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A comparative study on autologous bone grafting combined with or without posterior interosseous nerve neurectomy for scaphoid nonunion treatment

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KEYWORDS

Scaphoid nonunion;
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nerve;
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Outcome

Summary *Background and aim:* Scaphoid nonunion (SN) is a challenging state after scaphoid fracture. The posterior interosseous nerve neurectomy (PINN) is often performed adjunctively with scaphoid reconstruction using autologous bone grafts. However, it remains unclear whether PINN has a prophylactic or therapeutic value, and thus it results superior to patients with SN without PINN.

Methods: A retrospective study was performed to evaluate patients with SN who were treated with autologous bone grafts with (cohort 1) or without PINN (cohort 2) between 1996 and 2010. Clinical outcomes, Mayo-wrist score, quality of life by Short Form (SF)-36 questionnaire, and analysis of risk factors were included.

Results: A total of 151 patients with SN met the inclusion criteria, and 48 were lost in follow-up. The mean follow-up was 71.3 ± 39.0 months. Out of the remaining 103 patients, the union rate was without a statistical difference ($P = 0.847$) between cohorts 1 and 2. Functional results and the Mayo score were comparable in patients with bone union between both cohorts ($P > 0.05$). The results of wrist-pain measurements, including visual pain scales and wrist tenderness, were found to be similar ($P > 0.05$). Additionally, there was no significant difference in the quality of life.

Conclusion: The comparative study on autologous bone grafts for scaphoid reconstruction revealed comparable results for both patients with and without PINN independent from the

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choice of bone graft. We anticipate a prophylactic value of PINN due to a potential injury or an irritation during dissection of the wrist capsule. Further research on PIN, its sensory characteristics, and its impact on wrist function is required.

Levels of evidence: III

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Introduction

Scaphoid nonunion (SN), which has been reported to occur in 5% of all scaphoid fractures, is still a challenging therapeutic problem.¹ For patients with SN, wrist pain and scaphoid instability significantly impair their hand functions, and they result in carpal collapse.

The posterior interosseous nerve neurectomy (PINN) has been evolved as a standard procedure, and it is often employed to release patients from the chronic pain due to wrist pathology.^{2–9} Many groups have demonstrated that PINN allows good to excellent pain relief post-operatively^{2,7,8} as well as restoration of wrist functions.^{9–14} However, controversial demonstrations exist, and unsatisfactory results have been reported in pain control, strength enhancement, and mobility improvement.^{8,9}

PINN is also often performed as a standard procedure adjunctively with scaphoid reconstruction using bone grafts.^{3,15–18} Ideally, the combination of PINN and autologous bone grafting could cover all benefits of both surgeries.³ Nevertheless, it remains unclear so far whether this combination has a prophylactic or a therapeutic value, and thus it results superior to patients with SN without PINN, relevant evidence is currently rare.

In the present retrospective study, 103 patients who had received scaphoid reconstruction using autologous bone grafts with or without PINN in our center were reviewed and scheduled for follow-up. The aim of this study was to evaluate the long-term outcome of the combination of these two procedures, and to provide evidences for its future clinical role and indication.

Patients and methods

Patient selection and data obtainment

After approval of the local ethics committee (Nr. 837.074.11 (7616), Mainz, Germany), medical records of all patients who have been diagnosed and surgically treated for SN between December 1996 and December 2010 were systematically reviewed. The inclusion criteria were as follows: (a) SN diagnosed by computed tomography (CT) or conventional X-ray, (b) autologous bone-graft transplantation with or without PINN as a surgical method, (c) postoperative union or nonunion diagnosed by CT or conventional X-ray, and (d) the follow-up is ≥ 12 months.

Either 1,2-intercompartmental-supraretinacular-artery-vascularized bone graft (1,2-ICSRA-VBG), nonvascularized bone graft from the iliac crest (IC-NBG) or nonvascularized

cancellous bone grafts from the distal radius (DR-NBG) were employed. The dorsal approach was used on patients with proximal to mid-third nonunion, and the palmar approach was used on mid-third to distal nonunion. For mid-third nonunion, the surgical approach was decided by the sagittal CT image reading and discussion. PINN was performed for operations with dorsal approaches. All bone-graft transplantations were performed according to the methods previously reported.^{4,19–21}

Cast immobilization was performed for at least 6 weeks. After that, the cast was removed if the union was diagnosed, or cast immobilization was finished at the latest at 16 weeks postoperatively with or without scaphoid union. Radiological examinations were performed at 6, 12, and 16 weeks, and at the latest follow-up. Scaphoid union was diagnosed by a team of hand surgeons and radiologists. X-rays were performed in posterior–anterior, lateral, and scaphoid views. CT was employed if there was any doubt regarding the X-ray film or the clinical appearance for union/nonunion.

Perioperative variables were independently extracted from medical records by one reviewer, including age at the last scaphoid reconstruction, gender, body mass index (BMI), injured hand (dominant/nondominant), delay between injury and the last scaphoid reconstruction, smoking history, alcohol-consuming history, number of scaphoid operations, type of scaphoid reconstruction surgery, type of internal fixation, presence or absence of PINN, length of operation, length of hospital stay, and immobilization time.

Postoperative values were collected from the scheduled follow-up. The wrist pain was assessed applying a visual scale (0–10, no pain to strong pain). The tenderness on palpating the Tabetiere, on palpation after axial thumb pressure, and on palpating the distal scaphoid was examined. Surgical union as well as wrist and hand functions, including grip strength, key-pinch strength, active range of motion (AROM) for extension–flexion (E–F), and radial–ulnar abduction (R–U), were evaluated. The Mayo score was calculated and compared between both cohorts. Additionally, Medical Outcomes Study Short Form 36-Item Health Survey (SF-36) was used to access the quality of life (QoL) of patients. The SF-36 is a widely used, self-administered questionnaire with 36 items involving eight subscales: physical functioning, role limitations due to physical problems, bodily pain, general health perception, vitality, social functioning, role limitations due to emotional problems, and mental health. In addition, physical and mental component summary (PCS and MCS) scores can be calculated with scores of the above eight subscales.

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