A retrospective review of a series of interposition arthroplasties of the elbow

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ABSTRACT

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Conflicts of interest

None declared

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Background Interposition arthroplasty (IA) is mostly performed in younger patients where total joint replacement is contraindicated and an arthrodesis is unattractive. The outcome and complications of an IA were evaluated.

Methods We retrospectively reviewed 18 consecutive cases of interposition arthroplasty (IA) (one case was excluded as a result of incomplete records). Pre- and postoperative pain and function were evaluated. Complications, re-operations and revisions were recorded.

Results The mean age was 41 years (range 19 years to 59 years) at time of surgery. The primary diagnosis was post-traumatic osteoarthritis in 12 cases and inflammatory arthritis in five cases. The median follow-up was 54 months (range 8 months to 120 months). In 15 cases, at least one re-operation was performed. Seven cases were revised, with four of these to a total elbow replacement, an arthrodesis was performed in two cases and a re-do interposition was carried out in one case. The median interval from the interposition to revision was 23 months (range 8 months to 88 months). In 10 patients with the interposition currently *in situ*, mean visual analogue scale score for pain improved from 7.4 to 2.4 and mean Mayo Elbow Performance Score improved from 42 to 76 points.

Conclusions IA offered an improvement in pain and function but at a high cost. It is associated with a high complication rate the need for revision surgery.

INTRODUCTION

Elbow arthritis is a debilitating condition that presents with pain, stiffness and loss of function. The aetiology varies and both osteoarthritis and inflammatory arthritis affect the elbow. Primary osteoarthritis of the elbow is rare and the majority of cases are a result of post-traumatic changes. Rheumatoid arthritis is the most common inflammatory arthritis affecting the elbow. Surgery is indicated where conservative treatment fails. In older, low-demand patients, total elbow replacement offers an acceptable first-line therapy. The young, high-demand patient, however, poses a challenge because total elbow replacement is not a long-term solution for this group as a result of high rates of loosening [1].

Surgical treatment for elbow arthritis includes arthroscopic debridement, ulnohumeral arthroplasty, interposition arthroplasty, resection arthroplasty, total elbow arthroplasty and arthrodesis. The primary aim of the treatment is to reduce pain and improve function without compromising future surgical options. Sears et al. suggest that this requires accurate assessment of the primary patient complaint [2]. Patients with pain and stiffness at the extremes of motion may benefit from osteocapsular debridement, arthroscopic or open. Those with advanced degeneration and symptoms throughout their arc of motion may require joint resurfacing or replacement.

Arthroscopic treatment in the form of capsular release and debridement of impinging osteophytes in osteoarthritis has promising short- and midterm results [3]. Arthroscopic synovectomy in rheumatoid elbows has been shown to be a reliable procedure [4,5]. Ulnohumeral arthroplasty is performed for mild to moderate degeneration and can be performed arthroscopically or open. Satisfactory relief in pain and stiffness is achieved in up to 75% of patients, although these results typically deteriorate over the first decade [6]. Although total elbow arthroplasty is used in patients with osteoarthritis [7], the consensus appears to be that the outcome is less favourable in the younger, higher-demand patient. Resection arthroplasty and arthrodesis are not attractive options as a result of a loss of function, and many consider that these procedures should only be used as a last resort.

Interposition arthroplasty (IA) is one of the oldest reconstructive options for elbow arthritis described for a variety of indications [8]. Throughout the years, various interposition tissues have been used, varying from synthetic grafts to the current preferred option of Achilles tendon allograft [9–11] with or without a hinged external fixator as an adjunct [12]. It is considered as a salvage option in patients where conservative treatment has failed and total elbow arthroplasty is relatively contraindicated [10].

The present study reviewed and share the outcome of a series of IAs performed at our institution.

MATERIALS AND METHODS

Patients

We obtained approval from the institutional ethical committee for a retrospective review of all patients who had received an IA of the elbow. Between March 2001 and October 2010, we performed 18 cases of IA. One patient was lost to follow-up and was excluded as a result of incomplete records. The remaining 17 patients constituted the cohort of the study.

Treatment

Surgical technique. Our surgical technique evolved through the series. We used a longitudinal posterior skin incision, unless we utilized a previous scar. The ulnar nerve was identified in all patients and released *in situ*.

The Kocher interval between the anconeus and extensor carpi ulnaris muscles was identified and opened. The lateral collateral ligament was released off the humerus and the medial collateral ligament was left intact. Contractures were released and a synovectomy was performed when necessary. The radial head was then addressed. We used a variety of interposition material, with Achilles tendon allograft as our choice in the latter (ten) cases. This was sutured to the humerus through drill holes (Fig. 1). The humerus was reduced and range of motion (ROM) and stability checked.

Over time, we started using an external fixation as described by Morrey [13]. The external fixator (hinged elbow external fixator; Stryker, Kalamazoo, MI, USA) was then applied with 2 mm of distraction. The lateral collateral ligament was repaired and routine wound closure was performed. The elbow was dressed in a bulky 'Robert Jones' bandage. This dressing was debulked 24 hours to 48 hours after surgery.

Aftercare. Postoperative physiotherapy was initiated on the first day to maintain ROM. Full active and passive ROM was allowed from day 1, except in cases where triceps was taken down. In these cases, active extension was not allowed for 6 weeks. The

Fig. 1 The interposition graft is sutured to the distal humerus.

patients were discharged home as soon as their pain was controlled and they were able to maintain their ROM. They continued with a home exercise programme as prescribed by the physiotherapists. At 4 weeks, the external fixator was removed under general anaesthesia in theatre with gentle manipulation. We performed a wound check and review of their ROM 10 days to 14 days after the surgery. The patients were then seen at regular intervals (6 weeks, 12 weeks post-operatively and 3-monthly thereafter) and their ROM documented.

Evaluation of clinical outcome

The patients' folders were reviewed. All complications and re-operations were recorded. The patients were evaluated regarding pain, ROM, stability of the elbow and functional outcome. This was measured using a visual analogue scale (VAS) for pain and the Mayo Elbow Performance Score (MEPS) [14].

Statistical analysis

Pre- and postoperative outcome parameters (VAS for pain, MEPS and ROM) were compared using the Wilcoxon signed ranks test. $P < 0.05$ was considered statistically significant. All data were analyzed using SPSS, version 17.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Three surgeons performed all 17 procedures. In all patients, the indications for surgery were pain and loss of function where other (surgical) treatment options have failed. The patient characteristics and underlying pathologies are summarized in Table 1.

The previous procedures included open reduction and internal fixation (ORIF) of complex fractures and dislocations of the elbow ($n = 6$), arthroscopic debridement and removal of loose bodies ($n = 8$), osteocapsular release ($n = 11$), radial head excision or replacement ($n = 9$), ulnar nerve transposition ($n = 1$) and lateral collateral ligament reconstruction ($n = 1$). In a number of cases, the initial procedures were performed at other units.

The ulnar nerve was released *in situ* in all cases, except for one case where the nerve was previously transposed. The

Table 1 Patient characteristics

Mean (range) age (years)	41 (19–59)
Underlying aetiology	
Post-traumatic osteoarthritis	12
Primary osteoarthritis	2
Rheumatoid arthritis	2
Arthrogryposis	1
Mean (range) number of previous procedures	2.2 (0–6)

radial head was previously removed in seven cases and previously replaced in two cases. During surgery, the radial head was removed in a further six cases. One of the replacements was retained and one was removed. In two cases, the radial head was left *in situ*.

Various interposition materials were used through the series. Fascia lata autograft was used in one case, triceps tendon central slip autograft in two cases, bovine pericardium in four cases and tendon achilles allograft (our current choice) in the last ten cases. A hinged external fixator with distraction was

applied in the last 13 cases. In one case, the lateral collateral ligament was reconstructed and, in another case, both the medial and lateral collateral ligaments were reconstructed.

Complications, reoperations and revisions

There were no intraoperative complications.

Septic complications were observed in eight cases. This includes three cases of pin site sepsis from the external fixator pins that were treated with oral antibiotics. In a further two

Table 2 Summary of cases and complications

Number	Diagnosis	Age	Previous surgery?	Interposition material	External-fixator?	Complications	Revised?
1	Arthrogryposis	48	Yes (3)	Fascia lata	No	Deep sepsis Ongoing pain and poor function	Yes (arthrodesis)
2	JRA	23	No	Triceps	No	Ongoing pain and poor function	Yes (TER)
3	Post-traumatic OA	49	Yes (3)	Triceps	No	Ongoing pain and poor function	Yes (TER)
4	Post-traumatic OA	19	Yes (2)	Bovine pericardium	Yes	Deep sepsis Instability Triceps dysfunction	No
5	JRA	23	No	Bovine pericardium	Yes	Pinsite sepsis	No
6	Post-traumatic OA	27	Yes (2)	Bovine pericardium	Yes	Wound sepsis	No
7	Post-traumatic OA	49	Yes (2)	Achilles tendon allograft	Yes	Ulnar nerve symptoms	No
8	Post-traumatic OA	41	Yes (4)	Achilles tendon allograft	Yes	Pinsite sepsis Ongoing pain and poor function	Yes (revision IA)
9	Post-traumatic OA	58	Yes (2)	Achilles tendon allograft	Yes	Deep sepsis	No
10	Primary OA	44	Yes (2)	Achilles tendon allograft	Yes	Pinsite sepsis	No
11	Post-traumatic OA	43	Yes (3)	Bovine pericardium	No	Ongoing pain and poor function	Yes (arthrodesis)
12	Post-traumatic OA	35	Yes (3)	Achilles tendon allograft	Yes	None	No
13	Primary OA	49	Yes (1)	Achilles tendon allograft	Yes	Ongoing pain and poor function	Yes (TER)
14	Post-traumatic OA	51	Yes (0)	Achilles tendon allograft	Yes	Ulnar nerve symptoms Ongoing pain and poor function	Yes (TER)
15	Post-traumatic OA	47	Yes (1)	Achilles tendon allograft	Yes	None	No
16	Post-traumatic OA	45	Yes (6)	Achilles tendon allograft	Yes	Instability	No
17	Post-traumatic OA	38	Yes (4)	Achilles tendon allograft	Yes	Wound sepsis Fracture through pinsite	No

JRA, juvenile rheumatoid arthritis; OA, osteoarthritis; TER, total elbow replacement.

cases, there was superficial wound sepsis requiring oral antibiotics alone. There were three cases of deep sepsis that required washout and debridement in theatre, as well as intravenous antibiotics.

Two patients developed ulnar nerve symptoms of which one required release and transposition. There were two cases of postoperative instability. One of these cases was only moderate, although one was gross and required ligament reconstruction. We had one case of triceps dysfunction that required triceps repair. This comprised the patient with the gross instability in whom both complications were addressed at the same time. This patient also developed deep sepsis requiring surgery. One patient had a fall and sustained an ulnar fracture through an external fixator hole 2 months after removal of the external fixator. This fracture required ORIF.

At least one re-operation was performed in 15 cases (88%). Removal of the external fixator was not considered as a re-operation because this was part of a planned staged procedure. There was a mean of 1.5 re-operations per patient (range 0 to 5). Re-operations included: additional manipulation under anaesthesia ($n = 4$), washout and debride ($n = 3$), open release ($n = 2$), ulnar nerve release and transposition ($n = 1$), ligament reconstruction ($n = 2$), triceps repair ($n = 1$), ORIF ($n = 1$) and revision ($n = 7$).

Seven cases required revision for ongoing pain and poor function. Of these, four cases were revised to a total elbow replacement, two to an arthrodesis and, in one case, a re-do interposition arthroplasty. The revision surgery was performed at a median of 23 months after the initial interposition (range 8 months to 88 months). Table 2 summarizes the cases, complications and need for revision surgery.

Clinical outcome

The median follow up was 54 months (range 8 months to 120 months). At last follow-up, only ten patients still had their interposition *in situ*.

Table 3 shows the comparison of pre- and postoperative clinical outcome measures of the patients with their interposition still *in situ*. According to the MEPS score, five cases achieved an excellent result ($\text{MEPS} \geq 80$), four cases achieved a good result ($\text{MEPS} \geq 60$) and one case achieved a fair result ($\text{MEPS} \geq 40$). Most of the scored items improved significantly after the interposition arthroplasty. Both patients with instability pre-operatively had a poor result.

Figure 2 shows lateral radiographs of the same patient before and after undergoing IA with a good clinical result.

Seven cases have been revised earlier as a result of pain and poor function. The functional outcomes of these patients were also assessed (Table 4).

Table 3 Clinical outcome measures in patients with IA currently *in situ*

Outcome measure	Mean value (range)		<i>p</i> -value
	Preoperative	Postoperative	
MEPS (0–100)	42 (30–60)	76 (40–100)	0.05
Pain (0–45)	7 (0–15)	30 (0–45)	0.01
Range of motion (5–20)	12 (5–20)	17(5–20)	0.04
Stability (0–10)	8 (5–10)	8(0–10)	0.71
Function (0–25)	15 (0–25)	21(5–25)	0.06
Range of motion			
Flexion–extension arc	52° (0° to 130)	85° (5° to 125)	0.03
Pronation–supination arc	110° (40° to 160)	146° (40° to 180)	0.46
VAS	7.4 (6–8)	2.4 (0–6)	0.02

MEPS, Mayo Elbow Performance; VAS, visual analogue scale.

Fig. 2 Lateral radiographs of the same patient. (A) Severe post-traumatic osteoarthritis with metalware *in situ* prior to interposition arthroplasty (IA). (B) The same patient 5 years post-IA with a good clinical result.

Table 4 Clinical outcome measures of revised cases

Current situation (cases)	Mean current MEPS
Total elbow replacement (n = 4)	85 (60–100)
Arthrodesis (n = 2)	56 (45–50)
Re-do interposition (n = 1)	80

MEPS, Mayo Elbow Performance.

DISCUSSION

The present study aimed to review and share the outcome of our series of an IA of the elbow. In this series, an IA offered improvement of pain and function in the patients with the interposition still *in situ* (10 of 17). Pain had more significantly improved than range of motion or function. The procedure, however, was technically demanding and associated with a high complication rate and a frequent need for further surgery. The results were unpredictable and we were unable to pre-select those patients that would do well.

Our results though are similar to those reported in previously published series [10,15]. It was previously demonstrated that there is an association between preoperative instability and poor clinical outcome following an interposition arthroplasty [10,15,16]. This is confirmed in our own series.

The results that we found are typical for results of a salvage procedure. Importantly, we also showed that an interposition arthroplasty can be successfully revised to both a total elbow arthroplasty and an arthrodesis with good clinical results.

The surgical options, however, for young, high-demand patients with an arthritic elbow are limited. With pain and stiffness at the extremes of motion, a debridement and a release can achieve good results, regardless of whether it is open or arthroscopic [2]. An arthroscopic procedure is precluded when there was a need to remove metal or severe stiffness. However, with pain and stiffness throughout the full arc of motion, some type of resurfacing is indicated, whether by interposition or total elbow replacement. Several studies have reported that, although total elbow replacement in the young patient can be performed, it is associated with a high complication rate [2,10].

The main limitations of the present study are the retrospective character and the relatively small numbers.

IA can improve pain and function in the arthritic elbow. This, however, comes at a price because the procedure is

associated with a high complication rate and the need for revision surgery. Future salvage procedures are not compromised; an interposition arthroplasty can be successfully revised to a total elbow arthroplasty or an arthrodesis. Patients must be informed of the high rate of complications and failures before undergoing this procedure.

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