Adverse outcomes following hand surgery in patients with rheumatoid arthritis

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BACKGROUND: Up to 70% of patients with long-standing rheumatoid arthritis (RA) may present with rheumatic hand disease and benefit from hand surgical procedures (HSPs).

OBJECTIVE: Through retrospective review, the present study aimed to report HSPs in RA patients at a tertiary care centre to identify patient adverse outcomes (AOs) and their predictors.

METHODS: From 1989 to 2013, 96 patients who underwent ≥1 HSP(s) were identified from two local registries; their clinical records were independently reviewed by two trained physicians (surgeon and clinical) who used a standardized format. AOs were defined by consensus; data abstractor agreement was found in 90% of cases. Descriptive statistics were used in addition to Kaplan-Meier curves to determine the time to each AO, while logistic regression models were used to determine predictors of AOs.

RESULTS: At first HSP, 89.6% of patients were female, had a mean (± SD) age of 49.1±12 years, a disease duration of 12.2±7.2 years, 93.6% were positive for rheumatoid factor and 24% were receiving intensive treatment. A total of 130 HSPs were performed: the most frequent interventions were arthrodesis (25.4%), resection of the ulnar head (15.4%) and tenorrhaphy (14.6%). During follow-up, 33 AOs were reported in 27 (28.1%) patients, 87% of which occurred after the first HSP. The most frequent AO subsets were impaired wound healing (18.2%) and exposed pin (15.2%). Longer disease duration at first HSP (OR 3.07 [95% CI 1.04 to 9.08]; P=0.04) and intensive treatment (OR 1.08 [95% CI 1.002 to 1.156]; P=0.045) were predictors of AOs. The optimal disease duration cut-off to predict AOs was 20.1 years.

CONCLUSION: Early referral of long-standing RA patients for hand surgery, along with less aggressive treatment, favoured improved surgical outcomes.

Key Words: Rheumatoid arthritis; Hand surgery; Outcomes

Rheumatoid arthritis (RA) is a systemic inflammatory and autoimmune disease characterized by inflammation in the synovial joints. It typically causes a symmetrical small-joint polyarthritis that affects the proximal interphalangeal and metacarpophalangeal joints of the hands, wrists and feet (1). The wrist joint is often involved early in the disease course, and is regarded as one of the primary therapeutic targets because appropriate treatment prevents patient disability at work and preserves independent self-care (2). Currently, there is good evidence that early recognition of the disease and intensive treatment using disease-modifying antirheumatic drugs (DMARDs) favours improved outcomes and delays disability in RA patients (3). Nevertheless, when synovial inflammation persists over the follow-up period, joint destruction appears early and leads to rheumatic hand disease, which is characterized by deformity, dysfunction and, frequently, pain (4). Patient responses to DMARDs may be highly variable and it is currently exceedingly difficult to predict which patients will respond to which medication regimen, although current research to identify patient-specific disease signatures via genetic and proteomic approaches is ongoing.

Functional and aesthetic compromise, and symptomatic complaints are the most common manifestations of the rheumatoid hand and may affect up to 70% of patients with longstanding disease (5). In such a clinical context, indications for surgery, in order of priority are: impending tendon rupture or severe nerve compression, pain relief, improved function and to correct deformity (5). Although there are clear recommendations from the National Institute for Health and Clinical Excellence (NICE) regarding early surgical referral (6), the systemic, progressive and polyarticular nature of RA elevates the complexity involved in decision-making to higher levels than is found in other areas of hand surgery. The definition of successful surgical intervention according to rheumatologists and hand surgeons varies, and has been a matter of debate for generations of physicians (7-9). Generally, rheumatologists underestimate the benefits of HSPs, while the converse is true for hand surgeons. Moreover,
380 RA patients were randomly selected, and their records reviewed to had RA and attended the outpatient clinic of rheumatic diseases at the rheumatologist attending to the patient. Patient data are updated in a local registry created in March 2003 at the Department of Immunology and Rheumatology Registry.

HSPs in RA patients at a tertiary care centre between 1989 and 2013. Given the above considerations, the purpose of the present study was to perform a retrospective chart review and report the results of HSPs in RA patients at a tertiary care centre between 1989 and 2013. We were especially interested in identifying patient adverse outcomes (AOS) and their potential predictors, to better select and orchestrate surgical hand interventions in our population of RA patients with unique characteristics.

METHODS

Patient identification
The Instituto Nacional de Ciencias y Nutrición Salvador Zubirán is a national referral centre for rheumatic diseases, including RA, located in Mexico City, Mexico. Patients described in the present report were identified from two local registries, the first of which was initiated in the nation's reference centre for rheumatic diseases, including RA, located in Mexico City, Mexico. Patients described in the present report were identified from two local registries, the first of which was initiated in 1996 at the Department of Plastic Surgery. A total of 240 patients had undergone at least one HSP between January 1996 and December 2013, of whom 124 had a diagnosis of a rheumatic disease. The specific diagnosis was determined to be RA in 95 patients based on a different disease characterisation (age at RA diagnosis and at HSP, sex, years of education, socioeconomic status); disease characteristics (presence and type of rheumatoid factor [RF]); disease duration at first surgery; length of follow-up; detailed RA treatment at surgery; erosive disease; history of previous orthopedic surgery and location; number of visits to the rheumatologist within the year before surgery and presence of atlantoaxial luxation; HSP information (date, hand-surgical indication, surgeon identification, description of hand deformities and movement limitations, previous surgical evaluation(s), description of surgical procedure performed and description of surgery-related events); presence of comorbid conditions (according to chart diagnosis and Charlson score [11]); laboratory results at HSP (cytology, serum creatinine level and acute reactant phase determinations); and follow-up variables (hand surgical visits, physiotherapy indication and AOS as described below).

Clinical data ascertainment was confirmed by a second trained data abstraction and included comorbidities, RA treatment (type, dose and specific DMARDs), other treatment and laboratory information.

Ascertainment of AOs
A list of AOs was defined a priori. A literature review (12-15) identified 17 potential AOs to be included: wound infection, wound healing failure (or wound dehiscence), hematoma, seroma, instability, tendon rupture, edema/swelling, pain, bleeding (uncontrolled and/or excessive), failed consolidation, epidermolysis necrosis, sloughing, postoperative adhesions, loss of motion, fracture of the healed fusion/nonhealed fusion, fistula and exposed hardware. Items to be included in the list were discussed between surgical and clinical physicians until consensus was reached. Pain was excluded from the list because it was not objectively assessed at follow-up (eg, using a visual analogue scale). Edema was also excluded because there was no consensus regarding the lag time since surgical procedure up to when edema was considered to be a "normal finding". Loss of motion was not considered to be a complication if it was described after a surgical procedure with expected reduced range of motion (eg, arthrodesis). Finally, there were no reports of hematoma, instability or uncontrolled postsurgical bleeding. AOs were extracted from the charts independently by surgical and clinical physicians: agreement was found in 90% of the cases and, for the remaining 10%, consensus was reached.

Statistical analysis
Distribution of each variable was analyzed. Student’s t and χ² tests were used for normally distributed variables, and the Mann-Whitney U test for non-normally distributed variables. The time to each AO was considered to be a "normal finding". Loss of motion was not considered to be a complication if it was described after a surgical procedure with expected reduced range of motion (eg, arthrodesis). Finally, there were no reports of hematoma, instability or uncontrolled postsurgical bleeding. AOS were extracted from the charts independently by surgical and clinical physicians: agreement was found in 90% of the cases and, for the remaining 10%, consensus was reached.

Data collection
The clinical records of all cases were retrospectively reviewed by one hand surgeon trained in data abstraction. A standardized format was previously developed and included the following information: socio-demographic characteristics (age at RA diagnosis and at HSP, sex, years of education, socioeconomic status); disease characteristics (presence and type of rheumatoid factor [RF]); disease duration at first surgery; length of follow-up; detailed RA treatment at surgery; erosive disease; history of previous orthopedic surgery and location; number of visits to the rheumatologist within the year before surgery and presence of atlantoaxial luxation; HSP information (date, hand-surgical indication, surgeon identification, description of hand deformities and movement limitations, previous surgical evaluation(s), description of surgical procedure performed and description of surgery-related events); presence of comorbid conditions (according to chart diagnosis and Charlson score [11]); laboratory results at HSP (cytology, serum creatinine level and acute reactant phase determinations); and follow-up variables (hand surgical visits, physiotherapy indication and AOS as described below).

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TABLE 1
Patients, disease characteristics and treatment in the rheumatoid arthritis (RA) population, and in RA patients with and without adverse outcomes

<table>
<thead>
<tr>
<th>Patients</th>
<th>RA population (n=96)</th>
<th>Adverse outcome(s)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (n=27)</td>
<td>No (n=69)</td>
<td></td>
</tr>
<tr>
<td>Sociodemographic characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female sex, n (%)</td>
<td>86 (89.6)</td>
<td>25 (92.6)</td>
<td>61 (88.4)</td>
</tr>
<tr>
<td>Middle to low socioeconomic status, n (%)</td>
<td>77 (80.2)</td>
<td>21 (77.8)</td>
<td>56 (81.4)</td>
</tr>
<tr>
<td>Age at disease diagnosis, years</td>
<td>36.9±11</td>
<td>34.5±9.7</td>
<td>37.9±11.3</td>
</tr>
<tr>
<td>Disease duration at hand surgical procedure, years</td>
<td>49.1±12</td>
<td>48.9±12</td>
<td>49.2±12.1</td>
</tr>
<tr>
<td>Follow-up after hand surgical procedure, months</td>
<td>12.2±7.2</td>
<td>14.4±6.9</td>
<td>11.3±7.2</td>
</tr>
<tr>
<td>Disease duration up to HSP, years, mean ± SD</td>
<td>16.9±33.8</td>
<td>19±38.6</td>
<td>16±12.2</td>
</tr>
<tr>
<td>Serology results at surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rheumatoid factor positive</td>
<td>75 (92.6)*</td>
<td>19 (95)</td>
<td>56 (91.8)</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate, mm/h</td>
<td>26 (15–39)</td>
<td>29 (16–37.3)</td>
<td>25.5 (12.8–40)</td>
</tr>
<tr>
<td>Hemoglobin, mg/dL</td>
<td>13.4 (12.6–14.2)</td>
<td>13.1 (12.6–13.6)</td>
<td>13.5 (12.6–14.5)</td>
</tr>
<tr>
<td>Creatinine, mg/dL</td>
<td>0.7 (0.6–0.9)</td>
<td>0.73 (0.68–0.9)</td>
<td>0.7 (0.6–0.9)</td>
</tr>
<tr>
<td>Comorbidities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥1, n (%)</td>
<td>43 (44.8)</td>
<td>13 (48.1)</td>
<td>30 (43.5)</td>
</tr>
<tr>
<td>Comorbidity/patient</td>
<td>1 (1–3)</td>
<td>1 (1–2.5)</td>
<td>2 (1–3)</td>
</tr>
<tr>
<td>Previous visits to the outpatient clinic</td>
<td>2 (1–3)</td>
<td>2 (1–4)</td>
<td>2 (1–3)</td>
</tr>
<tr>
<td>RA-specific treatment at HSP, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Untreated</td>
<td>4 (4.2)</td>
<td>0 (0)</td>
<td>4 (5.8)</td>
</tr>
<tr>
<td>Corticosteroids</td>
<td>2 (2.1)</td>
<td>0 (0)</td>
<td>2 (2.9)</td>
</tr>
<tr>
<td>1 DMARD</td>
<td>20 (20.8)</td>
<td>4 (14.8)</td>
<td>16 (23.2)</td>
</tr>
<tr>
<td>≥2 DMARDs</td>
<td>47 (49)</td>
<td>12 (44.4)</td>
<td>35 (50.7)</td>
</tr>
<tr>
<td>≥2 DMARDs + corticosteroids</td>
<td>23 (24)</td>
<td>11 (40.7)</td>
<td>12 (17.4)</td>
</tr>
</tbody>
</table>

Data presented as mean ± SD or median (range) unless otherwise indicated. *Data missing for 15 patients. DMARD Disease-modifying antirheumatic drug(s); NA Not applicable.

RESULTS

Population characteristics (Table 1)
At first HSP, the 96 RA patients identified were predominantly middle-age ([mean±SD] 49.1±12 years), female (89.6%) and had a disease duration of 12.2±7.2 years. Most (93.6%) of the patients were positive for RF and the median erythrocyte sedimentation rate was 26 mm/h (range 15 mm/h to 39 mm/h). Almost one-half (45%) of the patients had at least one comorbid condition and the median number of visits to the outpatient clinic within the year before HSP was 2 (range 1 to 3). Finally, 47 patients were receiving ≥2 DMARDs, 20 one DMARD, 23 combined DMARD(s) and low doses of corticosteroids, two received corticosteroids as the sole RA therapy and four patients were not taking any RA-specific medication (Table 1).

HSPs
A total of 130 HSPs were performed in the 96 RA patients: 71 (74%) underwent one surgical intervention, 17 (18%) underwent two, seven (7%) underwent three and one (1%) underwent four. Most of the procedures were performed between 1995 and 2005; there was a decline in the number of interventions from 2006 onwards (Figure 2). All patients received a single dose of intravenous antibiotic as induction, were assigned to standard postoperative rehabilitation and continued taking their RA medication throughout the perioperative period. At the time of surgery, disease activity was not assessed using validated tools, although all patients underwent at least one rheumatic evaluation. Finally, patients underwent a median of 2 (range 1 to 3) rheumatic evaluations within the year before their HSP.
The most frequent surgical procedures were arthrodesis (25.4%), resection of ulnar head (15.4%) and tenorrhaphy (14.6%) (Table 2). Sixteen HSPs were performed in 15 patients and distributed as follows: mass resection (n=5), carpal tunnel release (n=4), pin fixation (n=3), capsuloplasty (n=1), trigger finger release (n=1), compartment syndrome release (n=1) and removal of osteosynthesis material (n=1). Due to the limited number of procedures within each category, they were included in Table 2 under ‘other hand surgical procedures’. Years of disease duration up to hand surgery were similar when compared according to specific HSP (Table 2).

AOs
Among 130 hand surgeries performed in the 96 RA patients, 33 AOs were reported in 27 patients (28.1% of the RA patients with an AO) (Table 3). Most (87%) AOs occurred after the first surgery. Furthermore, 29 of the 33 (87.9%) AOs presented as isolated, while four presented as clusters (impaired wound healing + postsurgical adhesions and wound infection + impaired wound healing). Among the 27 patients with AOs, 22 (81.5%) had one AO recorded, while four (14.8%) experienced two AOs and one (3.7%) patient experienced three AOs. The most frequent AO subsets were impaired wound healing and exposed pin (Table 3). Time to AO was highly variable among and within specific subsets, as shown in Table 3, and Figures 3 and 4.

Comparison of patients with/without AO(s) and predictors
As mentioned, 27 patients had 33 AOs recorded in their charts. Patient characteristics (demographic, disease-related, serological, comorbid conditions and treatment) at first AO were compared with those from patients without AOs and are summarized in Table 2. Patients who experienced AO(s) were more frequently indicated ≥2 DMARDs combined with corticosteroids, had longer disease duration at HSP, and tended to be older at diagnosis, have more comorbidities per patient and have lower hemoglobin levels.

Different models were tested to investigate possible predictors of first AO. Longer disease duration at first HSP (OR 3.07 [95% CI 1.04 to 9.08]; P=0.04) and more intensive treatment (OR 1.08 [95% CI 1.002 to 1.156]; P=0.045) predicted first AO.

Mild, yet significant, correlations were found between RA disease duration at surgery and hemoglobin level at surgery (r=−0.18; P=0.087) and comorbidities (r=0.28; P=0.006).

Finally, according to ROC curve analysis, the best cut-off for RA disease duration at surgery and hemoglobin level at surgery (r=−0.18; P=0.087) and comorbidities (r=0.28; P=0.006).

DiscUSSion
Surgical hand therapy is eventually considered in RA patients, especially those with long-standing disease. It requires knowledge, not only of the likely outcome of any surgical procedure but of the effects of continuing disease activity on the operated area over time. Furthermore, due to the nature of their disease, RA patients have many features that affect perioperative management and outcomes. Rheumatologists are not only in a leading position to decide when a patient should be referred to a hand surgeon, but also to identify unique patient risk factors to prevent surgery-related morbidity. However, patients may approach hand surgery with considerable apprehension; therefore, a successful first procedure (ie, ‘start with a winner operation’) can do much to build confidence in hand surgery and the relationship with the hand surgeon (16).
Differences in perceptions about rheumatoid hand surgery among relating postoperative mortality. Burke et al. confirmed significant differences in perceptions about rheumatoid hand surgery among rheumatologists, hand surgeons and hand therapists in the United Kingdom (UK), where patients were less likely to have medical insurance (similar to our population) and proposed that it could have resulted in delayed presentation to hand surgery clinics. Interestingly, UK surgeons were more conservative in their estimations of success regarding hand function recovery (49%) compared with their American colleagues (82.5%) or UK rheumatologists (24%). It may be relevant to emphasize that poor hand function recovery or pain control may be considered to be surrogates of AOs.

Finally, although published rates of orthopedic surgery for RA vary greatly among countries, regardless of whether the health care system is different or similar, we confirmed recent literature reports that showed a decline in surgical hand procedures in the past decade (27,28). Although there are several possible explanations, the introduction in recent years of more effective first-line DMARDs and drug combinations appear to be essential contributors.

Study limitations
The present study was retrospective in nature, and studies examining the associations between RA disease activity and previous surgical intervention and AOs at follow-up are scarce. Accordingly, it is difficult to establish the potential impact of previous and/or continuing disease activity in the operated joint on adverse surgical outcomes. Nonetheless, the number of previous visits to the outpatient clinic was similar in patients with/without AOs. In addition, validated indexes used to measure disease activity were not available when most of the surgeries were performed. There was also no available information regarding individual surgeon experience and his/her specialty designation, both of which have been established to influence postoperative complication rates (29,30).

Immobilization and physical therapy were indicated for all patients; however, compliance was not objectively assessed, and variability in the duration of immobilization can cause a delay in wound healing (31). We did not assess smoking, which has been associated with an increased infection risk due to impairments in wound healing and decreased immune response (32). Radiographic follow-up was not routinely assessed in the patients; accordingly, some AOs, such as radiographic loosening, could not be assessed (15).

Finally, we could not ascertain compliance with RA treatment during patient follow-up; however, it is questionable whether this would have significantly biased the results toward those who experienced AOs.

CONCLUSIONS
RA patients with longer disease duration and intensive treatment had a higher risk for AOs after HSP. Rheumatologists should refer patients for potential hand interventions early during their disease course and select them when disease activity is under control using the most conservative treatment. If not possible, surgeons should be aware that patients who have undergone intensive treatment may have a higher risk for AOs. A multidisciplinary approach including hand surgeons, rheumatologists and occupational therapists is more convenient for patients and more successful in targeted disease management (33-35).

Long-term follow-up of outcomes and complications need to be assessed in RA patients undergoing HSP to facilitate evidence-based decision making. There is a clear need for more unrestricted interdisciplinary training (and communication) between rheumatologists and hand surgeons.

DISCLOSURES: The authors have no financial disclosures or conflicts of interest to declare.

REFERENCES


