Radiolunate arthrodesis
A PROCEDURE FOR STABILISING AND PRESERVING MOBILITY IN THE ARTHRITIC WRIST
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We carried out arthrodesis of the radiolunate joint in 46 wrists (38 patients) for pain and ulnar translation of the carpus because of rheumatoid (42) or psoriatic arthritis (4). At follow-up, three patients had died and in three (1 bilateral) an additional midcarpal arthrodesis had been undertaken. The remaining 32 patients (39 wrists) were evaluated after a mean of five years.

The clinical results were good with a mean visual analogue score of 8.3 for pain, 7.2 for hand function and 9 for overall satisfaction. Except for palmar flexion, mobility was equal to or better than before operation. Radiologically, there was deterioration of the midcarpal joint with an increase in the Larsen score from 1.8 to 2.7 (p < 0.001), some decrease in carpal height and recurrence of carpal translation.

Radiolunate arthrodesis gives good clinical results at five years although there is some deterioration radiologically.

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Patients with early rheumatoid arthritis (RA) suffering painful synovitis of the wrist which is not controlled by conservative means, are commonly offered synovectomy and resection of the distal end of the ulna. As an alternative radiolunate (RL) arthrodesis can be carried out. This partial wrist arthrodesis has not yet been widely accepted as treatment for the early and middle stages of rheumatoid disease. Besides being helpful for a painful arthritic wrist, surgical stabilisation may also have the advantage of preventing or delaying the development of the typical zig-zag deformity of the arthritic hand.

Radiolunate arthrodesis was first described by Chamay, Della Santa and Vilaseca. They observed that in cases of spontaneous radiolunate fusion there was no further subluxation of the carpus and that a functional range of movement was preserved. Several authors have reported short-term results, showing that function is improved and pain decreased, but that carpal deterioration continues. In 1995 Della Santa and Chamay described radiological results with a mean follow-up of five years, showing that carpal subluxation was prevented, but that there was a progressive radiological deterioration in most wrists. This extensive study presented a wide range in the follow-up period, making it difficult to apply generally. There are, to our knowledge, no studies with a medium- to long-term follow-up, especially in regard to the clinical outcome. We have studied our results retrospectively in order to determine whether the results of this procedure remain satisfactory with longer follow-up.

Patients and Methods

Radiolunate arthrodesis was introduced in our hospital in 1989 for the treatment of arthritic wrists with moderate to severe destruction of the radiocarpal joint, especially when this was combined with an ulnar translation of the carpus. Severe disease of the midcarpal joint was considered a contraindication to this procedure.

We have studied 38 patients (27 women and 11 men) who were subjected to radiolunate arthrodesis between 1989 and 1994. The diagnosis of RA was made in 35 patients and of psoriatic arthritis in three. Eight patients had bilateral procedures giving a total of 46 operations. Except for four, two with psoriatic arthritis and two with RA, all patients also had a resection of the distal end of the ulna because of a painful distal radio-ulnar joint. The mean age at operation was 52 years (23 to 77). The mean duration of disease was 11 years (3 to 40) and the mean duration of symptoms in the wrist was five years (1 to 12).

All except one of the arthrodeses were fixed with titanium staples. Morsellised cancellous bone graft was added in all cases, from the resected ulna in 42 and from the distal radius in four. Postoperatively, the wrist was immobilised in a forearm cast for six weeks. By 1997, three patients had died and in three (4 wrists) a subsequent midcarpal arthrodesis had been carried out, leaving 32 patients with 39 radiolunate arthrodeses available for review at a mean
follow-up of five years (3 to 8). In addition to the arthrodesis, the scaphoid was also fixed to the radius in 11 wrists (RSL arthrodesis) because of substantial damage to the cartilage of the radioscpohoid joint. The patients were studied retrospectively, both clinically and radiologically.

The range of movement (ROM) of the wrists was measured by a goniometer and compared with the observations at the time of surgery. Visual analogue scales (VAS) for pain, hand function and satisfaction were recorded by the patients at follow-up. A score of 0 indicated the most severe symptoms and of 10 normal or satisfactory function. Standard PA and lateral views of the hand and the wrist were taken before and after operation and at follow-up. To quantify the radiological results, a modified Larsen score was used; the carpal height index as described by Youm et al and the carpal translation index as described by Chamay were measured by an independent radiologist. Statistical analysis of the ROM and the radiological data were calculated by paired sampled Student’s t-tests using SPSS (SPSS Inc, Chicago, Illinois).

Results

Before operation, the mean modified Larsen scores for the radioulnare and radioscpohoid joints were 2.7 (SD 1.3) and 2.2 (SD 1.2), respectively, indicating that most of the wrists had medium-stage disease. At follow-up, all radioulnare arthrodeses showed solid fusion, but in three of the 11 RSL arthrodeses the scaphoid failed to unite to the radius, producing minor symptoms. Staples entered or crossed the midcarpal joint in 12 wrists, making their removal after bony union necessary. This malposition of the staples occurred mostly in the first years of the study, before their position was routinely checked radiologically during operation. No other complications occurred.

At follow-up, the mean VAS was 8.3 (SD 1.9) for pain, 7.2 (SD 2.7) for function and 9 (SD 2.1) for patient satisfaction. In the wrists for which preoperative details were available mobility, dorsiflexion, radial and ulnar deviation and supination increased significantly, but there was a decrease in palmar flexion (Table I). No wrist developed a deformity. There were no notable differences at follow-up between the whole group and those for which preoperative information was available. At follow-up the mean range of movement was dorsiflexion 41°, palmar flexion 31°, ulnar deviation 20° and radial deviation 18°.

Radiologically, the modified Larsen score at the midcarpal joint showed progressive deterioration from 1.8 preoperatively to 2.7 at follow-up (p < 0.001). Surprisingly, however, the joint remained asymptomatic in most patients. The modified Larsen score of the triquetrolunate and scaphotrapezotrapezoid joints and the first carpometacarpal joint showed marked deterioration. Compared with the carpus, the hand joints showed less regression (Table II). The carpal height index decreased from 0.45 just after operation to 0.41 at follow-up. The ulnar translation index increased from 0.33 after operation to 0.36 at follow-up (Table III).

Discussion

The wrist is often involved in RA. Fleming, Crown and Corbett and Fleming et al reported that 4.5 years after onset of the disease the wrist is involved as often as the finger joints, although initially the incidence in the hand is higher. Fuchs et al described an approximately linear correlation between the duration of RA and the radiological damage to the hand and wrist. They did not, however, distinguish between the finger joints and the wrist. Scott, Coulton and Propert showed that after ten years the wrist is more severely affected than the hand. Belt, Kaarela and Lehto confirmed this pattern at 20 years. Hindley and Stanley also found greater damage in the wrist compared with the metacarpophalangeal joints.
9.5 years after onset of the disease. They advised earlier surgical intervention for the radiocarpal joint, particularly by way of radiolunate fusion, because the lunate fossa showed the most advanced destruction. This difference in progression of the disease between the wrist and hand is confirmed in our patients. Härmäläinen et al.\textsuperscript{12} in a prospective study, found that half of their patients showed an ulnar displacement of the carpus between four and five years, whereas other radiological changes, such as erosion and narrowing of the joint space, appeared later. Instability of the radiocarpal joint is an early phenomenon in the rheumatoid wrist and very likely to deteriorate. Both ulnar translation and radiolunate destruction can be treated by radiolunate arthrodesis.

The lunate, located in the centre of the proximal row of the carpus and connected to the radius and the other carpal bones by strong ligaments, transmits most of the forces from the hand to the forearm.\textsuperscript{13} This makes radiolunate arthrodesis most appropriate for restoring stability to the unstable arthritic wrist. Since it does not affect the mobility of the midcarpal joint a stable and mobile wrist should result.

Synovectomy with or without resection of the head of the ulna is known to produce acceptable clinical results, but radiological deterioration is not prevented, either at the wrist\textsuperscript{14,15} or other joints affected by RA.\textsuperscript{16} Resection of the distal ulna has been reported to exaggerate this instability, and can even lead to a dislocation of the radiocarpal joint.\textsuperscript{17-19} More importantly, progressive instability of the wrist will produce the typical bayonet deformity, often combined with a radial deviation of the hand. This position is known to initiate or accentuate an ulnar deviation of the metacarpophalangeal joints, the zig-zag deformity.

Chamay et al.\textsuperscript{1} were the first to report the short-term results of radiolunate arthrodesis in RA. They described the results of 12 spontaneous and seven operative radiolunate fusions. Follow-up was for five years in the spontaneous group but for only one year in the operative group. Functional mobility was maintained in both groups and there was only minimal loss of carpal height and increase in ulnar translation. Linscheid and Dobyns\textsuperscript{2} reported 16 radiolunate arthrodeses in RA and four in post-traumatic cases. Their mean follow-up was for 28 months. Within the rheumatoid group the overall results were good in 13. Stanley and Boot\textsuperscript{3} presented the clinical and radiological results of 16 radiolunate arthrodeses, all in RA. Clinical results were good in 12. Poor or fair results occurred in four wrists, mostly due to rapidly progressive disease. Loss of carpal height and a recurrence of carpal translation were not recorded and their mean follow-up was for only two years (1 to 3). Della Santa and Chamay\textsuperscript{4} reported the radiological results of 22 radiolunate arthrodeses carried out for RA with a mean follow-up of five years and compared these with 11 contralateral wrists which had not had an operation. They found the same deterioration in both groups, but the relationship to the clinical outcome was not discussed. There was also a wide range in length of follow-up (1 to 15 years).

Our clinical results, after a mean of five years, are very satisfactory as regards reduction of pain and patient satisfaction. Mobility increased in all directions except palmar flexion. The slightly reduced range of movement at follow-up has not lead to functional impairment. Since fixed radial deviation of the wrist did not develop, the risk of a zig-zag deformity with ulnar deviation of the metacarpophalangeal joints seems to be diminished. We have no reliable preoperative data about the finger joints and this can only be established by a prospective study.

The question remains as to whether, with time, the midcarpal joint will become progressively affected and symptomatic, making arthrodesis of the wrist necessary. In our series of 46, four wrists later required a more extensive midcarpal fusion and must therefore be considered poor results. Of the remainder, there has been a significant progression of destruction of the midcarpal joint with time, and yet the clinical results remain favourable (Fig. 1).\textsuperscript{1}

\textbf{Fig. 1a}  \hspace{1cm} \textbf{Fig. 1b}  \hspace{1cm} \textbf{Fig. 1c}

Radiographs of a 68-year-old woman who had suffered from RA for 7.5 years showing: a) ulnar translation of the proximal carpal row and symptomatic radiocarpal and distal radio-ulnar joints before surgery; b) restoration of radiocarpal subluxation (the midcarpal joint had a modified Larsen score of 2) after surgery; and c) the midcarpal joint with progressive narrowing (modified Larsen score 3) five years after operation, although the clinical result was excellent.
Destruction at the midcarpal joint appears to be less symptomatic and better tolerated than at the radiocarpal joint, probably because the midcarpal joint has a greater intrinsic stability. Our results also show that there is no need to add fusion of the radioscpahoid joint to radiolunate arthrodesis since the clinical results of the latter procedure alone are very satisfactory, and a fusion of the radioscpahoid joint does not give greater stability to the wrist.

Conclusions

In RA radiolunate arthrodesis gives a stable and comfortable wrist with improved mobility after five years. Deterioration of the midcarpal joint is not prevented. Conversion to a total wrist arthrodesis is rarely required. Radiolunate arthrodesis is to be recommended in early- to medium-stage wrist disease if symptoms continue in spite of adequate conservative treatment. It is indicated when there is synovitis with pain in the radiocarpal joint on clinical examination, an ulnar translation of the carpus and a good midcarpal joint on radiographs. It can safely be combined with resection of the head of the ulna.

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References