EXCISION OF THE CARPAL SCAPHOID FOR UNUNITED FRACTURE

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During the last twenty years great progress has been made in the diagnosis and treatment of fractures of the carpal scaphoid. Formerly non-union was the accepted end-result (Jones and Lovett 1923), but union by bone is now obtained in a high proportion of recent fractures. Nevertheless, non-union is still common. Most cases are discovered by chance or because the patient has a second injury. Certainly many patients with non-union have performed strenuous work for many years with nothing more than vague discomfort, and the accidental discovery of non-union does not demand special treatment. It must, however, be regarded as a potential source of trouble for two reasons: first, because of the almost inevitable development of osteoarthritic changes; and second, and far more important, because of the disastrous effects that often follow a further injury, particularly if arthritic changes are already present. The aggravated traumatic arthritis is seldom relieved by conservative treatment and the capacity of the patient for work may be greatly and permanently diminished.

Several observers have reported the results of total excision of the scaphoid (Böhler 1929, Aleman 1937–38, Soto-Hall 1948), but the relatively small numbers of cases left no margin to allow for the possibility of unfortunate selection. Hirsch (1935) reported favourably on nine patients, and Davidson and Horwitz (1938) were equally satisfied with the results of eight. All these observers believed that the operation should be done before the development of arthritis, but it must be remembered that arthritic changes are often present when the non-union is first recognised. We consider that total excision of the ununited scaphoid is of considerable value in selected cases.

TREATMENT OF NON-UNION BY TOTAL EXCISION OF THE SCAPHOID

This paper reports the end-results in nineteen patients who were treated by total excision of the bone. With two exceptions the disabling symptoms had been caused by a second injury. In all of them rest and physiotherapy had been tried without success. Of the nineteen patients, seventeen have been examined recently by the writer and two have replied to detailed questionnaires. One woman who was operated on by another surgeon thirteen years ago is included because the operation was performed only six months after the initial injury; in the other eighteen, all personal cases, eighteen months was the shortest intervening period. Seventeen patients were men and two were women. The average age at the time of operation was thirty-two years, the youngest being nineteen and the oldest fifty-one years. Excision was performed thirteen years ago in one patient, five to seven years ago in ten patients, and one to five years ago in eight patients.

Technique of the operation—A straight incision is made over the anatomical snuff box. The radial vessels and branches of the radial nerve are retracted and the capsular tissues are dissected off the dorsal aspect of the scaphoid. The bone is excised after careful division of the interosseous ligaments by a tenotomy knife and without any unnecessary use of elevators. The structures attached to the tuberosity are best dissected off at an early stage and a preliminary incision over the palmar aspect of the wrist may be used for this purpose. Forcible removal of the bone, causing damage to adjacent articular surfaces and stretching of ligaments, may be responsible for some of the disappointing results that have occurred after this operation.

Excision of the radial styloid process—The tip of the styloid process was excised in several patients and this should be done in every instance where there is marked arthritic "pointing."

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This opinion is supported by the findings of Barnard and Stubbins (1948). It was noted, however, that the end of the styloid process gradually becomes rounded of its own accord after excision of the scaphoid (Figs. 1 and 2). The wide excision of the radial styloid advocated by Barnard and Stubbins is contra-indicated when the scaphoid bone is also being excised because instability of the wrist joint may result.

![Fig. 1](image1.png) ![Fig. 2](image2.png)

A patient aged fifty years complained of severe pain after a recent injury to the wrist. Figure 1 shows the old ununited fracture of the scaphoid, "pointing" of the radial styloid process and general arthritis. The lateral view showed forward sliding of the semilunar. Figure 2 is the radiograph five years after complete excision of the scaphoid. The radial styloid process, which was not excised in this case, has rounded off. There is no radial deviation of the wrist. Full movements were regained.

![Fig. 3](image3.png) ![Fig. 4](image4.png)

Patient aged twenty-seven years. The proximal pole of the scaphoid bone had been removed eighteen months previously. There was persistent pain and disability. Figure 4 shows the same case six years after excision of the distal fragment of the bone. No arthritis has developed. Movements are full and the patient is doing strenuous work.

*After-treatment*—The wrist joint is immobilised on a short cock-up splint until all signs of irritation have subsided, usually after four to seven weeks. There is certainly nothing to be gained from encouraging movement too early. When movements are begun, progress is rapid, and most patients return to light work within two to four months.
Excision of the proximal fragment only—There are several reasons for opposing this method of treatment. The operation is difficult and may cause damage to the surrounding articular surfaces and ligaments; after removal of the proximal pole, the sharp edge of the distal fragment impinges against the lower end of the radius; and arthritic changes in cases of non-union usually appear first between the radial styloid and the distal fragment. It seems irrational therefore to retain the distal fragment (Figs. 3 and 4). In this series, one patient who had been treated by excision of the proximal pole gained relief only after excision was completed. In another patient the proximal pole was overlooked, yet the final result was "good" (Figs. 5 and 6).

Three factors concerned in the late results of total excision—1) The age of the patient—The worst results were in patients over the age of forty years with established arthritic changes, but in the same group there were just as many with remarkably good results. It is difficult to account for such variation in a similar group of patients.
2) Clinical evidence of arthritis—Disappointing results are likely to occur in patients of any age who show marked thickening on the dorsal aspect of the wrist joint and arthritic lipping.
between the os magnum, semilunar and radius (Fig. 7). In such cases dorsiflexion tends to remain limited and pain may persist over the dorsum.

3) **Subluxation of the os magnum and semilunar**—Posterior displacement of the head of the os magnum, as if there had been an incomplete perilunar subluxation, is also unfavourable (Fig. 8). In long standing cases there is a tendency for the semilunar to displace forwards with attenuation of its posterior part. This has been noted by other observers (Aleman 1937-38, Hirsch 1935, and Lambrinudi 1943). It may well be that in all these cases the original injury was in fact an incomplete perilunar transcarpal dislocation, spontaneously reduced but nevertheless associated with tearing of the interosseous ligaments. It may also be that such ligamentous damage is an important cause of non-union of the fracture.

To summarise, the result of excision should be good when the unfavourable factors just mentioned are absent. Even when there is doubt, nothing is lost and much may be gained by "trial" excision. If this fails, arthrodesis is no more difficult and may be even more certain, because there is a large space into which bone chips can be packed after excision of the scar tissue.

**TABLE 1**

<table>
<thead>
<tr>
<th>Age at time of operation</th>
<th>Number</th>
<th>Very good</th>
<th>Good</th>
<th>Fair</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-50 years</td>
<td>7</td>
<td>—</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>30-40 years</td>
<td>3</td>
<td>—</td>
<td>2</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>20-30 years</td>
<td>9</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>Totals</td>
<td>19</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

*Very good*. Practically full movement, no pain, capable of strenuous work.

*Good*. Able to handle tools of all kinds and perform fairly strenuous wrist work, for example joinery.

*Fair*. Pain when using tools, but capable of light work.

*Bad*. Complaining a good deal and fit for very light work only.

**ANALYSIS OF RESULTS**

The results are analysed in relation to three age groups.

1) **Age 40 to 50 years—seven patients**—In all these, the fractures were old; there was marked arthritis and movements were limited. All had sustained a recent injury and complained of severe pain. Three results were "good" and the patients could use their wrists strenuously and had little or no pain; two had a full range of movement five and six years after operation (Figs. 1 and 2). Three patients were not improved and were classified as "bad" results (Figs. 7 and 8). In one an arthrodesis has since been performed while the other two are doing light work. The remaining patient in this group, though improved, was classified as "fair" only.

2) **Age 30 to 40 years—three patients**—In one, there was arthritic lipping between the posterior margin of the radius and the semilunar; the result three years later was only "fair." The other two were operated on five and seven years ago respectively; there was minimal arthritis and the results were "good" with no evidence of deterioration.

3) **Age 20 to 30 years—nine patients**—In all of these, arthritic changes were either absent or moderate. Two patients who have not been examined clinically were classified as "fair" because they were still complaining of symptoms of moderate degree; one was still in the Army four years after operation, and the other was doing factory work. In the other seven patients the results were either "good" or "very good." In one man, the proximal pole of the
Figure 7 shows the radiographs of a patient, aged forty-two years, with an ununited fracture of the scaphoid. Note the arthritic changes on the dorsal and radial aspects of the joint, and also the posterior subluxation of the head of the os magnum. Figure 8 shows the radiograph four years after complete excision of the scaphoid. This gave a "bad" result. The patient is doing light work in a coal mine.

The scaphoid had been excised but pain and disability persisted until the remaining part of the bone was excised two years later (Figs. 3 and 4); since then he has worked as a milk roundsman with nothing more than aching in cold weather and some weakness. In another case a bone graft had been performed eighteen months before the excision. Of the three patients classified
as "very good," one was the woman already mentioned who had been operated on thirteen years ago, and two were engaged in very heavy occupations five and six years after operation.

Late results and late displacement of the semilunar—No deterioration of the wrist joints appears to have taken place in any patient after operation. In three, the condition was much improved by manipulation. Late radiographs show that in some cases there had been progressive forward displacement of the semilunar bone (Figs. 5 and 6); but this displacement was also present in several patients before operation and its significance is not quite clear. As the semilunar slides forward, the head of the os magnum and the posterior margin of the radius come into close contact and this may possibly lead to local arthritic changes.

Movements of the wrist joint after excision of the scaphoid—All patients suffered from some degree of stiffness before operation; in none were movements affected adversely but in the four patients with bad results there was no improvement. Four patients regained practically full movement and in the remaining eleven the range was improved. Maximal recovery sometimes took a year or more. Radial deviation of the hand was not seen and radiographs taken after several years show the wide gap still present at the site of excision (Figs. 2, 4).

CONCLUSIONS

1. The late results in nineteen cases of total excision of the carpal scaphoid bone for ununited fracture have been reviewed.

2. The results are least satisfactory when there is clinical evidence of arthritis on the dorsal aspect of the wrist, or subluxation of the os magnum and semilunar. In other cases good results usually can be expected.

3. The operation must be done carefully without injury to the neighbouring bones and ligaments. Total excision is preferable to excision of the proximal pole alone.

REFERENCES