learning Objectives:

1. *Advantages of the nipple-sparing mastectomy.*
2. *Challenges in autologous tissue reconstruction of nipple-sparing mastectomies.*
3. *Technique changes to allow successful autologous reconstruction of nipple-sparing mastectomies through an inframammary approach.*

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THE DONOR SITE MORBIDITY ASSOCIATED WITH DCIA PERFORATOR FLAPS: A FUNCTIONAL AND AESTHETIC PERSPECTIVE

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PURPOSE: In autologous breast reconstruction when the anterior abdominal wall is not sufficient or has previously been harvested, secondary options are chosen. Frequently these result in suboptimal donor defects. The lateral abdominal wall can often provide adequate tissue. We previously presented the DCIA perforator flap technique and with this study report on the functional and aesthetic outcomes of the donor site.

METHODS: A retrospective series of 20 DCIA perforator flaps performed in 12 patients by a single surgeon was done. Flap and donor site complications were recorded. Patients completed validated questionnaires assessing post-operative pain, functioning and satisfaction with their donor sites. Clinical exams documented donor site symmetry, complications and reconstructive quality.

RESULTS: Of the 20 flaps, 14 were in combination with DIEP or SIEA flaps to increase volume. 6 were used due to unavailable abdominal tissue. 1 week and 3 month postoperative pain scores were 2.63 and 1.25 (scale of 0-10) respectively. All patients were able to accomplish their ADLs with minimal to no difficulty and were able to return to work. Almost all patients were satisfied with the appearance and symmetry of their donor site and overall abdominal contour. If patients did report discomfort or tightness it was greater in the anterior abdomen than the flanks. Clinical exams demonstrated no hernias or flank asymmetry.

CONCLUSIONS: The DCIA perforator flap can transfer flank tissue by itself or in combination with the DIEP or SIEA flap efficiently, with limited complications and morbidity of the donor site and high aesthetic and functional satisfaction.

Learning Objectives:

Participants will learn about the functional and aesthetic morbidity of the donor site and the potential uses of the DCIA perforator flap in the current algorithm for autologous breast reconstruction.

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FREE FIBULA RECONSTRUCTION AFTER OSTEOMYELITIS IN THE DEVELOPING WORLD: A UGANDAN EXPERIENCE

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PURPOSE: International surgical missions often involve adverse conditions, paucity of OR resources & equipment and difficulties fostering sustainable care. The purpose of this study is to demonstrate not only the ability to perform successful microsurgical reconstruction of complex defects in a third world setting, but also to promote involvement of local residents & staff in order to create a legacy of care.

METHODS: A retrospective review of 6 consecutive Ugandan patients who survived either haematologic or post-traumatic osteomyelitis resulting in long bone defects greater than 8cm following sequestrectomy. All patients underwent free fibula reconstruction. Surgical success was defined as absence of microsurgical surgical complications and radiographic evidence of union. Follow up was performed at 3, 6 and 12 months.

RESULTS: The mean age of the patients was 10.2 years of age (range 2-35). Average length of long bone defect was 9.6 cm (range 8-11 cm). Reconstructed defects included: Three Radial defects, two Femeral defects and one Humeral defect. Three of six fibular flaps were raised on the Anterior Tibial Artery to preserve the growth plate. All six patients achieved bony union with no microsurgical complications. Ugandan residents had hands-on involvement during all cases and local health care professionals performed long-term care. Local surgeons and residents performed the most recent case independently.

CONCLUSIONS: The free fibula is a viable option for reconstruction of large bony defects after osteomyelitis. Complex microsurgical reconstructive techniques can be effectively taught during surgical missions.

Learning Objectives:

1. *Participants will gain insight into performing successful microsurgical reconstruction on international surgical missions.*
2. *Participants will understand the role of treating post-infectious long bone defects with free tissue transfer.*
3. *Participants will gain an appreciation of ethical responsibility to share applied knowledge with local health professionals during international surgical missions.*

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