

# Denervation of the radiocarpal joint

A FOLLOW-UP STUDY IN 22 PATIENTS

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**D**enervation surgery has been a mainstay of our management of chronic pain in the wrist. If there is useful movement at the wrist we prefer denervation to arthrodesis.

We have reviewed 22 patients at a mean of 50 months after such denervation surgery at the wrist. This was the only treatment in 16 patients; the other six also had other treatments. Pain was reduced in 16 patients, and 17 were satisfied or improved. None of the patients wished to have a supplementary arthrodesis.

We stress the importance of preoperative blockade tests and of a very detailed knowledge of the local anatomy.

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Denervation of the wrist by the surgical division of nerve fibres which conduct pain sensation was first described by Wilhelm in 1966<sup>1</sup> as a treatment for post-traumatic arthritis. Using his methods, Geldmacher, Legal and Brug<sup>2</sup> reported that 85% of patients had satisfactory reduction of pain and Buck-Gramcko<sup>3</sup> showed that denervation gave complete absence of pain, or only slight pain during heavy work, in 69% of patients and a reduction of pain in a further 24%. Selective denervation seems to abolish or alleviate pain while preserving some sensibility and mobility at the wrist.

The successful surgical treatment of pain in the wrist requires that there is some useful movement at the joint, no obvious inflammation or oedema, and positive blockade tests.

## Patients and Methods

We reviewed four women and 18 men at a mean of 50 months (14 to 168) after selective denervation of the wrist. Their mean age at surgery was 46 years (24 to 67) and the indications are shown in Table I. Two patients had had pain with every movement, eight had pain after normal use and work, and 12 had pain on excessive use of the wrist, all for six months to three years. All had had at least six months of conservative therapy before operation and had failed to respond to bracing, anti-inflammatory medication and physiotherapy. In each case, complete relief or considerable reduction of pain had been shown by at least two pre-operative blockade tests.

**Preoperative nerve blockade.** Denervation of the wrist is indicated only after confirmation that blockade of the affected nerve(s) by local anaesthetic relieves symptoms. Blockade is performed as follows (Figs 1 and 2):

*Posterior interosseous nerve.* Dorsomedial injection approximately 3 cm proximal to the carpal region, passing vertically down to the radius (Figs 1a and 2a, 1).

*Articular branch of the superficial radial nerve to the first cleft.* The injection is dorsal between the bases of the first and second metacarpals at the ulnar border of the first dorsal metacarpal vein. This nerve should be blocked before testing the superficial radial nerve to avoid false-positive results (Figs 1b and 2a, 2).

*Articular branches of the lateral cutaneous nerve to the forearm.* Blockade is by injection of 1 ml of local anaesthetic perivascularly about 3 cm proximal to the carpus around the radial vessels (Figs 1c and 2b, 3).

**Table I.** Indications for denervation surgery of the wrist in 22 patients

Indication	Number
Fracture of radius	7*
Fracture of scaphoid	7†
Arthritis	2
Kienböck's disease	1‡
Rheumatoid disease	3
Chronic instability	1
Congenital malformation and arthritis	1

\* one without, two with mild and four with severe radiological arthritis

† all nonunions with secondary arthritis

‡ stage 4 with carpal collapse

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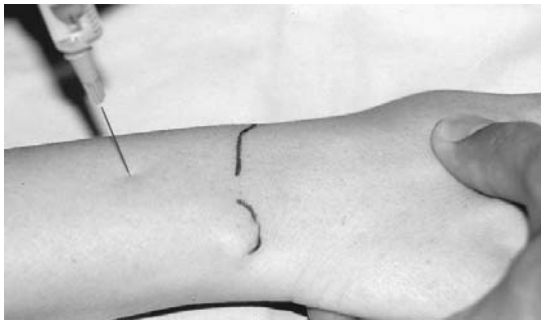


Fig. 1a

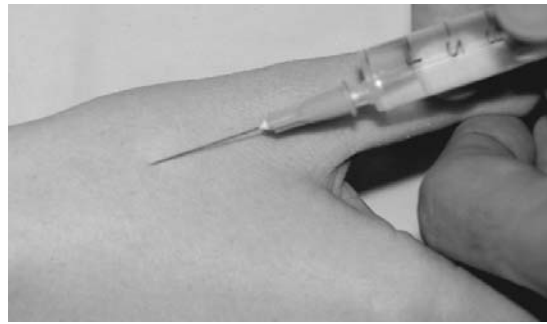


Fig. 1b

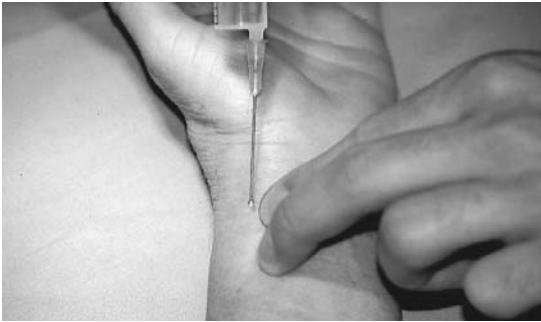


Fig. 1c



Fig. 1d

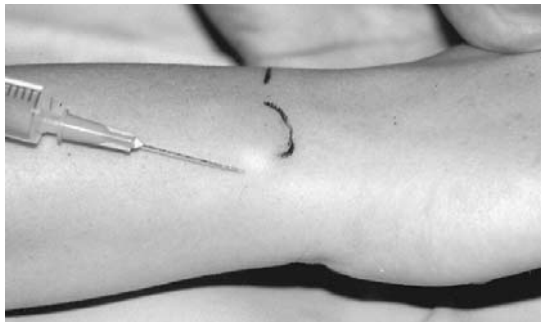


Fig. 1e

Preoperative pharmacological nerve blockade by injection of local anaesthetic for the posterior interosseous nerve (a), the articular branch of the first intermetacarpal space (b), the articular branch of the lateral cutaneous nerve of the forearm (c), the anterior interosseous nerve (d) and the dorsal articular branch of the ulnar nerve (e).

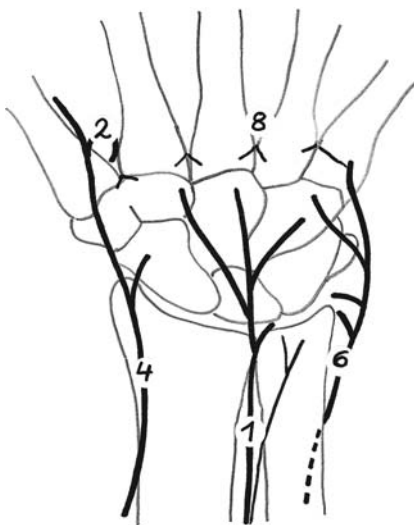


Fig. 2a

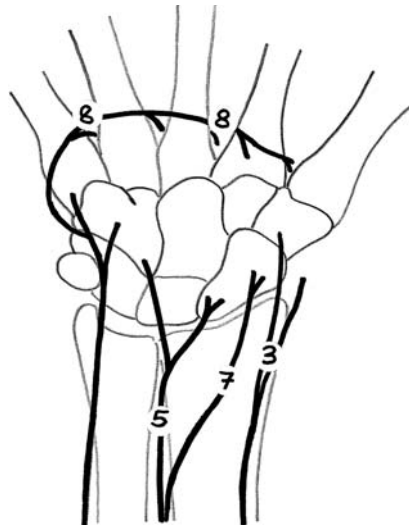


Fig. 2b

Innervation of the wrist from (a) the dorsal and (b) the palmar aspects; see text for numbers.

**Table II.** Additional surgical procedures in six of the 22 patients having denervation of the wrist

	Number
Styloidectomy	1
Synovectomy	2
Osteotomy of the radius	1
Carpal tunnel release	2

*Articular branch of the superficial radial nerve.* This is blocked by transverse subcutaneous infiltration from the previous site (Fig. 2a, 4).

*Anterior interosseous nerve.* A vertical approach is made 3 cm proximal to the distal wrist crease at the ulnar border of palmaris longus, and local anaesthetic is injected superficial to the radius and the interosseous membrane (Figs 1d and 2b 5, 7).

*Dorsal articular branch of the ulnar nerve.* The injection is at the ulnar border of the styloid process with infiltration towards the bone and in a volar direction (Figs 1e and 2a, 6).

*Palmar cutaneous branch of the median nerve.* Subcutaneous infiltration is performed between the radial vessels and the tendon of palmaris longus.

*Perforating branches of ulnar nerve.* A small injection is made dorsal to the respective intermetacarpal joints (Fig. 2, 8).

**Operative techniques.** Complete denervation of the wrist was the main surgical treatment, but six patients had other procedures (Table II). Surgery was performed under general anaesthesia or axillary block, using a tourniquet. The use of a magnifying loupe was necessary only in a few difficult cases.

We selectively divided the posterior interosseous nerve, the articular branch of the superficial radial nerve to the first intermetacarpal space, articular branches of the lateral cutaneous nerve of the forearm, the articular branch of the superficial radial nerve, the anterior interosseous nerve, and the dorsal articular branch of the ulnar nerve. Redon drains were used in the major incisions and a compression bandage applied, with temporary splintage.

Two of the nerves require an anatomically precise dissection, and selection is based on a careful evaluation of the results of the test blockade, the spread of pain, and the changes seen on radiographs. The necessary skin incisions are shown in Figure 3.

*Posterior interosseous nerve.* A longitudinal incision is made about 3 cm proximal to the carpus (1), and the fascia is split at the radial border of the extensor pollicis longus. The posterior interosseous nerve is deep and some fibres innervating the distal radioulnar joint leave the main nerve proximally. These must be separated from the main nerve as far proximally as possible before division. The superficial radial nerve is exposed through the same incision.

*Lateral cutaneous nerve of the forearm and the anterior interosseous nerve.* A curved incision (3) is made on the flexor surface over the distal end of the radius and the radial artery to expose the lateral cutaneous nerve of the forearm parallel to the artery. The nerve, surrounding perivascular tissue, and the radial veins are cut and ligated. As an alternative, the fibres innervating the joint may be carefully located and cut separately.

*Anterior interosseous nerve (3).* This can be located by exposing pronator quadratus between flexor carpi radialis and the radial artery. Flexor carpi radialis, the digital flexors tendons and the median nerve are retracted and the nerve exposed at the distal side of the muscle with a diathermy needle.

*Subcutaneous palmar branches of the median nerve.* These are exposed at the wrist crease (3). Complete separation of these branches is necessary to avoid unpleasant postoperative disturbances in sensibility in the thenar region.

*Ulnar nerve.* Division of the dorsal articular branch of the ulnar nerve is performed through a curved incision over the styloid process of the ulna (4). Where there is widespread pain, the perforating branch of the ulnar nerve may require division through a dorsal incision from the base of the second to the base of the fourth metacarpal (5). The tendons of the long extensors are retracted and the layer of

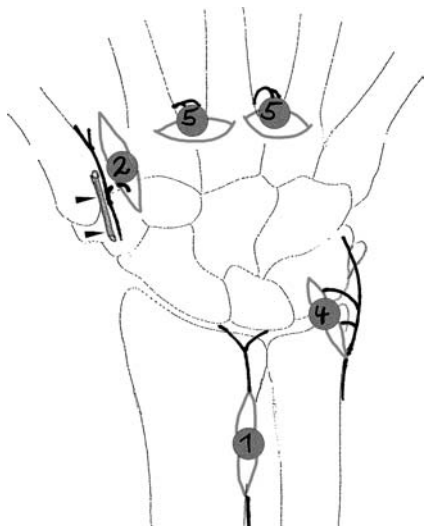


Fig. 3a

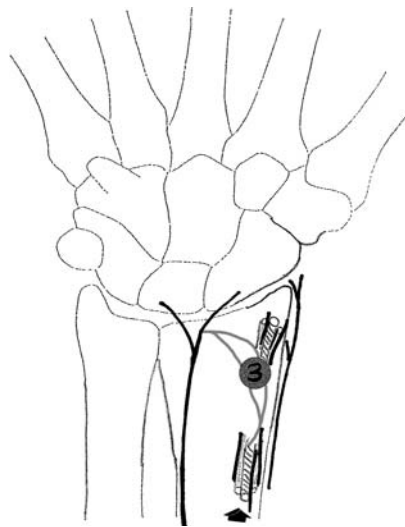


Fig. 3b

Skin incisions for wrist denervation from (a) the dorsal (the first metacarpal vein is marked by arrows) and (b) the palmar aspects (radial vessels are marked by an arrow).

**Table III.** Subjective reports by the 22 patients after denervation surgery

	Number
Very satisfied	7
Major improvement	10
Satisfied	3
Not satisfied	2

**Table IV.** Symptoms and working ability reported by Meine, Buck-Gramcko and Nigst for 22 patients after denervation surgery

Symptoms	Working ability	Number
None	Full	6
Present after overuse	Full	9
Pain after normal use	Sparing of hand at work	6
Pain with every movement and at rest	Change of work	1
Arthrodesis		0

connective tissue over the bases of the metacarpals is diathermised over a semilunar area.

*Articular branch of the first metacarpal space.* An incision is made dorsal to the first carpometacarpal joint. The nerve is on the medial side of the first metacarpal vein, running towards the radial artery as it perforates muscle to reach the palmar side of the hand.

After operation, the wrist is splinted for a few days, with elevation and the administration of non-steroidal anti-inflammatory drugs (NSAIDs). Early stress on the joint must be avoided.

## Results

Table III gives the results in 22 patients. Seventeen were very satisfied or improved, three patients were satisfied, and only two patients regarded the surgery as unsatisfactory. None was made worse.

Using the subjective rating scale of Meine, Buck-Gramcko and Nigst, 15 patients had no adverse symptoms or only minor pain when stressing the wrist (Table IV). Six had pain during normal use of the joint and two had no improvement of symptoms. As regards strength, 12 patients reported improvement and ten no change.

There were no postoperative complications, but 11 patients reported a loss of sensation in the first dorsal interosseous space. The mean hospital stay was three days, initially in plaster, until removal of the drains. Early movement in two patients led to pain and swelling, but both had started heavy work before the stitches were removed. Their symptoms settled with four weeks of conservative care, but we now advise the use of a removable splint for two to four weeks after surgery between sessions of physiotherapy.

## Discussion

Denervation surgery of the wrist has been used successfully since 1996.<sup>1-6</sup> It can be used for chronic pain, either

alone or combined with styloidectomy, osteotomy of the distal radius or ulna, or carpal tunnel release, or as specifically targeted. The number of possible combinations in regard to both target nerves and additional surgical procedures makes the comparison of results difficult. Anatomical variations of the nerve branches are another variable factor.<sup>9,10</sup> Ishida, Tsai and Atasoy<sup>7</sup> reported 13 complete and four partial denervations, but only 24% of the patients were satisfied at a mean follow-up of 51 months, and they concluded that denervation surgery alone was not indicated.

Ekerot et al.<sup>5</sup> reported that 70% improved in a series of 46 patients. Buck-Gramcko<sup>3</sup> reviewed 195 patients of whom 69% had marked improvement at a mean follow-up of 4.5 years; 24% had less pain. Only 5% had no benefit, and all had concomitant intra-articular fractures, instability, and cartilage defects and also reported heavy use of the wrist. Röstlund, Somnier and Axelsson<sup>8</sup> obtained good results with a simplified four-nerve neurotomy. One problem of assessment is the lack of objective criteria for success: some patients may be influenced by social security and disability payments.<sup>4</sup> In addition, symptoms may recur after years of complete absence of pain, possibly because the joint was innervated simultaneously by several nerves. All the nerve trunks in the vicinity of the wrist may contribute to its innervation and there are known to be extensive connections between individual nerve branches. Success depends on meticulous evaluation and surgery in well-motivated patients.

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