ARTHRODESIS OF THE WRIST IN RECONSTRUCTIVE SURGERY


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Arthrodesis of the wrist is often indicated after injuries of the brachial plexus or of more than one peripheral nerve, in anterior poliomyelitis, and in certain cases of Volkmann's ischaemic contracture. A frequent indication for the operation is the liberation of the tendons of forearm muscles for subsequent transplantation to the fingers.

Most techniques make use of a dorsal skin incision with division of the extensor retinaculum and displacement of the extensor tendons. This encourages the formation of adhesions which may mar the result of any subsequent tendon transplantation. In many cases it is impossible to predict whether arthrodesis of the wrist will eventually be required in addition to tendon transplantation: in such cases, the tendon transplantation should be done as a first step, and the tendons should not be disturbed by any subsequent operation on the wrist.

Smith-Petersen (1940) described a medial approach with excision of the lower end of the ulna which was used as a graft to bridge the resected wrist joint. This operation leaves the dorsal structures undisturbed, but produces a thickened unsightly wrist. Seddon (1952) modified the operation to overcome this, and his technique, used regularly since 1946, has given satisfactory results.

TECHNIQUE OF OPERATION

A pneumatic tourniquet is used, but is released before the wound is closed. A four-inch incision is made on the medial side of the wrist over the lower end of the ulna and over the carpus. The dorsal branch of the ulnar nerve is identified and protected (Fig. 1). The lower end of the ulna is exposed subperiosteally, and two cuts are made with a motor saw outlining a triangular graft with its base posteriorly, which in the average adult wrist is about two and a half inches long (Fig. 2). The graft is removed together with the head of the ulna.

The carpus and lower end of the radius are cleared anteriorly and posteriorly. A diamond-shaped area, centred on the radio-carpal joint, is outlined with drill holes which traverse the radius and carpus, and the graft bed thus outlined is removed with an osteotome (Fig. 3); longitudinal cuts with an osteotome are made at the two ends of the diamond, proximally into the radius and distally into the bases of the metacarpals. No further excision of joint surfaces is required. The triangular graft, its base facing dorsally, is impacted into the prepared bed with a punch (Fig. 4), care being taken that the graft lies centrally in the radius.
This technique automatically gives about 25 degrees of dorsiflexion, and ulnar deviation is adjusted so that, with the thumb opposed, the first metacarpal lies in the same plane as the radius in both antero-posterior and lateral planes. The pneumatic cuff is removed, haemostasis secured, and the wound closed in layers.

At the conclusion of the operation a plaster is applied from the metacarpal heads to the uppermost third of the arm, and is split immediately. The plaster is changed after two weeks for a below-elbow plaster. The patient may usually be discharged from hospital within three weeks of operation. Union is usually sound after about sixteen weeks.

Brooks (1949) pointed out that in lesions of the brachial plexus involving the fifth, sixth and seventh cervical nerves, and in certain cases of anterior poliomyelitis, the pronator quadratus muscle is the only active pronator. The function of the muscle is destroyed by this operation. In these cases, therefore, and in those in which there is no active control of pronation and supination, the forearm is fixed in 45 degrees of pronation by a single screw transfixing the ulna and the radius. This was done in five cases in this series. Figure 5 shows the operation in diagrammatic form. When rotation is controlled in this way a full-length arm plaster should be used throughout the period of immobilisation.

**REVIEW OF RESULTS**

The patients in this series were treated at the Wingfield-Morris Orthopaedic Hospital and the Royal National Orthopaedic Hospital under the care of Mr H. J. Seddon.

Thirty-four cases were available for review. The shortest follow-up was one year. The causes of the paralysis were: brachial plexus injury 17; anterior poliomyelitis 9; injuries of more than one peripheral nerve 8.

**Indications for operation**—In all but two cases the operation was performed to improve the motor function of the limb. In one case pain in the wrist was an additional indication. The remaining case was that of a man with complete brachial plexus paralysis: he refused amputation, and arthrodesis of the wrist was done for cosmetic reasons to correct ulnar deviation.

When there was any doubt as to the advisability of arthrodesis the wrist was immobilised for a time in a light plaster, and the decision for or against operation was left to the patient: he usually made up his mind within a week.
Results and complications—We have been pleased with the results of this operation. Fusion has been obtained in good position; the scar is not conspicuous (Fig. 6), and is invisible with the arm by the side. The complications were few but important.

1. Post-operative swelling was severe enough in three cases to necessitate removal of the plaster: in two of these the wound was reopened and a haematoma evacuated. These complications occurred early in the series before we realised the importance of removing the pneumatic cuff and arresting all bleeding before closure of the wound.

2. One patient developed compression of the median nerve in the carpal tunnel, necessitating division of the flexor retinaculum.

3. In one of the cases in which the ulna was screwed to the radius there was a subsequent fracture through the radial screw hole: this healed uneventfully.

There were no complications involving the tendons.

Radiological features—The addition of bone chips, either from the head of the ulna or from the iliac crest (Brooks 1949), did not seem to hasten union.

In most cases the graft did not reach the metacarpal bases. This did not affect consolidation.
Increasing ulnar deviation in a boy of fourteen. The graft had been placed eccentrically in the radius of the wrist (Fig. 7), and the small amount of carpo-metacarpal movement retained is an advantage to the patient.

Unless the graft is punched well across at the end of the operation, it lies medially rather than centrally in the radius. This is of no importance in the adult, but in adolescents operated upon before the distal radial epiphysis has closed it may lead to increasing ulnar deviation (Fig. 8).

Bony union between radius and ulna is rapidly produced by the insertion of a single screw, as shown in Figure 9. This figure also shows a pseudarthrosis at the proximal end of the graft—the only pseudarthrosis in the series. It was of no functional importance because there was firm fibrous union and the limb was anaesthetic.

SUMMARY

1. A medial approach is preferred for arthrodesis of the wrist in reconstructive surgery because there is no interference with the extensor tendons.
2. The value of pre-operative assessment by a trial period in plaster is mentioned.
3. The technique of operation is described.
4. In the absence of active pronation, screwing the ulna to the radius in 45 degrees of pronation is advised.
5. The necessity for securing haemostasis before closing the wound is emphasised.
6. Thirty-four cases are reviewed. The shortest follow-up was one year and the longest twelve years. The result was satisfactory in all cases. Most patients were discharged from hospital after the plaster had been changed two weeks after operation. Union occurred in about sixteen weeks.

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REFERENCES

