No Benefits of Combining Proximal Row Carpectomy With PIN Neurectomy for Wrist Disorders—A Comparative Study With Systematic Review of the Literature

Aucun avantage à combiner la carpectomie proximale avec la neurectomie interosseuse postérieure en cas de trouble du poignet—une étude comparative et une analyse bibliographique systématique

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Abstract

Background: Posterior interosseous nerve (PIN) resection in combination with proximal row carpectomy (PRC), is a preferred method in order to obtain rapid recovery. However, the contribution of such combination to results isn't known well. **Objectives:** We performed a comparative study to evaluate the effects of PIN neurectomy for PRC and a systematic review of the literature was performed to identify whether such combination has an advantage. **Methods:** Patients with wrist diseases who underwent PRC were evaluated retrospectively. Patients without PIN neurectomy (group 1, n = 7) and with PIN neurectomy (group 2, n = 8) were compared in respect of mean age, follow-up, gender, Q-DASH, VAS, MAYO wrist scores, flexion–extension/radial–ulnar deviation range of motion at final follow-up. The MEDLINE database was searched for studies published between 2005 and 2015, as the second part of the study. The following keywords were used: “proximal,” “row,” “carpectomy.” Studies, which met the inclusion criteria, were evaluated in terms of such combination. **Results:** There were no significant difference between the groups in regard with age ($P = .463$), follow-up period ($P = .728$), the ranges of flexion–extension ($P = .431$) and radio–ulnar deviation ($P = .689$), Q-DASH ($P = .452$), and MAYO scores ($P = .728$). In the second part of the study, 12 studies met the inclusion criteria and none of them was specifically evaluating such combination. Only one study had specific comments on PRC with PIN neurectomy. **Conclusion:** According to our study (which, to our knowledge, was the first comparative study in the literature), we advocate not to combine PRC with PIN neurectomy for such an approach has no advantage.

Résumé

Historique : La résection interosseuse postérieure (IOP) combinée à la carpectomie proximale (CTP) est favorisée pour stimuler une convalescence rapide. Cependant, on en connaît mal l'apport sur les résultats. **Objectifs :** Les auteurs ont procédé à une étude comparative pour évaluer les effets de la neurectomie IOP pour la CTP et à une analyse bibliographique systématique pour déterminer si cette combinaison comportait des avantages. **Méthodologie :** Les chercheurs ont soumis les patients ayant une maladie du poignet qui avaient subi une CTP à une évaluation rétrospective. Ils ont comparé les patients sans neurectomie IOP (groupe 1, n = 7) à ceux en ayant subi une (groupe 2, n = 8) pour ce qui est de l'âge moyen, du suivi, du sexe, des scores du poignet Q-DASH, VAS et MAYO, ainsi que de l'amplitude de flexion–extension et de déviation radio-ulnaire au suivi final. Dans la

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deuxième partie de l'étude, ils ont effectué des recherches dans la base de données MEDLINE pour en extraire les études publiées entre 2005 et 2015. Ils ont utilisé les mots-clés suivants: *proximal, row, carpectomy*. Ils ont évalué les études qui respectaient les critères d'inclusion en fonction de cette combinaison. **Résultats :** Les chercheurs n'ont constaté aucune différence significative entre les groupes pour ce qui est de l'âge ($p = 0,463$), de la période de suivi ($p = 0,728$), de l'amplitude de flexion–extension ($p = 0,431$) et de déviation radio-ulnaire ($p = 0,689$), ainsi que des scores Q-DASH ($p = 0,452$) et MAYO ($p = 0,728$). Dans la deuxième partie de l'étude, 12 études respectaient les critères d'inclusion et aucune n'évaluait expressément cette combinaison. Une seule étude incluait des commentaires sur la CTP combinée à la neurectomie IOP. **Conclusion :** D'après la présente étude, qu'ils croient être la première étude comparative sur le sujet, les chercheurs préconisent de ne pas combiner la CTP à la neurectomie IOP, car elle ne comporte aucun avantage.

Keywords

neurectomy, proximal row carpectomy, posterior interosseous nerve, wrist

Introduction

Proximal row carpectomy (PRC) is a salvage procedure used to treat several wrist conditions.^{1,2} In order to obtain rapid recovery, some authors prefer to combine PRC with posterior interosseous nerve (PIN) resection.^{1,3-17}

Review of the literature revealed several studies reporting the benefits of such combination (3-5). However, all of the studies on this subject were case series^{1,3,5-11} or studies comparing PRC and PIN neurectomy with other procedures, such as limited carpal fusions¹²⁻¹⁵ capsule interposition arthroplasty,¹⁶ or rehabilitation protocols.¹⁷ From evidence-based point of view, the value of case series are limited.¹⁸ In order to obtain clearer results, we performed a comparative study to evaluate the effects of PIN neurectomy for PRC. Additionally, systematic review of the literature from 2005 to 2015 for PRC + PIN neurectomy combination was performed.

Materials and Methods

This was a retrospective study of patients having a PRC for the treatment of various wrist diseases between January 2005 and January 2015. Indications for PRC were scaphoid nonunion advanced collapse, Kienböck disease, missed perilunate dislocation, and untreated radius distal fracture (Table 1).

Inclusion criteria included all patients who underwent a PRC and minimum of 1-year follow-up. Patients with rheumatoid diseases and/or previous wrist surgeries were excluded from the study.¹⁵ Patients (9 male, 6 female) who met the criteria were examined and called for final examination (Table 2).

Surgeon A did not resect PIN; surgeon B routinely performed PIN neurectomy with PRC. Thus, patients were examined in 2 groups as group 1 of 7 patients (5 male, 2 female) without PIN neurectomy and group 2 of 8 patients (4 male, 4 female) with PIN neurectomy (Table 2).

Data were gathered from patient registry and final evaluation. The patients in both groups were compared in respect of mean age, follow-up, gender, Quick DASH¹⁹, VAS (0: no pain, 10: worst pain), MAYO wrist scores²⁰ at final evaluation. Flexion–extension and radial–ulnar deviation ROM were measured

with goniometer.²¹ Also, arthritis was assessed on posteroanterior and lateral X-rays of hand.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. All patients signed an informed consent for the surgery itself and the procedure that they received depended on the surgeon. After general anesthesia, all patients were operated supine over a hand table and tourniquet was set. A dorsal longitudinal skin incision was made overlying the third and fourth extensor compartments until exposure of the capsule. A resection of the PIN was systematically carried out by surgeon B. The PIN was visualized on the ulnar ridge of the distal radius and terminal branches were divided transversely from the floor of fourth compartment 1 cm proximal to the joint. Next, the capsule was cut open through an H-shaped incision. Lunate was sharply excised either en bloc or in piecemeal fashion, and then the scaphoid and triquetrum were removed. Care was taken to preserve the volar radiocarpal ligaments. Following bone excision, the wrist capsule and extensor retinaculum were closed in layers. Post-operative protocols included 3 weeks of immobilization with passive motion exercises just after the soft tissue recovery and followed by controlled active motion.

Statistical analysis of the data was made with IBM SPSS Statistics version 23 software. The Kolmogorov-Smirnov test was used for variable groups, Student *t* test was used for variables with normal distribution and the values were presented as mean. Pearson χ^2 test was used in comparison of categorical values. A two-tailed *P* value of $<.05$ was considered statistically significant.

The second part of the study was a systematic review of the literature. Results were reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.²² An electronic MEDLINE database search (searched from January 2005 to January 2015) was performed. Search terms included “proximal,” “row,” and “carpectomy” keywords. One of the authors reviewed all studies with full English texts. All types of studies were included (a) if there was a combination of proximal row carpectomy and posterior interosseous nerve neurectomy, (b) if clinical results of such

Table 1. Indications for Surgery.

	SNAC	Kienböck Disease	Missed Perilunate Dislocation	Untreated Radius Distal Fracture
Group 1	2	3	2	—
Group 2	3	3	1	1

Abbreviation: SNAC, Scaphoid non-union advanced collapse.

combination were mentioned. Collected data included: study type/design/year of publication, number of included patients, mean follow-up, demographic data, clinical results and any comments on combination of PRC and PIN neurectomy.

Results

Indications for surgery and the demographic data of the patients are displayed in Tables 1 and 2. Baseline characteristics and the indications for surgery were similar in both groups. There were no statistically significant difference between the groups in regard to age and follow-up period ($P = .463$ and $P = .728$, respectively). None of the patients had previous surgery in the affected wrist before.

At the latest follow-up, the range of flexion–extension and radio–ulnar deviation was found higher in group 1, but the difference was not significant statistically ($P = .431$ and $P = .689$, respectively). Contrarily, both Quick DASH and MAYO scores were higher in group 2, but the difference was again insignificant ($P = .452$ and $P = .728$, respectively). The results are displayed in Table 3.

Capitro radial arthrosis was detected in one patient of group 2 on X-rays at last follow-up control.

In the second part of the study, a total of 155 citations were evaluated with full articles and searched if there was such combination: following the inclusion criteria and review of the full texts 12 citations that combined PRC with PIN neurectomy were included into the study. The literature review demonstrated that none of the trials was comparing PRC alone and PRC combined with PIN neurectomy. To the best of our knowledge, the present study was the first comparative study

specifically evaluating such combination. Of the 12 studies 3 were prospective^{13,14,16} and 2 were retrospective series^{12,15} comparing PRC with PIN neurectomy with other procedures. Remaining 7 were case series.^{1,5,7,8,10,11,17} Only Ali et al had specific comments on PRC with PIN neurectomy⁵ (Table 4). The methodological heterogeneity of the included studies, the lack of control groups and/or preoperative clinical data precluded unbiased results.

Discussion

Proximal row carpectomy is a successful salvage procedure used to treat various wrist conditions (1, 2). On the other hand, some authors advocate combining PRC with PIN neurectomy in order to obtain better results.^{3,5} The rationale for denervation is to provide an additional pain management option by eliminating the terminal articular sensory nerve fibers. Another reason that PIN excision has become common place in wrist salvage surgery in general is that it is easily exposed by a dorsal incision. But, theoretically, PIN neurectomy has potential complication of creating Charcot-like changes.²⁴ Additionally, we think that combining PRC with PIN neurectomy necessitates a longer incision, prolonged operation time, so increased risk of complications. Yet, we have not identified any complications related to PIN neurectomy, so far.

After all, even if one does not formally identify the PIN and resect it, in the technique of the PRC, could possibly have severed the PIN from the dorsal capsule. Wilhelm anatomical studies have shown that the transverse limb of the incision (In H, T, or U shaped wrist capsule dissections) could denervate the dorsal wrist capsule.^{23,24} This possibility is compatible with our results, in that, PIN resection has no benefit when combined with PRC. Additionally, this possibility could be another reason that there is no difference between the groups. Besides, there is no direct information in the literature about situation of branches of PIN, after PRC capsular dissection. On the other hand, when PIN reaches the radiocarpal joint, it divides into 3 to 4 main branches in the capsular tissue.²⁴ Therefore, after the capsular incision in PRC, it is possible that some of the

Table 2. Patient Characteristics.

	Patients	Age	Male	Female	Dominant	Nondominant	Follow-Up ^a
Group 1	7	45.5 (24-58)	5	2	4	3	48 (12-181)
Group 2	8	41 (25-61)	4	4	6	2	36.8 (12-168)

^aMonths.

Table 3. Comparison of Groups According to Clinical Results.

	Q-DASH	VAS	MAYO	Flex-Ext	RD-UD
Group 1	21.7 (6.8-59)	1.7 (0-6)	65 (50-80)	86.2 (50-120)	34 (20-65)
Group 2	28.2 (6.8-44.5)	2.3 (0-7)	67.3 (50-85)	74.3 (45-120)	30.3 (20-65)
P	.452	.562	.728	.431	.689

Abbreviations: Ext, extension; Flex, flexion; RD, radial deviation; UD, ulnar deviation.

Table 4. Clinical Results of Studies on PRC Combined With PIN Neurectomy.

Study First Author	Design	N (PRC + PIN)	Mean Follow-Up	Mean Age	Mean Flex + Ext	Mean RD + UD	DASH/ Q-DASH	VAS	MAYO	Conclusion
Dacho et al (2008)	PRC vs McA	30	27 months	39.5	75	33	25	1.2	57	NC
Croog et al (2008)	Case series	21	10 years	38	105	42	12	NR	84	NC
Richou et al (2009)	Case series	24	116 months	36	76	45	31	1.2	NR	NC
Edouard et al (2010)	Rehabilitation in PRC (case series)	13	25.2 months	41	53	25	38.9	NR	NR	NC
Ali et al (2012)	Case series	81	19.8 years	41	69.4	30.8	25.2	NR	61.8	Surgical adjuncts to improve long-term outcomes may be the addition of a PIN neurectomy with all PRC procedures
Hohendorff et al (2012)	STT vs PRC	11	1 year	32.5	81.4	39.6	36.7	1.6	54.6	NC
Wall et al (2013)	Case series	17	20 years	36	68	NR	16	1.5	NR	NC
Singh et al (2014)	FCA vs PRC	22	47 months	54	60	28	NR	NR	NR	NC
Berkhout et al (2015)	FCA vs PRC	12	17 years	40	97	39	NR	1.6	67	NC
Fukushima et al (2015)	Capsule interposition in PRC (comparison)	30	1 year	36.5	NR	NR	42.5	NR	NR	NC
Lenoir et al (2015)	Prognostic (case series)	27	59 months	51	81	32	22	NR	57	NC
Buluc et al (2015)	Case series	24	41.7 months	39.7	80.2	40.4	17.4	NR	67.3	NC

Abbreviations: Ext, extension; FCA, four-cornerarthrodesis; Flex, flexion; McA, midcarpal arthrodesis; NC, no specific comment on PIN neurectomy; NR, not recorded; PIN, posterior interosseous nerve; PRC, proximal row carpectomy; RD, radial deviation; STT, scaphotrapeziotrapezoid; UD, ulnar deviation.

branches could remain intact, without a neurectomy. Thus, theoretically, a PIN neurectomy 1 cm proximal to the joint would provide more effective denervation.

Review of the literature revealed several studies including such combination, but interestingly none was a comparative study (Table 4). It is well known that best evidence comes from prospective, comparative studies and it seems there is a real gap in the literature to make conclusion on this subject.¹⁸

In the present study, we obtained good results in both groups (Table 3). Although we obtained better results by MAYO in patients with neurectomy and better results by Q-DASH without neurectomy, the differences were not significant (Table 3). Interestingly pain relief was better in patients without neurectomy in our series but again the difference was not significant. Range of motion, both in flexion–extension and radial–ulnar deviation arcs were also greater in patients without neurectomy (Table 3).

Our results were comparable with other studies in the literature (Table 4). However, most of the articles included in the second part of our study, lacking either ROM measurements or Q-DASH, VAS, or MAYO scores (Table 4).

This is a real problem in comparing the series or performing systematic review. Additionally most of these studies had not commented on PIN neurectomy. Only Ali et al suggested adding neurectomy to all PRC procedures, for they obtained better results.⁵

Our results clearly demonstrated that combining PIN neurectomy with PRC has no advantage. On the other hand, the number of the patients included in the study prevents more strict conclusions, even though this is only comparative study in the literature. Two-surgeon retrospective study design is also another weakness of the study.

Conclusion

We advocate not to combine PRC with PIN neurectomy not only for such an approach has no advantage but also has some potential complications.

Authors' Note

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Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained. The work was done in Katip Celebi University.

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