Posterior Interosseous Neurectomy Alternative for Treating Chronic Wrist Pain

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Abstract

Background Wrist denervation is one of the several available options for treating chronic wrist pain; partial wrist denervation performed through a single dorsal incision by resecting the distal posterior interosseous nerve provides good outcomes.

Questions/Purposes This study evaluated the results of posterior interosseous neurectomy (PIN) in patients with chronic wrist pain secondary to scaphoid nonunion advanced collapse (SNAC) and scapholunate advanced collapse (SLAC).

Methods In total, 30 wrists obtained from 28 patients (25 males, 3 females) were assessed. The dominant hands of 25 (right-handed) patients, nondominant hands of 5, and both hands of 2 were considered. The average age at the time of surgery was 35 (range: 19–50) years, and the average follow-up duration was 18 (range: 12–30) months. Fifteen and 13 patients had wrists with SNAC and SLAC, respectively, and all of those underwent PIN performed through the dorsal approach. The pre- and postoperative range of motion, grip strength, and pain relief percentage were recorded for all the 30 wrists.

Results The average postoperative Disabilities of the Arm, Shoulder and Hand score was 30 (range: 20–80), and the difference between the pre- and postoperative scores was statistically significant. Ninety percent of the patients were satisfied with the results of PIN and reported improvement in grip strength and pain relief.

Conclusions Thus, PIN may be an effective surgical technique for wrist reconstruction.

Clinical Relevance To help patients challenge pain and maintain their wrist joint range of motion.

Keywords

- ▶ neurectomy
- ▶ wrist arthrodesis
- ▶ wrist joint

Wrist denervation is one of the several treatment modalities for chronic wrist pain.¹ Complete wrist denervation alleviates chronic wrist pain by approximately 67% in patients with degenerative arthritis.^{2,3} Some studies have reported that the efficacy of partial neurectomy in relieving chronic wrist pain is inconsistent as compared with total wrist denervation;⁴ however, partial neurectomy may be an effective alternative to wrist salvage.⁵

In 1998, Berger described a single dorsal incision technique for anterior and posterior interosseous nerve denervation and reported that 76% patients with chronic wrist pain

and degenerative arthritis showed improvements with respect to their pain rating and grip strength.⁶ There is no evidence suggesting that partial denervation procedures alter the proprioception of the wrist and that they yield promising results for palliating pain without prolonged postoperative immobilization or absence from work.

Here, we examined wrists with scaphoid nonunion advanced collapse (SNAC) and scapholunate advanced collapse (SLAC) to assess whether posterior interosseous neurectomy (PIN) can reduce chronic wrist pain in patients with such wrists.

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Materials and Methods

Study Design

This prospective study included 28 patients with SNAC and SLAC wrists who presented to our institute between January 2014 and December 2017 and refused to undergo or postponed partial wrist arthrodesis. All of the patients had previously undergone PIN. A total of 30 wrists from those 28 patients (26 wrists from 25 males and 4 wrists from 3 females) were considered for assessment. The dominant hands of 25 patients (right-handed), nondominant hands of 5, and both the hands of 2 were involved. The average age at the time of the surgery was 35 (range: 18–50) years, and the average follow-up duration was 18 (range: 12–30) months. Fifteen and 13 patients presented with SNAC (grade III, 10 patients; grade II, 5 patients) and SLAC (grade II, 9 patients; grade III, 4 patients) wrists, respectively.

The average duration of wrist pain prior to evaluation was 3.5 (range: 0.6–10) years. The pain was centrally and radially located in 20 and 10 wrists, respectively. All the patients reported that their wrist injuries were caused by a fall on the outstretched hand. Scaphoid fractures were diagnosed in 14 patients and were treated with long-term casting. Eight patients were diagnosed with wrist sprain, and six cases were missed. All the patients underwent trials with nonsteroidal anti-inflammatory drugs and/or splints to alleviate their pain.

The patients were diagnosed with degenerative changes, which were caused by SNAC in 15 wrists and SLAC in 13 patients. Twenty-two patients were engaged in professions involving heavy usage of their hands (manual workers), whereas the remaining reported that their professions demanded minimal activity.

All the patients with SNAC and SLAC wrists underwent detailed evaluation of their histories, systematic physical examination of bilateral wrists, and radiography, and preoperatively completed the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire.

Moreover, all the patients with SNAC and SLAC wrists underwent PIN performed through the dorsal approach. The posterior interosseous nerve was exposed on the floor of the fourth dorsal extensor compartment. The dorsal approach was centered 3 cm between the third and fourth compartments just proximal to the extensor retinaculum. A 1-cm portion of the posterior interosseous nerve was then

removed. The skin was closed with sutures, and hand dressing was applied for 2 weeks. The sutures were removed 15 days later, after which the range of motion (ROM) protocol and strengthening program were initiated (►Fig. 1).^{7–9}

Preoperative wrist anesthesia block testing was not used in this study.

All the wrists were examined for grip strength and ROM. Each patient rated his/her pain relief using a visual analog scale (VAS) and completed the DASH questionnaire. All the patients were questioned regarding their satisfaction with the results of the procedure.

Bilateral wrists were physically examined, and radiographs were recorded at each follow-up. The DASH questionnaire (Arabic forum) on the restriction of occupational and daily activities was completed by each patient. During the follow-up, the patients were questioned about the postoperative improvement in their pain. Pain relief was reported as either minimal or worse. The patients were also questioned if they were able to return to their job or had to change their occupation.

Statistical Analysis

ROM, grip strength, and DASH scores were compared. Statistics analysis was performed for correlations between the pre- and postoperative follow-up results. All data were analyzed using the SPSS 13.0 software for Windows (SPSS Inc., Chicago, IL).

Results

A total of 30 wrists from 28 patients from the chronic wrist pain registry who underwent PIN for pain relief were included. No postoperative complications associated with PIN were reported in any of the patients. The average ROM and grip strength at an average of 18 (range: 12–30) months was considered in the follow-up evaluation. Differences in ROM, as revealed through preoperative measurements, were not statistically significant ($p = 0.413$; ►Table 1).

The average preoperative and postoperative grip strengths of the affected wrist were 34 (range: 10–55) and 50 (range: 20–70) kg, respectively, indicating a statistically significant average improvement of 20% (range: 5–100%; $p = 0.065$). The average VAS score that was 7.89 (range: 4.0–9.5) preoperatively decreased to 6.46 (range: 3–7) postoperatively.

Fig. 1 Dorsal approach for posterior interosseous neurectomy. (A) The dorsal approach was centered 3 cm between the third and fourth compartments just proximal to the extensor retinaculum. (B) Exposure of the nerve between the third and fourth compartments. (C) Exposure of the nerve on the floor of the fourth compartment.

Table 1 Preoperative and postoperative wrist range of motion and grip strength

	Preoperative	Other wrist	Postoperative (last follow-up)
Flexion (degrees)	40	54	43
Extension (degrees)	30	60	30
Radial deviation (degrees)	19	20	20
Ulnar deviation (degrees)	36	40	32
Grip strength (kg)	34	56	50

The average preoperative DASH score was 45 (range: 10–95), and the average postoperative DASH score was 30 (range: 0–80), as observed after the data analysis; this difference was statistically significant ($p = 0.002$). In 90% of the patients, grip strength improvement and pain relief indicated satisfactory surgical outcomes.

Discussion

Denervation for wrist pain treatment has evolved from total wrist denervation to posterior interosseous nerve denervation. Wrist denervation offers the advantage of pain relief and minimizes prolonged immobilization and loss of motion.⁴ Dellon reported that 90% of patients who underwent isolated PIN reported good subjective pain relief.¹⁰ Fuchsberger et al reported that complete wrist denervation was an effective treatment option for patients with painful wrist conditions. Moreover, they reported no dynamic instability, reduced pain, and improved overall functioning.¹¹

In our data search, for patients with partial wrist denervation caused by SNAC and SLAC who refused to undergo surgery or postponed it, the average preoperative and postoperative DASH scores were 45 and 30, respectively, and the difference was statistically significant ($p = 0.002$); moreover, those patients reported 90% satisfaction after the surgery. These results were similar to those in the study by Schweizer et al who reported an average DASH score of 26 for total wrist denervation.¹²

In the patients in this study, postoperative grip strength was 50, which was statistically significant ($p = 0.065$), the VAS score was 6.46, and pain relief with high scores indicated patient satisfaction.

In addition to other procedures, such as limited wrist arthrodesis, Schweizer et al recommended total denervation for wrist pain caused by degenerative changes and for cases wherein reconstructive procedures are unlikely to be successful. All the included patients were informed that wrist denervation might not be definitive and that limited wrist arthrodesis could be required later.¹²

The primary genicular nerve supply to the wrist comprises the posterior interosseous nerve and the lateral antebrachial cutaneous as well as articular branches from the

ulnar nerve. Other genicular innervation comprises the anterior interosseous nerve, branches of the ulnar nerve, palmar cutaneous branch of the median nerve, and a branch from the superficial branch of the radial nerve.¹³ Berger described combined anterior and posterior interosseous nerve denervation performed through a single dorsal incision and reported a 79% decrease in pain with a 76% patient satisfaction rate.⁶ The symptoms of chronic wrist pain or carpal instability³ were similar to those observed in patients found through our data search on chronic wrist pain caused by SNAC and SLAC.

In this study, preoperative local injection testing was not performed because there were no differences in the outcomes among patients using wrist block testing¹⁴ and because preoperative block testing was poorly associated with the DASH score and postoperative pain outcomes.³

There is no evidence suggesting that partial denervation affects the proprioception of the wrist joint and that the procedure is a promising option for palliating pain without prolonged postoperative immobilization.^{15,16}

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None.

Conflict of Interest

None declared.

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