Treatment of the mobile, painful arthritic elbow by distraction interposition arthroplasty

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Between 1986 and 1994, 13 patients with mobile painful arthritic elbows were treated by distraction interposition arthroplasty using fascia lata. The mean period of follow-up was 63 months. An elbow distractor/fixator was applied for three to four weeks to separate the articular surfaces and to protect the fascial graft.

Nine of the 13 patients (69%) had satisfactory relief from pain; eight (62%) had an excellent or good result by the objective criteria of the Mayo Elbow Performance score. Four have required revision to total elbow arthroplasty at a mean of 30 months with good results to date.

Instability of the elbow, both before and after surgery, was found to be associated with unsatisfactory results. The rate of success when the procedure was performed for inflammatory arthritis was similar to that for post-traumatic arthritis, about 67%. Eight complications occurred in six patients, all in the group with post-traumatic arthritis. Two of these required further surgical procedures such as transposition of the ulnar nerve or repair of hernia of the fascia lata.

Although less reliable than prosthetic replacement, distraction interposition arthroplasty is a useful option in the treatment of young, high-demand patients with arthritis of the elbow. It is rarely indicated in the presence of generalised inflammatory arthritis, but may be of value in those patients in whom the disease is limited primarily to the elbow.

In the arthritic elbow movement may be preserved but pain leads to considerable functional impairment. For patients with diminished demands, prosthetic arthroplasty is an effective and reliable treatment, but for young, active patients other options are often preferred. Arthrodesis is unattractive because of the resulting functional impairment. Biological interposition arthroplasty has been proposed as an alternative for this group of patients, but there is little objective information regarding the long-term benefits.

A modification of interposition arthroplasty has recently been described in which an external distractor/fixator device is applied across the elbow, distracting the articulating surfaces. This allows immediate passive movement of the elbow while protecting the interposed graft material and repair of soft tissues.

We have reviewed the results of 13 consecutive patients with painful, mobile arthritic elbows who were treated by this method. To date, there has been no report which deals with the procedure for our defined group of patients. The few previous reports of interposition arthroplasty have focused on the use of the procedure for the treatment of stiff or ankylosed elbows, or for rheumatoid arthritis.

Patients and Methods

Between 1986 and 1994, the senior author (BFM) treated 13 consecutive patients, five men and eight women, with painful mobile arthritic elbows using distraction interposition arthroplasty (DIA). For all patients pain was the primary complaint and the indication for surgery. Patients with substantial bone loss including one or both humeral condyles, those lacking active elbow flexion and those with ongoing sepsis were excluded, as were patients who were more than 60 years of age or who were felt to place lower demands on their elbows as a result of systemic or concomitant conditions.

The patients have been followed up for a minimum of 24 months with a mean of 63 months (29 to 121). Their mean age was 33 years at the time of operation (24 to 50). The dominant arm was involved in seven. The arthritis was post-traumatic in 10 and inflammatory in three. One of the patients with post-traumatic arthritis was referred with...
continuing pain after a previous interposition arthroplasty had been performed without the use of the distractor.

Operative technique. The surgical technique has gradually evolved and the method which we now describe has been used for the last three years. A longitudinal posterior skin incision is preferred, but if there is a previous incision this should be reopened. The ulnar nerve is identified and decompressed if symptomatic; otherwise it is simply mobilised and protected. The interval between anconeus and extensor carpi ulnaris (Kocher’s interval) is developed. The origin of the common extensor muscles and of the lateral ligament complex are released from their origin on the humerus; the joint surfaces are exposed by supinating and applying a varus stress to the forearm (Fig. 1). The contours of the articulating surfaces of the humerus and ulna are prepared using a semicircular saw, a rongeur, or a burr to develop a gap of at least 3 mm. The head of the radius is preserved if there is a painless range of movement in the forearm. This maximises the surface area of the joint and reduces valgus stress. Peripheral osteophytes may be removed. In some instances a ‘radialisation’ procedure is performed in which the ulnar articular margin for the head of the radius is removed to facilitate rotation of the forearm.

Application of the graft. Autogenous fascia lata was used as the interpositional graft material in all the patients. Three or four drill holes are made from the posterior to anterior direction across the distal humerus, emerging just proximal to the leading edge of the surface of the joint. Mattress sutures are placed to secure the graft anteriorly, and the two ends of each suture are then passed through the same drill hole. The ends of the sutures are placed through the graft posteriorly in a horizontal mattress fashion, and are tied (Fig. 2). This effectively stabilises the graft on to the humerus. In all instances, the Dynamic Joint Distractor (Howmedica, Rutherford, New Jersey) was used as the distractor/fixator. The current device allows half-pin application and the axis pin is removed to lessen the likelihood of infection (Figs 3 to 5).

After-care. An axillary catheter is used for continuous infiltration of local anaesthetic for 24 to 48 hours while the elbow is moved by continuous passive motion. The patient is allowed home on the third day. At four weeks, the distractor is removed under general anaesthesia and the elbow is gently but firmly examined, and not forcibly manipulated, to determine the firmness of the endpoints and to guide the surgeon as to the expected final arc of movement which will be achieved. Progressive static splints are used to facilitate the recovery of movement of the elbow and are applied and adjusted by the patient. Generally, both a flexion and an extension splint are used continuously over three weeks and at night for a further three months.
Assessment. The clinical records and radiographs of all patients were reviewed. The 13 patients were interviewed by the authors and were examined by them or by their local orthopaedic surgeon according to our protocol. No patient was lost to follow-up. The Mayo Elbow Performance score (MEPS) was calculated for each patient assessing movement, pain, stability and the functions of daily living. Anteroposterior and lateral radiographs were taken.

Since the purpose of the procedure was to relieve pain, we defined an unsatisfactory result as one in which the patient continued to have either moderate or severe pain. The differences in outcome measures before and after surgery were examined using a paired t-test. Differences with a probability of chance occurrence of <5% were considered to be significant.

Results

Satisfactory relief from pain was reported by nine of the 13 patients. According to the MEPS, four results were excellent, four good, one fair and four poor. One patient with a good result for four years, subsequently developed pain and had a total elbow arthroplasty (TEA) performed 5.5 years after the initial procedure; three of the patients with poor
results also required an arthroplasty. Of those who did not require further surgery, the mean MEPS was 34 points (20 to 50) before and 79 (20 to 100) after the operation ($p = 0.0002$, Tables I and II).

Of the three patients whose primary diagnosis was inflammatory arthritis, two had excellent results with an improvement of the MEPS from 30 to 97 points ($p = 0.03$). The third patient with Reiter’s syndrome (case 10) continued to have pain in the elbow and subsequently had a successful TEA.

Of the ten patients with post-traumatic arthritis, nine had a DIA performed for the first time. Of these, two had an excellent result, four good and three fair or poor. Two with poor results and one with a good initial outcome eventually required a TEA for continued or recurrent pain in the elbow. Of the six patients who did not require this procedure, the MEPS improved from a mean of 37 to 76 points ($p = 0.005$).

The patient who had an interposition arthroplasty without distraction performed elsewhere and who underwent revision to a DIA had a fair result, with improvement in the level of pain from moderate before to mild after operation.

**Elbow instability.** Before operation, nine patients had stable elbows and four had varying degrees of instability. Of the former, eight had satisfactory results. The single patient in this group who developed instability after operation had

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (yr)</th>
<th>Follow-up (mth)</th>
<th>Diagnosis</th>
<th>Number of previous operations</th>
<th>Pre-operative instability (grade)</th>
<th>Pain Preop/postop</th>
<th>Extension preop/postop (degrees)</th>
<th>Flexion preop/postop (degrees)</th>
<th>MEPS† Preop/postop (points)</th>
<th>Result†</th>
<th>Complications</th>
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<td>33</td>
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<td>Severe/mild</td>
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<td>10</td>
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<td>3</td>
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<td>15/TEA</td>
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<td>U</td>
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<td>130/130</td>
<td>35/95</td>
<td>S</td>
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<td>Severe/none</td>
<td>40/30</td>
<td>100/115</td>
<td>25/100</td>
<td>S</td>
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<td>Revision (PTA)</td>
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<td>50/55</td>
<td>74/95</td>
<td>30/60</td>
<td>S</td>
<td>Ulnar nerve</td>
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</table>

* Mayo Elbow Performance score
† S, satisfactory; U, unsatisfactory
‡ Post-traumatic arthritis
§ Total elbow arthroplasty
¶ Satisfactory for four years, then required TEA for recurrent pain
Table II. Preoperative and postoperative Mayo Elbow Performance score

<table>
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<th>Score Description</th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>p value</th>
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<td>Pain</td>
<td>3.3</td>
<td>33.3</td>
<td>0.0002</td>
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<tr>
<td>Movement</td>
<td>13.9</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>8.8</td>
<td>9.4</td>
<td></td>
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<tr>
<td>Function</td>
<td>8.3</td>
<td>21.1</td>
<td>0.001</td>
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<tr>
<td>Mayo Elbow Performance score</td>
<td>34</td>
<td>79</td>
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In our patients, the most common indication for DIA was post-traumatic stiffness. Patients with this problem are generally apparent within the first six to 12 months. Only one patient with poor relief of pain initially experienced subsequent improvement. A good initial result was predictive of a continued satisfactory result in 88% of cases whereas a poor initial result indicated an unsatisfactory final outcome in 80% of cases.

The indications for DIA in inflammatory and systemic conditions are limited since many patients have multiple involvement of joints and place lower demands on the elbow. They are suitable for a total elbow arthroplasty. For patients with inflammatory or systemic disease, DIA is indicated in those with high demands whose disability is mostly limited to the elbow. Two of the three patients in our study who met these criteria had a satisfactory result; one continues to work as a golf professional 4.5 years after surgery with almost no pain and a functional arc of movement.

In our patients, the most common indication for DIA was post-traumatic stiffness. Patients with this problem are...
younger and generally have no other limitation on their activities. There have been few reports on interposition arthroplasty for the treatment of this type of patient.\textsuperscript{5,8} In our series, seven of the ten patients treated for post-traumatic arthritis had initial satisfactory relief of pain. The alternative to DIA for patients with post-traumatic arthritis is TEA. This is felt to be the procedure of choice in the older patients with lower demands. Satisfactory results vary between 14\% and 75\%.\textsuperscript{3,11-14} Schneeberger et al\textsuperscript{2} recently reported objective results of 83\% and subjective satisfactory results of 95\% over a mean period of follow-up of 5.5 years, in 44 patients with post-traumatic arthritis treated by the semi-constrained Coonrad-Morrey prosthesis. The variation in results may reflect experience with different designs of implant. The distortion of the joint surfaces resulting from the loss of articular bone, from malunion, or from injury to the collateral ligaments may preclude the use of a resurfacing implant.

Our findings have shown that nine of 13 patients had a satisfactory result after DIA. The rate of success when the procedure is performed for inflammatory arthritis is similar to that for post-traumatic changes, about 67\%. In patients without pre-existing instability of the elbow it was 89\%. This procedure is a practical option for the treatment of painful arthritis of the elbow in young, high-demand patients. The expected outcome and limitations must be carefully considered before surgery.

Benefits may be received by the senior author from a commercial party related directly or indirectly to the subject of this article.

References