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Original article

Results of percutaneous fixation and distal radius core decompression in scaphoid waist non-unions treated without grafting

Résultats de la fixation percutanée sans greffe osseuse dans les pseudarthroses du tiers moyen du scaphoïde associée à la décompression de l'extrémité distale du radius

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ABSTRACT

Scaphoid non-union management is still a challenge in clinical practice for orthopaedic surgeons. Though several treatment methods have been described, there is an ongoing debate about optimum management. Based on new concepts about avascular conditions, promising results were reported with metaphyseal decompression of the distal radius by increasing the vascularization of the radial column of the carpus. We aimed to evaluate the clinical, radiological, and functional outcomes of distal radius core decompression and fixation with palmar percutaneous cannulated compression screws without grafting in patients with scaphoid waist fracture non-union. Twenty-nine patients with scaphoid non-union were included in this prospective study. There were 27 male and 2 female patients with an average age of 29 years (range 18–45 years). Mean time from the injury to surgery was 18.3 months. The Slade and Geissler classification was used to classify the non-unions. Wrist range of motion (ROM), pain based on a visual analog scale (VAS), and the Mayo wrist score were used to assess the clinical outcomes. Postoperative radiographs and CT-scans were reviewed to assess fracture union, carpal alignment and screw position. The average clinical follow-up was 76 weeks (range: 74–87 weeks) postoperatively. Mean time to union was 11 weeks (range: 7–18 weeks). There was no humpback/no DISI in any of the cases. Twenty-six patients healed successfully with no additional procedures. Three patients with failed union underwent revision surgery with grafting. At the final follow-up, average wrist ROM was 61 ° (range: 30–80) in extension and 61 ° (range: 35–80) in flexion, the average Mayo wrist score was 66 ± 20 (range: 20–90), and the mean VAS was 2 ± 2 (range: 0–7). Percutaneous fixation without grafting associated with distal radius core decompression can provide satisfactory outcomes in surgical management of scaphoid non-unions.
Level of evidence: II.

Mots clés :
Vissage
Pseudarthrose
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Traumatisme du poignet
Chirurgie
Décompression

RÉSUMÉ

Le traitement des pseudarthroses du scaphoïde reste un challenge en pratique clinique pour le chirurgien orthopédiste. Bien que plusieurs méthodes de traitement aient été décrites, le traitement optimal est encore débattu. À partir de nouveaux concepts sur les troubles vasculaires, des résultats prometteurs ont été rapportés avec la décompression métaphysaire de l'extrémité distale du radius par le biais d'une augmentation de la vascularisation de la colonne radiale du carpe. Notre but était d'évaluer les résultats cliniques, radiologiques et fonctionnels de la décompression de l'extrémité distale du radius associée à l'ostéosynthèse par voie palmaire avec des vis canulées en compression sans greffe osseuse chez des

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patients présentant une pseudarthrose du tiers moyen du scaphoïde. Vingt-neuf patients avec une pseudarthrose du scaphoïde ont été inclus dans cette étude prospective. Il y avait 27 hommes et deux femmes avec un âge moyen de 29 ans (18–45). Le temps moyen écoulé entre le traumatisme et la chirurgie était de 18,3 mois. La classification de Slade et Geissler a été utilisée pour regrouper les pseudarthroses. Les mobilités (ROM) du poignet, la douleur évaluée sur une échelle visuelle analogique (EVA) et le Mayo wrist score ont été utilisés pour apprécier le résultat clinique. Les radiographies et les scanners postopératoires ont permis d'apprécier la consolidation de la fracture, l'alignement du carpe et la position de la vis. Le recul moyen était de 76 semaines (74–87). Le temps moyen pour obtenir la fusion était de 11 semaines (7–18). Il n'y eut ni cal vicieux ni désaxation en DISI dans aucun des cas. Vingt-six patients avaient consolidé sans nouvelle intervention. Trois patients avec une pseudarthrose persistante ont été réopérés par greffe osseuse. Au recul final, la mobilité moyenne du poignet était de $61^\circ \pm 14^\circ$ (30–80) en extension et de 61° (35–80) en flexion; le Mayo wrist score moyen était de 66 ± 20 et la douleur sur l'échelle visuelle analogique était en moyenne de 2 ± 2 (0–7). Une ostéosynthèse percutanée sans greffe osseuse associée à une décompression de l'extrémité distale du radius peut donner des résultats satisfaisants dans le traitement chirurgical des pseudarthroses du scaphoïde.
Niveau de preuve. – II.

1. Introduction

Scaphoid non-union cases are still a challenge in clinical practice for orthopaedic surgeons. Several treatment methods have been described to manage scaphoid non-unions, but none has been found to be superior [1]. Open reduction and internal fixation with bone grafting is still the most frequently performed surgical procedure [2], in which non-vascularized or pedicled rotational bone grafts are used [3].

Percutaneous screw fixation is usually recommended for minimally-displaced acute fractures, early-stage non-unions with normal scapholunate angle and no cystic bone changes, avascular necrosis, fixed deformity and damaged cartilaginous continuity [4]. Several studies propose using percutaneous fixation to treat scaphoid non-union [4–6]. Major advantages of this technique include the procedure being performed through a minimal incision, no bone devascularization, no carpal ligament damage, and minimal scar tissue development [7].

Metaphyseal core decompression (MCD) of the distal radius produces reactive hyperemia in the carpal bones and accelerates the vascularization of the radial column [5]. Previous studies [5,8] have described the radiographic changes of demineralization involving both the radius and carpus following fractures and suggested that this demineralization was indicative of increased vascularity. Furthermore, Illarramendi and De Carli identified radionuclide uptake extending across the carpus in cases of non-displaced fractures of the distal radius. They also noted spontaneous resolution of Kienböck's disease after a non-displaced distal radius fracture [5].

This study aimed to evaluate clinical and functional outcomes of distal radius core decompression plus percutaneous screw fixation without grafting in the treatment of the scaphoid waist non-union.

2. Patients and methods

2.1. Patients

The study was performed in a prospective manner after approval by our ethics committee. Thirty-two patients who were diagnosed with scaphoid waist fracture non-union between May 2012 and September 2014, and those who gave written consent were enrolled in the study. Exclusion criteria consisted of bone tumours, bone infections, traumatic sequela of the hand or wrist, another simultaneous carpal bone fracture, arthritis, and congenital deformity. The inclusion criteria were scaphoid waist non-union, minimal fracture line, and normal scapholunate angle without humpback deformity and no DISI configuration (grade I–II–III in the Slade and Geissler classification [9]).

Although intrascaphoid angle measurement is unreliable and depends on the orientation of the CT plane, it was measured on coronal CT slices by drawing a perpendicular line to each of the proximal and distal poles and calculating the resulting angle. Three patients who did not attend regular follow-up visits were excluded from the study. Of the remaining 29 patients, there were 27 males and 2 females. Mean age of the subjects was 29 years (range: 18–45). Dominant limbs were affected in 21 (79%) of the patients. All fractures were at the scaphoid waist. The mean time elapsed from the fracture event until the surgery was 75 weeks (range: 28–86). Nineteen patients were immobilized by casting and waited for healing before the decision to perform surgery was made when non-union was detected. Eight patients came to the hospital later, only after aggravation of the pain after trauma. In the remaining two patients, the fracture was not detected at the emergency room, and diagnosed later in the outpatient setting.

Preoperative and postoperative X-rays and CT-scans were performed routinely in all subjects. Preoperative MRI was performed to confirm the absence of proximal pole avascular necrosis. Slade–Geissler and Schernberg [10] classifications were used to define and evaluate the non-union [7,8]. Grip and pinch forces were measured with a dynamometer and pinchmeter (Jamar, Fabrication Enterprises Inc., White Plains, NY, USA). Mayo wrist scores were recorded before and after the surgery.

2.2. Surgical technique

All patients were operated by the same orthopaedic surgeon. Without being inflated, a tourniquet cuff was placed in each patient's arm to allow conversion of the procedure into an open surgery, if needed. Reduction was achieved by forcing the wrist into dorsiflexion and ulnar deviation with the hand supinated. The reduction was confirmed by fluoroscopy. The margins of radiocarpal, scaphoid, and scaphotrapezial joints on the palmar side of the hand and wrist were marked with a skin marker to make a 5 mm incision, distal to the scaphotrapezial joint. Soft tissues were dissected, and the distal pole was exposed. Temporary fixation was performed with a 1.0 mm K-wire, introduced from the lateral part of the scaphotrapezial joint at a 45 ° angle to the dorsal and medial lines. Length was measured over the K-wire before drilling with a 2.5 mm cannulated drill bit. A 3.5 mm headless cannulated

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