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PROSTHETIC ARTHROPLASTY OF THE SHOULDER

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Twenty-six patients, 18 with rheumatoid arthritis, underwent arthroplasty of the shoulder between 1973 and 1980, with an average follow-up of 3 years. The Stanmore and Kessel arthroplasties and the Neer hemiarthroplasty were used. Twenty-one patients undergoing 22 elective arthroplasties considered that the operation was worthwhile. Pain was completely relieved in 12 shoulders. Movement was improved in 18 shoulders. The priority of restoring movements which improved independence and self-respect is emphasised; the results were far superior to those obtained by an arthrodesis.

Key words: fractures; joint prosthesis; osteoarthrosis; rheumatoid arthritis; shoulder

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Since 1973, patients attending the Royal National Hospital for Rheumatoid Disease in Bath have been considered candidates for total prosthetic arthroplasty of the shoulder. Poor shoulder function in a polyarthritic patient was frequently a critical contribution to overall disability and when this was associated with severe, constant pain, unrelieved by adequate medical and physical therapy, arthroplasty was considered. Radiographic changes ranged from loss of joint space to gross erosion of the adjacent articular surfaces with occasional dissolution of the humeral head. Initially, the Stanmore prosthesis was used and later the Kessel reversed ball and socket design. When these prostheses could not be adequately placed due to a small, fragile glenoid, then a Neer hemiarthroplasty was inserted.

Our primary aim was to achieve pain relief, not only at rest but sufficient to allow the patient to sleep on the affected side; secondarily we hoped to improve movement, in accordance with the aims of the original designers (Lettin & Scales 1973, Neer 1974).

This paper is a result of our preliminary experience with shoulder arthroplasty.

PATIENTS AND METHODS

There were 26 patients: 18 suffered from rheumatoid arthritis, one from primary osteoarthrosis, two from long-standing post-traumatic osteoarthrosis and the remaining five had sustained fresh fracture dislocations. The average age was 59 (25–78) years and follow-up averaged 3 years (5 months – 8 years). Twenty-seven arthroplasties were performed. The one bilateral case had rheumatoid arthritis. The type of prosthesis used in each aetiological group is shown in Table 1.

General anaesthesia and a standard delto-pectoral approach were used. A coracoid osteotomy was performed in all cases, except one Kessel arthroplasty and the group of fresh fractures.

The stability of the prosthesis was checked, particularly in full internal and moderate external rotation. The superior rotator cuff was significantly attached in one arthritic patient only and therefore no attempt was made to repair the cuff in these cases. In the fresh fracture group the superior rotator cuff and tuberosity fragments were re-attached. The subcapsularis was repaired in all patients. Suction drainage was used routinely. In the post-operative phase the arm was im-

Table 1. Total patients and groups by type of arthroplasty and aetiology. The fresh fractures occurred in an older group.

Patients	No.	Rheumatoid arthritis	Osteoarthrosis and trauma	Average age (years)	Average follow-up years	
Stanmore arthroplasty	4	3	1	54 (51–58)	7	Bilateral case with R.A.
Kessel arthroplasty	9	9	0	52 (25–75)	2	
Neer hemi-arthroplasty	3	–	–	66 (33–78)	2	
		6	–	57 (33–77)	3	
		–	7	73 (66–78)	2	
Total	26					

mobilised in a triangular sling and bandage for a period of between 5 and 12 days.

No attempt was made to protect the rotator cuff, apart from active assisted exercises which all patients performed to a variable degree; most required physiotherapy for 2 or 3 months.

RESULTS

Pain

Twenty-one patients underwent 22 elective arthroplasties; all patients had relief of pain. The pre-operative pain level and the pain levels at final review for each shoulder were compared (Table 2). The small group of fresh fracture patients was added to assess the discomfort that may be expected from the Neer prosthesis alone.

Movements

When the average maximum range of combined humeroscapulothoracic abduction and internal rotation achieved with each type of prosthesis was compared, the Kessel showed the greatest improvement (Figure 1). We also studied the rate of progress of abduction with each prosthesis, from 1 month after operation to final review. Most patients continued to improve abduction for 6 months but fresh fracture patients improved for 12 months.

Function

One rheumatoid patient developed a remarkable increase in bulk of the deltoid muscle after a Neer

Table 2. Pre-operative pain in 22 shoulders in 21 patients. Post-operative pain at review. The five fresh fracture patients show that some post-operative pain may be expected in the absence of arthritis.

	Pain			
	None	Slight	Moderate	Severe
Pre-operative rheumatoid and osteoarthrosis	–	–	–	22
Post-operative				
Stanmore (5)	3	1	1	–
Kessel (9)	5	4	–	–
Neer (8)	4	3	1	–
Post-operative fresh fractures				
Neer (5)	2	3	–	–

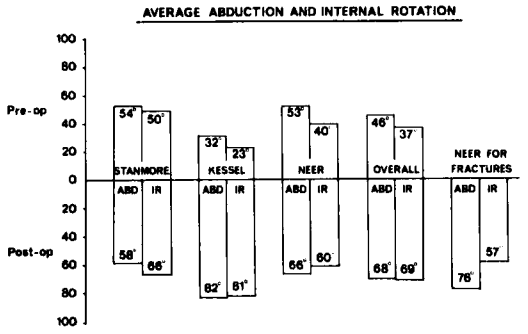

Figure 1. Pre- and post-operative average ranges of abduction (ADB) and internal rotation (IR) compared for each type of arthroplasty. Postoperative ranges for the fresh fracture group are compared.

hemiarthroplasty. All 21 patients felt their daily living abilities had improved and that the operation had been worthwhile.

Complications

Post-operative subluxation of a Neer prosthesis inserted for a fracture occurred and persisted for 12 days. It was painful, but corrected spontaneously with physiotherapy and within 9 months the patient was able to achieve 150° of painless combined abduction.

One late subluxation of a Neer prosthesis for fracture occurred in the second month. There was moderate pain initially but it settled rapidly although physiotherapy was required for 1 year.

One patient initially had a Kessel prosthesis, which was unstable due to bone impingement following erosion of the glenoid fossa, and this prosthesis dislocated. Within 48 h a Neer prosthesis was inserted and this was exceptional in that bone cement was required to achieve fixation. Three years later the patient had slight pain with use, 60° combined abduction and 50° internal rotation. He considered the operation worthwhile.

There were no infections or wound haematomata of the elective arthroplasties. A lucent zone was noted around the glenoid implant of two of the Stanmore prostheses although measurable displacement or movement did not occur, and there was no change in functional ability.

DISCUSSION

The patients who were offered arthroplasty in this study suffered severe, constant, disabling pain and considerable loss of movement, partly due to the pain, but also to mechanical factors such as superior humeral subluxation and subacromial impingement. Our patients had very little if any rotator cuff function and therefore arthroplasty had to compensate for this as well as relieve pain. The deltoid muscle can achieve 90° of abduction in the absence of rotator cuff function (Bechtol 1980), and the power of abduction can be enhanced by providing a fixed fulcrum which constantly maintains a depressed position of the humeral head, thus mimicking the action of an intact rotator cuff (Inman et al. 1944). Clearly, the requirements for maintaining the humeral head in a depressed state can be achieved, either with a linked ball and socket design, or, with a non-linked type with a large subacromial and glenoid spacer (McNab 1976). The non-linked design suffers the risk of dislocation either in the early post-operative phase or later when it is more difficult to treat, but it can allow greater range of movement. Because non-linked prostheses are unstable with poor musculature we prefer a linked prosthesis in our polyarthritic patients. The Kessel type appears to have given the best and most reliable results in our hands. The linked prostheses are, however, limited by design in abduction and rotation, and if there is any error in emplacement, then acromial impingement will also limit movement. Subacromial impingement occurred in our patients with Stanmore arthroplasties and accounts for the limited abduction but impingement also occurred with Kessel prostheses when replacing a large humeral head.

Limited abduction is not a problem because activities such as combing hair or brushing teeth can be achieved with flexion and internal rotation.

In our series all patients were able to reach their mouths, buttocks or the small of their backs, but only one Neer arthroplasty for fracture, seven Kessel and two Stanmore arthroplasties allowed patients to reach the back of their necks. Our overall results, therefore, are at least as good as arthrodesis, but the total arthroplasties are bet-

ter, 9 out of 14 patients being able comfortably to reach the back of their necks.

We therefore maintain that there is significant advantage in a painless shoulder with a good range of internal rotation, even if the patient fails to regain more than 60° combined abduction. It is of interest that good ranges of combined abduction beyond 90° could be achieved with Neer hemiarthroplasties after fracture if the greater tuberosity did not impinge.

Arthroplasty of the shoulder should still be reserved for patients with severe disabling pain. Arthroplasty is preferred to arthrodesis because the maintenance of a range of internal rotation greatly improves the patient's function, particularly in the presence of progressive polyarthropathy. All prostheses with a restricted range of rotation should be placed to allow free internal rotation from neutral; any external rotation would then be a bonus.

A linked prosthesis should be placed to maintain a depressed humeral head relative to the acromion and provide a mechanical advantage for the deltoid. This also avoids acromial impingement. A non-linked prosthesis has the greatest potential for achieving a good range of abduction if it provides a painless, stable fulcrum and the deltoid muscle length and power are maintained. However, wide abduction is not essential in the daily living requirements of our patients with polyarthritis and atrophic muscles, and we therefore prefer the stability of a linked prosthesis.

REFERENCES

Bechtol, C. O. (1980) Biomechanics of the shoulder. *Clin. Orthop.* **146**, 37–41.

Inman, V. T., Saunders, J. C. de C. M. & Abbot, L. C. (1944) Observations on the function of the shoulder joint. *J. Bone Joint Surg.* **26**, 1–30.

Lettin, A. W. F. (1979) Arthroplasty of the shoulder. In: *Operative surgery,* (Ed. Rob, C., Smith, R.), 3rd edn. *Orthopaedics,* Part II, pp. 472–478. Butterworth and Co Ltd, London.

Lettin, A. W. F. & Scales, J. T. (1973) Total replacement arthroplasty of the shoulder in rheumatoid arthritis. *J. Bone Joint Surg.* **55**-B, 217.

McNab, I. (1976) Development of a gleno-humeral arthroplasty for the severely destroyed shoulder joint. *J. Bone Joint Surg.* **58**-B, 137.

Neer, C. S. (1974) Replacement arthroplasty for gleno-humeral arthritis. *J. Bone Joint Surg.* **56**-A, 1–13.

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