AVASCULAR NECROSIS OF THE HUMERAL HEAD
TREATED BY CORE DECOMPRESSION
A RETROSPECTIVE REVIEW

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Thirty shoulders, in 20 patients, which had undergone core decompression for symptomatic avascular necrosis of the humeral head were reviewed 2 to 14 years later (average 5.6).

Twenty-two showed good or excellent clinical results; the other eight shoulders had required arthroplasty. All 14 shoulders with stage I or II radiological changes (Ficat and Arlet 1980) at operation had good or excellent results.

We advocate early core decompression for symptomatic avascular necrosis of the humeral head.

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Avascular necrosis of the head of the humerus is uncommon and there have been few reports concerning its natural history and management (Cruess 1978; Rindell 1987; Laroche, Arlet and Mazieres 1990). Most series have implicated steroids as an aetiological factor in association with a variety of diseases such as systemic lupus erythematosus, asthma, and chronic renal disease (Cruess 1978; Rindell 1987; Laroche et al 1990).

Treatment has usually been by exercises and the avoidance of strenuous use and overhead movements of the shoulder (Cruess 1978). When these measures failed to relieve disability, hemiarthroplasty or total shoulder replacement has been used (Neer 1955; Cruess 1976; Neer, Watson and Stanton 1982).

Core decompression for the treatment of avascular necrosis of the femoral head has been reported extensively with success rates varying from 40% to 90% (Hopson and Siverhus 1988; Meyers 1988). Its use is controversial but it appears to be efficacious in the early stages of hip disease (stages I and II of Ficat and Arlet 1980). To date, there are no published reports of its use in the humeral head. We now describe our experience and the long-term follow-up of this method of treatment.

PATIENTS AND METHODS

We identified all patients who had undergone core decompression for the treatment of symptomatic avascular necrosis of the humeral head between 1977 and 1989 at the Johns Hopkins University School of Medicine or the Good Samaritan Hospital of Baltimore. Thirty-four core decompression procedures had been performed on 23 patients. Two patients (three shoulders) had been lost to follow-up in the immediate postoperative period and another patient (one shoulder) had died four months after operation from unrelated causes. The remaining 30 shoulders were reviewed at an average follow-up of 5.6 years (2 to 14). Preoperative imaging studies, operation reports, and pathology reports were examined retrospectively and final follow-up evaluations were made during a clinic visit (14 patients) or by telephone consultation with the patient or the patient’s doctor (six patients).

The patients’ mean age was 38 years (22 to 76); there were 11 women and 9 men with 30 affected shoulders. Steroid drugs had been given to 27 patients for a variety of primary diseases (lupus erythematosus, 7 shoulders; asthma, 5; trauma, 4; rheumatoid arthritis, 2; neuritis, 2; glaucoma, 2; multiple sclerosis, 2; Crohn’s disease, 2; renal transplant, 1. In only 3 shoulders was there no record of steroid dosage.

In all patients symptomatic treatment had failed to relieve the symptoms. The time from the onset of symptoms to the performance of core decompression averaged 9.6 months (3 to 48).

Imaging. Radiographic staging had been performed on anteroposterior and lateral films according to the system derived by Ficat and Arlet (1980) for the hip, adapted for the shoulder (Table I). Six shoulders had stage I changes, 8 stage II, 10 stage III, and 6 stage IV.

Isotope bone scans had been performed on seven
Table I. Radiographic classification of avascular necrosis of the shoulder according to Ficat and Arlet (1980)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Joint space</th>
<th>Head contour</th>
<th>Trabecular pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal</td>
<td>Normal</td>
<td>Osteoporosis</td>
</tr>
<tr>
<td>II</td>
<td>Normal</td>
<td>Normal</td>
<td>Wedge sclerosis</td>
</tr>
<tr>
<td>III</td>
<td>Normal or slightly decreased</td>
<td>Subchondral collapse</td>
<td>Sequestrum appearance</td>
</tr>
<tr>
<td>IV</td>
<td>Decreased</td>
<td>Collapse</td>
<td>Extensive destruction</td>
</tr>
</tbody>
</table>

patients (11 shoulders) preoperatively; all revealed increased uptake. Radiologically, these shoulders had been categorised as stage I (3), stage II (2), stage III (5), and stage IV (1).

Magnetic resonance images had been obtained from four patients preoperatively; all were consistent with avascular necrosis. One of these patients had stage II and three had stage III radiological changes. None of these patients had had isotope bone scans.

Operative procedure. A 2 cm incision was made in the anterior axillary fold just above the pectoralis major tendon. By blunt dissection within the deltopectoral interval the incision was carried down to the proximal humerus. A 5 mm diameter coring device was driven into the proximal humeral metaphysis just lateral to the bicipital groove. Care was taken not to enter the bicipital sulcus to avoid damaging the ascending branch of the anterior circumflex artery which may be the main vessel supplying the humeral head (Gerber, Schneeberger and Vinh 1990). Biplanar radiography was used for accurate localisation of the instrument within the head.

Biopsy specimens were examined in 19 of the 20 patients. In one patient (2 shoulders) with stage III radiological changes, the biopsy specimens were mislaid.

Postoperatively, the arm was kept in a sling for three to five days. Pendulum exercises were started on day one or two and actively assisted forward flexion, abduction, and rotation exercises were begun as soon as they were tolerated. Activities of daily living were not restricted except that heavy lifting was forbidden for three months. Patients who needed them were allowed to use crutches.

Clinical evaluation. Clinical evaluation was by the UCLA shoulder rating system (Kay and Amstutz 1988). Ten points were assigned in each of three categories, pain, function, and active movement, with a maximum score of 30 points. An excellent result scored 27 points or more; a good result 24 to 26; a fair result 21 to 23; and a poor result scored less than 21. Patients who required hemiarthroplasty or total shoulder arthroplasty were recorded as poor results.

RESULTS

Histological findings. There were 18 positive biopsies for avascular necrosis. The diagnosis was made on the evidence of fat necrosis and marrow fibrosis with wide trabeculae caused by apposition of new bone on dead bone. Ten of the biopsies were considered to provide doubtful evidence of avascular necrosis. They showed areas of appositional new bone and occasional trabeculae with empty lacunae, but no fat necrosis or marrow fibrosis. These specimens were reviewed retrospectively by another pathologist with the same results. Core biopsies of the humeral head are often fragile and do not always provide good specimens for histological diagnosis.

The eight patients (ten shoulders) with indeterminate histology all showed strong indirect evidence of avascular necrosis, including typical radiological changes in the humeral head, histologically proven avascular necrosis of other joints, and positive isotope scans or MR images (Table II). On these grounds we regard these ten shoulders as proven cases of avascular necrosis.

Clinical and radiographic results. At final follow-up 20 shoulders had an excellent UCLA score and two were good (Figs 1 and 2). Eight were poor, all having required either hemiarthroplasty or total shoulder replacement.

All shoulders with initial stage I or II changes (n = 14) had good or excellent results. Of the ten stage III shoulders, seven had excellent results and three required arthroplasty. Of the six stage IV shoulders one had a good result and five required arthroplasty. The time from core decompression to shoulder arthroplasty was less than one year in five patients (all stage IV) and four to six years in three.

At the time of follow-up 11 of the 14 stage I and II shoulders had not deteriorated radiologically; four of the ten stage III shoulders showed radiological progression; and all but one of the six stage IV shoulders had required replacement.

DISCUSSION

At an average follow-up of 5.6 years we found good and excellent results from core decompression of the humeral head in 73% of the shoulders reviewed in the series.

All patients with stage I or II radiological involvement had good or excellent results. Seven of the ten stage III shoulders had good or excellent clinical results despite the fact that four of them showed radiological progression. Core decompression did not appear to alter the progress of stage IV disease although it is worth noting that arthroplasty was delayed for up to five years in four of these cases.

All patients reported immediate pain relief after decompression, probably from decreased intraosseous pressure as has been shown after decompression of the femoral head (Hungerford 1979).

As with avascular necrosis of the hip, the results were better if decompression was done early, before the humeral head had collapsed. Although the anatomy of the humeral head is in some ways similar to that of the femoral head, the glenoid is much shallower and less conforming than the acetabulum and the shoulder does
AVASCULAR NECROSIS OF THE HUMERAL HEAD TREATED BY CORE DECOMPRESSION

Table II. Details of eight patients (ten shoulders) with indeterminate humeral head histology

<table>
<thead>
<tr>
<th>Case</th>
<th>Initial stage</th>
<th>Diagnosis</th>
<th>Other shoulder involved</th>
<th>Isotope bone scan</th>
<th>MRI</th>
<th>Other joints with positive histology</th>
<th>Final follow-up stage</th>
<th>Period of steroid usage†</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>II</td>
<td>Trauma</td>
<td>No</td>
<td>NA*</td>
<td>NA</td>
<td>L. hip</td>
<td>IV</td>
<td>Short</td>
</tr>
<tr>
<td>2</td>
<td>II</td>
<td>Trauma</td>
<td>Yes. Positive histology</td>
<td>NA</td>
<td>NA</td>
<td>Both hips</td>
<td>II</td>
<td>Short</td>
</tr>
<tr>
<td>3a</td>
<td>I</td>
<td>Asthma</td>
<td>Yes. Indeterminate histology</td>
<td>Positive</td>
<td>NA</td>
<td>R. hip</td>
<td>I</td>
<td>Long</td>
</tr>
<tr>
<td>3b</td>
<td>III</td>
<td>Asthma</td>
<td>Yes. Indeterminate histology</td>
<td>Positive</td>
<td>NA</td>
<td>R. hip</td>
<td>TSA‡</td>
<td>Long</td>
</tr>
<tr>
<td>4</td>
<td>I</td>
<td>SLE§</td>
<td>Yes. Positive histology</td>
<td>NA</td>
<td>NA</td>
<td>Both hips</td>
<td>I</td>
<td>Long</td>
</tr>
<tr>
<td>5</td>
<td>I</td>
<td>Renal transplant</td>
<td>No</td>
<td>Positive</td>
<td>NA</td>
<td>Both hips</td>
<td>I</td>
<td>Long</td>
</tr>
<tr>
<td>6a</td>
<td>III</td>
<td>Glaucoma</td>
<td>Yes. Indeterminate histology</td>
<td>NA</td>
<td>Positive</td>
<td>Both hips</td>
<td>III</td>
<td>Short</td>
</tr>
<tr>
<td>6b</td>
<td>II</td>
<td>Glaucoma</td>
<td>Yes. Indeterminate histology</td>
<td>NA</td>
<td>Positive</td>
<td>Both hips</td>
<td>II</td>
<td>Short</td>
</tr>
<tr>
<td>7</td>
<td>IV</td>
<td>SLE</td>
<td>No</td>
<td>Positive</td>
<td>NA</td>
<td>None</td>
<td>TSA</td>
<td>Long</td>
</tr>
<tr>
<td>8</td>
<td>II</td>
<td>SLE</td>
<td>Yes. Positive histology</td>
<td>NA</td>
<td>NA</td>
<td>Both hips</td>
<td>II</td>
<td>Long</td>
</tr>
</tbody>
</table>

* not applicable, test not performed  
† short < 2 months; long > 2 months  
‡ total shoulder arthroplasty  
§ systemic lupus erythematosus

Figure 1a – Avascular necrosis of the shoulder associated with steroid treatment for systemic lupus erythematosus. The preoperative isotope bone scan showed increased uptake. Biopsy showed the histological changes of avascular necrosis. Figure 1b – Six years after core decompression there has been some humeral head collapse, but clinically the shoulder was rated as 'excellent'. Figure 1c – Twelve years after decompression the patient complained of 'catching' in the shoulder. Several loose bodies were removed and the symptoms resolved.

Figure 2a – Avascular necrosis of the shoulder associated with steroid treatment for asthma. The diagnosis was confirmed by MRI and bone biopsy. Figure 2b – Three years after core decompression the patient had no clinical symptoms.
not sustain the body-weight. For these reasons the shoulder may continue to function satisfactorily despite considerable deformity, and shoulder decompression may be more efficacious in later stages of the disease, stage III, than it is in the hip. Since the only other effective treatment for pain in the shoulder from avascular necrosis is arthroplasty, the minimally invasive procedure of core decompression would seem to be the procedure of choice.

All the patients included in our series had significant shoulder symptoms that persisted despite conservative treatment. Core decompression provided virtually immediate symptomatic relief with complete return of function. However, since AVN of the shoulder is a rare condition, no large series have been reported and the natural history of the condition is unknown. Therefore, the influence of core decompression on the natural history in our patients must remain uncertain.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


