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Original Research Article

The Interest of Wrist Denervation in Managing Degenerative Wrists: A Study of 25 Cases

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Abstract: ***Background:*** Wrist denervation is a palliative intervention aimed at alleviating painful symptoms while preserving joint mobility. However, the outcomes of this procedure remain controversial. ***Objectives:*** The purpose of our study is to assess the long-term results of wrist denervation. ***Design & Methods:*** Our experience involved 25 denervations performed between 2009 and 2019. Retrospective evaluation of results focused on pain (visual analog scale), function (Quick Dash), joint ranges of motion, and radiological control. ***Results:*** Our patients were middle-aged men (average age: 44 years) and one woman (age: 47 years); 16 of them were manual laborers. The dominant side was affected in 20 cases. The conditions treated included sequelae of scaphoid nonunion in 16 cases, severe scapholunate ligament injury in 5 cases, distal radius fracture in 3 cases, and Kienböck's disease in 1 case. Our surgical technique involved three approaches: dorsal, dorso-radial, and dorso-ulnar, with excision of the posterior interosseous nerve, anterior interosseous nerve, and articular branches of the radial sensory nerve and dorsal cutaneous branch of the ulnar nerve. Two patients were lost to follow-up. The average follow-up period was 43 months. Pain, assessed using a visual analog scale, averaged 3 at rest and 5 during activity. There was no change in wrist joint ranges of motion. The average postoperative Quick Dash score was 22.24/100. Only 5 patients showed no improvement. Radiological findings remained stable in the majority of cases. Complications included transient paresthesias (2 cases), algodystrophy (2 cases), and cold intolerance (2 cases). Only 5 patients required reclassification. ***Conclusions:*** The typical indication is a chronically painful wrist in a patient retaining useful strength and ranges of motion. This experience confirms the expected outcomes of this surgery: pain relief and preservation of mobility, following a technically precise yet simple procedure with few notable complications and this therapeutic option does not preclude the possibility of subsequent surgery of a different nature.

Keywords: Wrist denervation, Pain management, Palliative surgery, Chronic wrist pain, Surgical outcomes.

BACKGROUND

Wrist denervation is a palliative intervention aimed at alleviating painful symptoms while preserving joint mobility. The principle behind this procedure involves interrupting painful afferents by selectively sectioning articular nerve branches. It is indicated for any painful cartilage degeneration, either as a primary or secondary intervention or in combination with other procedures. However, the outcomes of this procedure remain controversial, with satisfaction rates in the literature ranging from 25% to 90% [1]. It therefore seems legitimate to evaluate the long-term results of wrist denervation.

DESIGN & METHODS

Our experience involved 25 wrist denervations performed between 2009 and 2019 in our department. All included patients had chronic painful wrists, with the etiology primarily distributed as follows: SNAC wrist in 64%, SLAC wrist in 20%, sequelae of distal radius fracture in 12%, and Kienböck's disease in 3%. We excluded all patients who had undergone additional wrist procedures to avoid influencing the evaluation of the

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functional and radiological outcomes of wrist denervation.

The surgical technique used was preceded by a lidocaine test(Figure1), which has a negative predictive value; a negative test contraindicates denervation according to Wilhelm [2]. Our technique was performed under regional anesthesia and involved three incisions: dorsal, dorso-ulnar, and dorso-radial.

The dorsal approach (Figure 2) was made through a longitudinal incision of 4 to 5 cm medial to the Lister's tubercle, with the fourth extensor compartment opened. The extensor tendons were then retracted medially, allowing exposure of the posterior interosseous nerve (Figure3), which was excised 2 to 3 cm above the radiocarpal joint. Through the same dorsal approach, the interosseous membrane was opened, and the anterior interosseous nerve was easily identified and excised for 2 to 3 cm.

The second dorso-ulnar incision (Figure 4) allowed for the sectioning of the articular branches from the dorsal branch of the ulnar nerve and the medial cutaneous nerve of the forearm. A subcutaneous dissection was performed extending from the dorsal incision posteriorly and to the flexor carpi ulnaris anteriorly, leaving the sensory branch in its subcutaneous environment.

Finally, the third incision (Figure5) was made along the radial border of the wrist to section the branches from the sensory branch of the radial nerve through subcutaneous dissection.

Postoperatively, a plaster splint immobilization was recommended, followed by a rehabilitation phase.

The retrospective functional evaluation of the results concerned pain (VAS) [3], function (QuickDASHscore) [4], range of motion, and wrist strength using a vigorimeter. The radiological evaluation was performed using anterior and lateral wrist X-rays before wrist denervation and at the last follow-up.

The results were entered and analyzed using SPSS software version 26. We set the significance threshold at p=0.05.

Figure 1: Preoperative xylocaine test

Figure 2: Dorsal incision

Figure 3: Excision of the posterior interosseous nerve and opening of the interosseous membrane to excise the anterior interosseous nerve

Figure 4: Second dorso-ulnar incision: to excise the sensory branch of the ulnar nerve and the branches of the medial antebrachial cutaneous nerve, followed by a skin dissection to leave the sensory branch of the radial nerve in its cutaneous environment

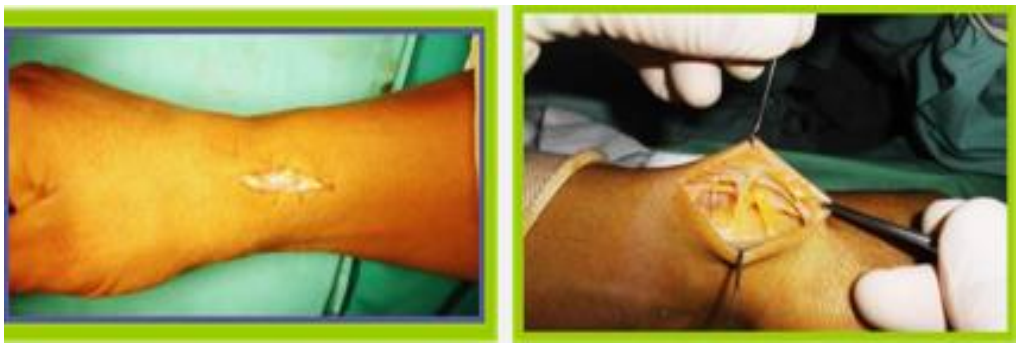

Figure 5: Third incision: Radial border to section the articular branches arising from the sensory branch of the radial nerve

RESULTS

Our patients were middle-aged men (average age: 44 years) and one woman (age: 47 years); 16 of them were manual laborers. The dominant side was affected in 20 cases (80%). The conditions treated included SNAC WRIST in 16 cases (64%), SLAC WRIST in 5 cases (20%), sequelae of distal radius fracture in 3 cases (12%), and Kienböck's disease in 1 case (4%). Our surgical technique involved three approaches: dorsal, dorso-radial, and dorso-ulnar, with excision of the posterior interosseous nerve, anterior interosseous nerve, and articular branches of the radial sensory nerve and dorsal cutaneous branch of the ulnar nerve. Two patients were lost to follow-up. The average follow-up period was 43 months. Pain, assessed using a visual analog scale, averaged 3 at rest and 5 during activity (Table 1). There was no significative change in wrist joint ranges of motion (Table 2). The average of postoperative function was 22.24/100. The grip strength measured with a dynamometer averaged 58.4 kPa on the operated side, compared to 78.8 kPa on the healthy side.

Only 5 patients showed no improvement. Radiological findings remained stable in the majority of cases. Complications included neuromas (2 cases), algodystrophy (2 cases), and cold intolerance (2 cases). Only 5 patients required reclassification.

Table 1: Postoperative pain assessment

Visual Analog Scale (VAS)	Rest	Activity
Non-painful (VAS =0)	5	0
Potentially painful (VAS 1_3)	18	14
Moderately painful (VAS 4_6)	2	8
Intense pain (VAS>6)	0	3
Total	25	25

Table 2: Postoperative mobility assessment

Moderate joint mobility	préoperative	postopérative	gain
Flexion / extension	43°/42°	46°/40°	+3°/-2°
RI / UI	11°/25°	11°/28°	0/+3°

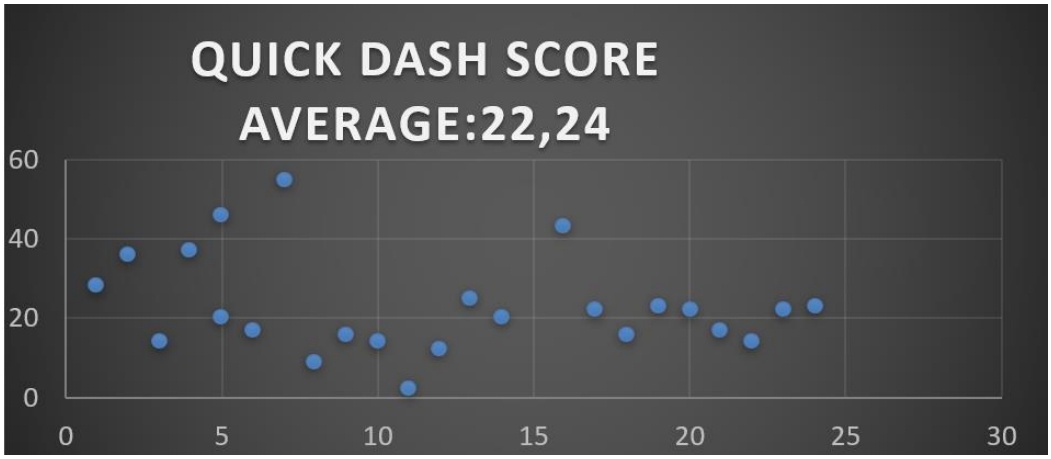

Figure 6: Postoperative function assessement

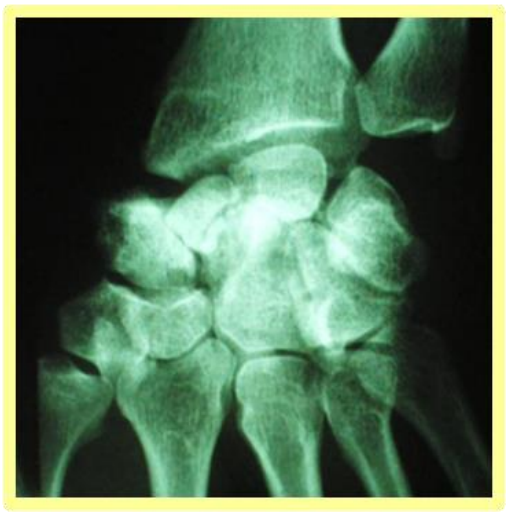

Figure 7: Day 0

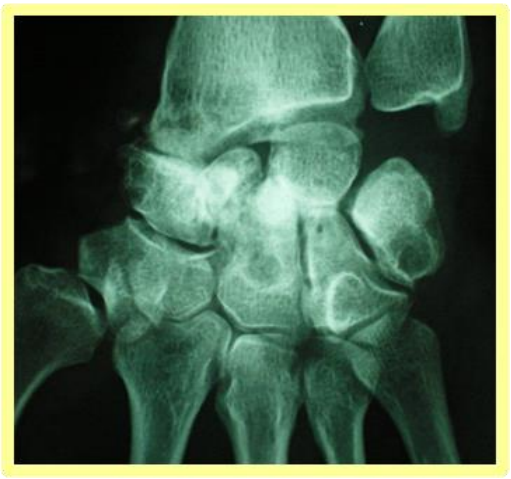

Figure 8: Nine years later Absence of extension of arthritic surfaces or Charcot-like effect

DISCUSSION

Our study has limitations, including its retrospective nature, the involvement of multiple surgeons, and the disparity in follow-up times ranging from 3 to 12 years. The average age reported in the literature ranges between 40 and 60 years. The average age in the series by Picart *et al.*, was 58 years, in the series by Arthure Dellestable *et al.*, was 53.7 years, and in the series by M. Rothe *et al.*, was 47 years, which is comparable to our series (average age of men 44 years and women 47 years) [5–7].

The dominant limb was the most frequently operated on in the various series, with 75% of cases in

the series by Picart *et al.,* and 63% of cases in the series by M. Rothe *et al.,* which is consistent with our series where 80% of cases involved the dominant limb [5,7].

SNAC wrist and SLAC wrist lesions have dominated the etiologies in several series, including the one by Picart *et al.,* where they accounted for 41% [5]. This was also observed in our series, but at a higher rate of 84%.

Our operative technique involves three incisions: dorsal, dorsoradial, and dorsoulnar. It was inspired by the techniques of Buck Gramcko and Wilhelm, with Wilhelm being the first surgeon to describe the wrist denervation technique in 1959. The technique is preceded by a test with xylocaine because, according to Wilhelm, a negative test is a contraindication for total wrist denervation, as pain may be conveyed by nociceptive afferents from the endosteum, particularly in advanced arthroses [1,8]. However, this has not been demonstrated in other studies [9].

The mean follow-up period in our series was 43 months, which is comparable to studies found in the literature. Specifically, the study by Picart *et al.,* reported a follow-up of 56 months in a series of 39 wrists [5], while Delcalux *et al.,* documented a follow-up of 41 months in a series of 33 wrists [10]. These findings suggest that the duration of follow-up in our study aligns closely with those in previous research, providing a similar timeframe for evaluating long-term outcomes.

Regarding pain, our study demonstrated that 92% of patients postoperatively experienced little to no pain (VAS ≤ 3), which is consistent with the majority of studies showing postoperative pain improvement. For example, the study by Simon *et al.,* [1]. reported that 81% of patients were either little to no pain (VAS ≤ 3). Similarly, the study by Delcalux *et al.,* [10]. showed a significant reduction in the VAS score, from 7.1 preoperatively to 1.8 postoperatively at the last follow-up.

Our results showed an improvement of +3 degrees in wrist flexion and +3 degrees in ulnar inclination; however, this difference was not statistically significant, with a p-value of 0.1. This finding is in line with studies by Foucher *et al.,* [9] and Delclaux *et al.,* [10], which also did not report a significant improvement in mobility. Furthermore, we observed no correlation between the improvement in mobility and the stability of joint range of motion, which may be explained by the presence of ankylosis.

The measurement of grip strength using a dynamometer in our series revealed a 25% reduction in strength on the operated wrist compared to the opposite wrist. This finding is similar to the series by Simon *et al.,*[1], which reported a 30% decrease in grip strength.

The mean QuickDASH score in our series was 22.4, which is similar to the series by Delclaux *et al.,* [10], who reported a score of 23. However, we observed differences in outcomes based on etiology, as highlighted in several studies, such as those by Radu [11] *et al.,* and Buck Gramko *et al.,* [12], which found a better response to denervation in "SNAC wrist" compared to Kienböck's disease. Unfortunately, in our study, we did not investigate this correlation.

In our series, most cases did not exhibit any signs of osteoarthritic extension, and Charcot joint disease was notably absent. This finding aligns with the results of Wilhelm's study [2], which suggests that the preservation of deep sensory perception in the affected limb plays a key role in preventing such complications.

In our series, postoperative complications included two cases of neuromas, two cases of algodystrophy, and one case of cold intolerance. According to the literature, neuromas are the most common postoperative complication. To minimize the risk of their formation, it is crucial to ensure that nerve branch avulsion is performed by dissection [1].

CONCLUSION

Wrist denervation offers an effective surgical solution for chronic wrist pain of various origins, providing pain relief while preserving strength and mobility. This study confirms the expected outcomes, with a simple, technically precise procedure and minimal complications. Additionally, it allows for future surgeries if necessary, making it a valuable treatment option for managing chronic wrist pain.

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