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Original article

Modified Suzuki frame for the treatment of difficult Rolando fractures

Le cadre de Suzuki modifié pour le traitement des fractures de Rolando difficiles

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Abstract

Fifteen consecutive patients with severely comminuted Rolando fractures were treated by closed reduction and fixation with a modified Suzuki frame without rubber bands, followed by immediate mobilization. All the fractures healed within 5 weeks. At 3 months, no rotational deformity was observed. The Kapandji score was equal that of the contralateral thumb in eight cases. No residual pain was recorded. Grip strength was 78% and pinch strength was 78% of the contralateral hand. One patient needed the frame tension modified. One patient developed a sensory deficit in the area of the superficial branch of the radial nerve that resolved spontaneously in 3 months. One patient healed with a 2-mm articular step-off, but the clinical outcome was good. Our retrospective study suggests that the small modification we made to the Suzuki frame provides a relatively simple and minimally invasive technique for the treatment of comminuted Rolando fractures.

Keywords: Suzuki frame; Rolando fracture; Intra-articular fracture of the hand; Dynamic fixation; Early mobilization

Résumé

Quinze patients consécutifs soufrant de sévères fractures comminutives de Rolando ont été traités par réduction à foyer fermé, avec le cadre de Suzuki modifié sans bandes élastiques et avec une mobilisation immédiate. Toutes les fractures ont consolidé dans les cinq semaines. À trois mois, aucune déformation rotatoire n'a été observée. Dans huit cas, le score de Kapandji était identique à celui du pouce controlatéral. Aucune douleur résiduelle n'a été rapportée. La force de préhension était de 78 % et la force de pince 78 % de celle de la main controlatérale. La tension du cadre a dû être modifiée pour un patient. Un autre a développé un déficit sensitif dans le territoire du rameau superficiel du nerf radial ayant régressé spontanément dans les trois mois. Un dernier a guéri avec une marche d'escalier intra-articulaire de 2 mm mais avec un bon résultat clinique. Notre étude rétrospective suggère qu'une légère modification du cadre de Suzuki, telle que nous l'avons utilisée, est une technique relativement simple et minimalement invasive pour le traitement des fractures comminutives de Rolando.

Mots clés : Cadre de Suzuki ; Fracture de Rolando ; Fracture intra-articulaire de la main ; Fixation dynamique ; Mobilisation précoce

1. Introduction

Fractures of the base of the first metacarpal account for 4% of all hand fractures [1]. About 9–21% of those are Rolando fractures [2] with variable comminution. A variety of treatments have been described in literature, depending on the degree of comminution. The surgical approach and final outcome depend greatly on the fracture pattern and articular surface involvement, and how well the latter is restored if damaged [3].

For non-comminuted or slightly comminuted intra-articular fractures, the prevailing fixation techniques rely on plates and screws [4]. However, there is no consensus on the treatment of profoundly comminuted Rolando fractures with fragments too

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small to qualify for this type of internal fixation. Alternative techniques have been described for these specific cases [5–10]. Despite technical advances in plate design and instrumentation, including lower-profile titanium plates, complications occur commonly with plate fixation of metacarpal fractures. Furthermore, plate fixation often requires tenolysis and plate removal in metacarpal fractures [11].

We previously reported the preliminary results of a single patient with a Rolando fracture [12] treated with a slightly modified Suzuki frame [8,13,14]. The current study is the first ever published series evaluating outcome in patients operated using this novel surgical technique.

2. Patients and methods

2.1. Patients

From July 2012 to November 2015, 15 adult patients with a Rolando fracture having variable displacement and severe comminution were referred to our hand surgery department. Open fractures and complex traumas such as amputations, subtotal amputations and crush injuries were excluded from the study. Thirteen patients were men and two were women, with an average age of 40 years (range 18–86 years, SD 19.1). Eight fractures involved the dominant hand and seven the non-dominant hand. The histories given by the patients included a fall onto the hand in 11 cases, direct trauma in 3 cases and polytrauma with an unclear mechanism of the injury in 1 case. The mean time from injury to the surgical treatment was 3.5 days (range 1–10 days, SD 2.1). The surgical treatment was discussed with the patient at the time of arrival and a modified Suzuki frame was proposed as a fixation strategy to all patients. New anterior-posterior (AP), oblique and lateral (LL) plain digital X-rays were taken in all cases prior to surgery.

2.2. Surgical technique

We used a modified Suzuki frame as previously described by Giesen et al. [12]. All procedures were performed by the same surgeon.

Anesthesia was based on the patient's preference and/or need to surgically repair other injuries in polytrauma patients. Regional anesthesia was used in five cases, general anesthesia in six cases and local anesthesia in four cases. Closed reduction was performed and fixation was maintained with a modified Suzuki frame that consisted of one 1.6 mm and one 1.5 mm K-wire, but no rubber bands. The 1.6-mm K-wire was passed from palmar-radial to dorsal-ulnar through the trapezium at 90° to the axis of the metacarpal bone, with the wrist in 0° extension. The 1.5-mm K-wire was passed through the head of the first metacarpal bone, parallel to the previous wire (Fig. 1A). To hook the distal K-wire on the proximal one, the frame was constructed with a dorsal to palmar S shape in order to avoid a contact between the frame and skin when the thumb was flexed (Figs. 1(B and C)–3). The operative time was recorded in all cases.

2.3. Postoperative care

The patients were encouraged to move the thumb immediately and began a controlled active mobilization regimen without splinting within one week after the procedure.

2.4. Postoperative follow-up

All patients underwent their first clinical and radiological follow-up within 1 week of the surgery to verify the amount of distraction across the fracture and if necessary, modify it by changing the curvature of the frame's arms. In two cases, a CT-scan of the thumb 2 weeks post-surgery with the frame in place was performed in order to verify joint congruity (Fig. 4).

The next follow-up was planned at 5 weeks postoperative (mean 33.8 days, range 27–41 days, SD 3.7). At this point, if bone union was visible on the radiographs, the K-wires were removed in an ambulatory setting without anesthesia.

Follow-up was planned for all patients at a minimum of 3 months postoperative (mean 95 days, range 35–294 days, SD 66). All patients were seen by the surgeon at each follow-up. X-ray views were taken in a standardized manner to measure any postoperative articular step-off.

2.5. Assessment

At each follow-up, function of the affected thumb was measured using the Kapandji score [15] and was compared to the contralateral side. Grip strength (Jamar Dynamometer position 2) and pinch strength were also recorded and compared to the uninjured thumb.

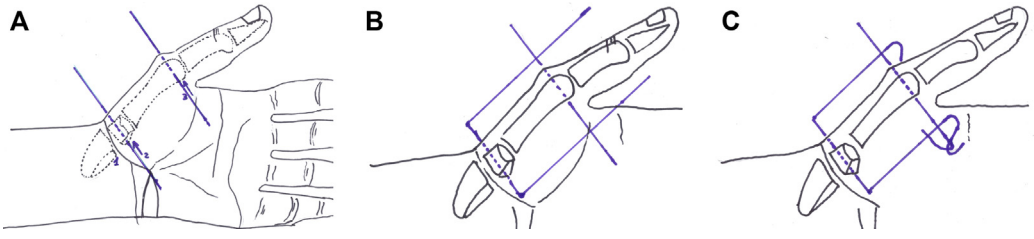

Fig. 1. Drawing of surgical technique (palmar view) showing the scaphoid (1) and the insertion of the proximal (2) and distal (3) K-wires (A). Bending of K-wires to hook the distal K-wire on the proximal K-wire (B and C).