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Surgical technique

Arthroscopic grafting of scaphoid nonunion – surgical technique and preliminary findings from 23 cases

Grefe d'une pseudarthrose du scaphoïde sous arthroscopie – technique chirurgicale et premiers résultats à partir d'une série de 23 cas

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Abstract

We report our experience with the arthroscopic treatment of 23 cases of scaphoid nonunion. We explain the surgical technique and describe the different steps needed to achieve bone union. We report our initial clinical and radiological results. This was a prospective non-randomized study. Inclusion criteria were a scaphoid nonunion without radiocarpal arthritis, without any time limit and without any selection as to nonunion location. Before the operation, patients underwent an X-Ray and CT scan or MRI. Schernberg's classification was used to evaluate the location of the nonunion. Internal fixation was performed with a screw or K-wires. Bone grafts were taken from the dorsal side of the distal radius using a T-Lok™ bone marrow biopsy needle (Argon Medical Devices, Plano, TX, USA). A CT scan was performed 3 months after the operation to determine whether union was achieved. Pain, strength and range of motion were evaluated before and after the operation. The patients' smoking habits were also documented. The average follow-up was 17.3 months (4–41). There were 20 men and 3 women with an average age of 26 years (17–63). The average duration of nonunion before the operation was 17 months (6–60). Based on Schernberg's classification, there was one type I, 12 type II and 10 type III nonunions. Wrist strength increased from 32 to 41 kg. Union was obtained in all patients after an average of 4 months (3–12). Numerous treatments have been described for treating scaphoid nonunion: Matti–Russe, Fisk–Fernandez bone graft, vascularized bone graft, bone substitutes, etc. The success rate varies depending on the technique and study design. We have described an arthroscopic technique for treating scaphoid nonunion with very promising preliminary results. Arthroscopic debridement is needed to ensure good quality bone at the graft site, while preserving extrinsic vascularization. Traction is used during the operation to restore the scaphoid height, once debridement has been completed. Use of the compacted cancellous bone plugs adds stability to the nonunion site and helps to fill the defect. We have yet to encounter a case in which this technique cannot be used (other than the presence of radiocarpal or midcarpal arthritis), whether there is a large bone defect or the nonunion site is very proximal.
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Keywords: Nonunion; Scaphoid; Arthroscopy; Bone graft; K-wire; Screw

Résumé

Nous rapportons notre expérience du traitement arthroscopique des pseudarthroses du scaphoïde carpien à partir d'une série continue de 23 cas. Nous développons la technique chirurgicale en précisant les différentes étapes nécessaires à l'obtention de la consolidation. Nous rapportons nos premiers résultats, cliniques et radiologiques. Il s'agit d'une série prospective, non randomisée. Les critères d'inclusion étaient l'existence d'une pseudarthrose du scaphoïde sans limite de temps et quelle que soit la localisation. Les critères d'exclusion étaient l'existence d'une arthropathie radiocarpienne. L'imagerie préalable à l'intervention était au minimum soit une radiographie et un scanner ou arthroscanner, soit une radiographie et un IRM. La classification des pseudarthroses a été réalisée selon la classification de Schernberg des fractures du scaphoïde tenant compte du niveau lésionnel. Les moyens d'ostéosynthèse utilisés étaient soit une vis à double pas type Whipple-Herbert, soit 2 broches de Kirschner. La greffe osseuse a été prélevée à chaque fois dans l'extrémité distale du radius à l'aide d'une tréphine spécifique T-Lok™ bone marrow

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biopsy needle (Argon Medical Devices). L'évaluation de la consolidation a été réalisée de façon systématique par un scanner au troisième mois postopératoire. La douleur, la force et les amplitudes articulaires ont été évaluées avant l'opération et au dernier recul. L'existence d'une intoxication tabagique a également été notée. Les 23 patients opérés ont été revus avec un recul moyen de 17,3 mois (4–41). Il s'agissait de 20 hommes et 3 femmes avec une moyenne d'âge de 26 ans (17–63). La durée moyenne d'évolution de la pseudarthrose avant l'intervention était de 17 mois (6–60). Les pseudarthroses se répartissaient en une fracture de type 1, 12 fractures de type 2 et 10 fractures de type 3 selon la classification de Schernberg. La force est passée de 32 à 41 kg. La consolidation a été obtenue chez tous les patients avec un délai moyen de 4 mois (3–12) indépendamment du délai préopératoire, du type de fracture ou de la présence d'une intoxication tabagique ou du moyen d'ostéosynthèse. De nombreux traitements ont été décrits pour la prise en charge des pseudarthroses du scaphoïde allant de la greffe osseuse autologue, encastrée ou intercalaire, aux greffons vascularisés, en passant par l'injection de substituts osseux ou l'adjonction de facteurs de croissance. Les taux de consolidation obtenus sont très variables en fonction des séries et des auteurs. Nous proposons ici une technique arthroscopique dont les premiers résultats sont très encourageants. Le débridement arthroscopique permet de s'assurer de la qualité du site receveur tout en préservant la vascularisation extrinsèque. La traction permanente permet de redonner la hauteur du scaphoïde une fois le débridement réalisé. L'utilisation de carottes osseuses spongieuses compactée assure une stabilité primaire et un remplissage le plus complet possible de la perte de substance osseuse. Nous n'avons pas trouvé jusqu'à présent de cas où cette technique ne pouvait être utilisée (en dehors de la présence d'une arthropathie) qu'il s'agisse de pertes de substances importantes ou d'atteintes très proximales.

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Mots clés : Pseudarthrose ; Scaphoïde ; Arthroscopie ; Greffe osseuse ; Broche ; Vis

1. Introduction

When a scaphoid fracture progresses to nonunion, the carpus gradually becomes misaligned, which leads to the development of radiocarpal and then midcarpal arthritis [1,2]. This progression corresponds clinically to stiffening of the wrist with pain and loss of strength. Open surgical treatment of scaphoid nonunion relies on vascularized or non-vascularized grafts, typically in combination with internal fixation [3–7]. This treatment leads to union in 80% to 91% of cases, depending on the technique used. Arthroscopy has been used for several years to treat nonunion cases, with a success rate that is at least as good as with open surgery [8–11]. We will describe in detail our experience with this technique, including the results of our first 23 cases.

2. Material and methods

2.1. Series

This was a prospective, non-randomized study performed between December 2012 and September 2015. Twenty-three patients were operated on and reviewed after a mean of 17 months (4–41). There were 20 men and 3 women with a mean age of 26 years (17–63). Patients were enrolled in the study if they had a scaphoid nonunion, independent of the chronicity or the location. Patients with radiocarpal arthritis were excluded. Before the procedure, X-rays and a CT scan or CT arthrography were performed, or X-rays and an MRI. The nonunion was classified according to Schernberg's classification for scaphoid fractures [12], which takes into account the location of the injury. Either a double-threaded Herbert/Whipple[®] bone screw or K-wires were used for fixation. In all patients, the bone graft was harvested from the distal radius using a T-Lok[™] bone marrow biopsy needle (Argon Medical Devices, Plano, TX, USA). The surgical technique is described in the next paragraph. Bone union was assessed using a CT scan 3 months

after the surgery. Pain, strength and joint range of motion were evaluated preoperatively and at the last follow-up. The patients' smoking habits were also documented.

2.2. Surgical technique

2.2.1. Patient positioning

The patient is supine with the arm in 90° abduction and resting on an arm board. A tourniquet cuff is placed at the base of the operated limb. A counter-support pad needed for traction is secured to the table, where it rests against the tourniquet. The arthroscopy system is placed at the patient's feet, with the surgeon standing on the side of the operated arm, near the patient's head. An image intensifier is placed across from the operated arm, at the patient's feet. The traction tower is located on the arm board when a sterile tower is used, or secured to the contralateral side of the surgical table when a non-sterile tower is used (Fig. 1). Hence, for a left scaphoid injury, the surgeon is

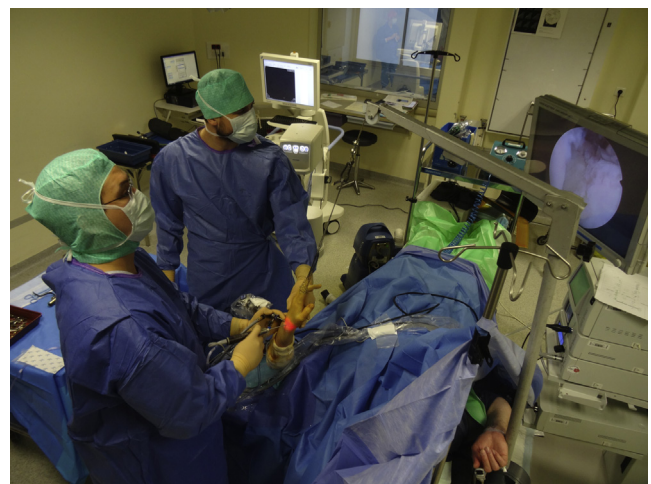


Fig. 1. Patient setup for treating nonunion of the left scaphoid. The left arm rests on an arm board. The fluoroscopy unit is placed on the patient's left at his feet and the video screen on the right.

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