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Fifth metacarpal neck fracture: Non-locking mini plate vs Foucher pinning

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Abstract

Fractures of the fifth metacarpal neck are common injuries that can result in functional impairments if not properly managed. Surgical intervention is indicated when flexion angulation exceeds 30°, or in cases of rotational deformities or shortening greater than 3 mm. This study aimed to evaluate the clinical and functional outcomes of two surgical techniques: intramedullary pinning and fixation with non-locking mini-plates. A total of 83 patients with fifth metacarpal neck fractures were included, with 61 treated by intramedullary pinning (Group I) and 22 by non-locking mini-plates (Group II). Outcomes were assessed using subjective parameters (pain, Disabilities of the Arm, Shoulder, and Hand [DASH] score) and objective measures (grip strength, range of motion, and radiographic alignment).

Keywords: Fifth metacarpal neck fracture; Intramedullary pinning; Non-locking mini-plate; Foucher; Surgical outcomes

1. Introduction

Metacarpal fractures are common, representing 10% of all upper limb fractures [1]. They are caused by direct trauma to the metacarpal head or by a twisting mechanism [2]. These fractures account for nearly half of all hand fractures [3,4]. Orthopedic treatment is typically indicated if the following criteria are met: flexion deformity of the metacarpal head <30° [5,6], absence of rotational deformities [7], and shortening <3 mm [8]. When these conditions are not met, surgical treatment becomes necessary. Several biomechanical studies have compared different osteosynthesis techniques for fifth metacarpal fractures [9,10,11]. The objective of this study is to analyze therapeutic outcomes and compare two surgical methods—intramedullary pinning and non-locking mini plates-based on a series of 81 patients treated in the Orthopedic Trauma Department, Aile4, at Ibn Rochd University Hospital Center, Casablanca.

2. Material and methods

We conducted a retrospective, comparative, single-center, multi-surgeon study on 83 closed fractures of the fifth metacarpal neck, surgically treated between January 2015 and December 2021 in the Orthopedic Trauma Department, Aile 4, at Ibn Rochd University Hospital Center, Casablanca. All patients had isolated fractures of the fifth metacarpal neck and did not meet the criteria for orthopedic treatment. The patients were divided into two groups: Group 1, treated by pinning, and Group 2, treated by non-locking mini plate. All surgeries were performed under axillary block anesthesia with a pneumatic tourniquet at the base of the limb. In Group 1, a dorsomedial approach was made at the base of the fifth metacarpal (M5) with an average incision length of 2 cm. This was followed by square-point trephination and the insertion of three 1.6 mm Kirschner wires under fluoroscopic control in 61 cases. Immobilization was maintained for two weeks, after which rehabilitation began (Figure 1).

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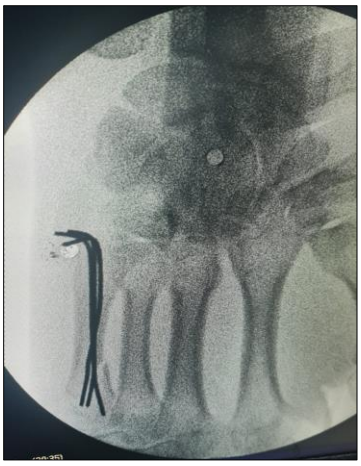

Figure 1 Foucher Pinning

In Group 2, a dorsomedial approach was performed with retraction of the dorsal branch of the ulnar nerve and the extensor tendons. A non-locking T-plate was then inserted with 2.0 mm screws in 22 cases. No immobilization was used, and early rehabilitation was initiated (Figure 2).

Figure 2 Non-locking Mini Plate

The results were analyzed using subjective criteria based on the Quick-DASH questionnaire, strength comparison with the contralateral side, and objective criteria, including the angle between the head and the diaphysis on ¾ radiographs after healing, as well as the presence of complications.

3. Results and discussion

The mean age of the patients was 30.5 years, with a range of 17 to 56 years, and a male-to-female ratio of 5.23. The dominant side was affected in 51.85% of cases, with two cases of bilateral fractures. The average time to treatment was 5 days. The average angle measured on the ¾ radiographs was 50.2°, with Group 1 showing an average angle of 49.6° and Group 2 an average of 52°. The average Quick-DASH score was 20.4, with Group 1 having an average of 21.7 (range 12–41) and Group 2 an average of 16.8 (range 11–25). Regarding overall hand strength, the two bilateral cases treated with mini plates were excluded. Strength was considered satisfactory and comparable to the contralateral side in 17 cases (94.4%) in Group 2 and 77.9% in Group 1. The number of rehabilitation sessions was twice as long in Group 1, with an average of 27 sessions compared to 15 sessions in Group 2. The average angle measured on ¾ radiographs after consolidation was 16.2°, with Group 1 showing an average of 17.9° and Group 2 an average of 11.3°. Complications included one case of stiffness and one case of sepsis due to hardware in Group 2. In Group 1, there was one case of malunion (Figure 3), which required osteotomy with mini plate fixation, one case of Complex Regional Pain Syndrome, and three cases (4.9%) of stiffness requiring subsequent arthrolysis.

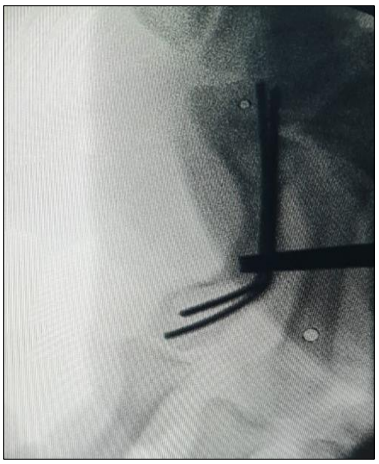

Figure 3 Malunion secondary to failure of Foucher pinning

Various surgical techniques have been described for the osteosynthesis of fifth metacarpal neck fractures: Kapandji pinning [12], L-shaped pinning [13], Foucher pinning [14], external fixation [15], non-locking plate fixation [16], and locking plate fixation. Surgical treatment is associated with complications such as stiffness, pin migration, adhesions to the extensor tendons, and non-union [17]. These risks are reduced with open reduction and Foucher pinning [18]. Facca [19] found similar pain levels between Foucher pinning and mini plate treatments, with slightly better Quick-DASH scores in the mini plate group. Jin Rok's cadaveric study [20] showed that mini plates were more resistant to forces than pinning and centromedullary screws, though the comparison was limited as only one centromedullary pin was used. Soo Min [21] did not find radiological or clinical differences between mini plate or pinning treatment, except that DASH scores and grip strength were lower in patients treated with mini plates after a two-year follow-up, which he attributed to hardware removal. Fusetti [22] suggested that open surgery, despite causing loss of fracture hematoma, did not affect union, but this remains inconclusive. Boussakri [23] described the advantages of using a single large-diameter centromedullary pin (18/10) to reduce bending and false tracts, as well as to shorten surgical time and reduce infection risk.

4. Conclusion

Fifth metacarpal neck fractures are very common, particularly in young individuals, and are often caused by direct trauma. Surgery is indicated when clinico-radiological criteria are met. The choice between different types of pinning and plate fixation should consider the advantages and disadvantages of each technique. Pinning reduces operative time and the risk of infection but may result in a longer recovery of joint range of motion. In contrast, the use of mini plates allows for earlier rehabilitation and reduces the risk of stiffness.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Court-Brown CM, Heckman JD, McQueen MM, Ricci WM, Tornetta P, McKee MD. Rockwood and Green's fractures in adults. 8th ed. Wolters Kluwer; 2015.

[2] De Jonge JJ, Kingma J, van der Lei B, Klasen HJ. Fractures of the metacarpals: A retrospective analysis of incidence and aetiology and a review of the English-language literature. Injury. 1994;25(6):365-9.

[3] Feehan LM, Sheps SB. Incidence and demographics of hand fractures in British Columbia, Canada: A population-based study. J Hand Surg Am. 2006;31(7):1068-74.

[4] Braakman M, Oderwald EE, Haentjens MH. Functional taping of fractures of the fifth metacarpal results in a quicker recovery. Injury. 1998;29(1):5-9.

[5] Hofmeister EP, Kim J, Shin AY. Comparison of two methods of immobilization of fifth metacarpal neck fractures: A prospective randomized study. J Hand Surg Am. 2008;34(8):1362-8.

[6] Ali A, Hamman J, Mass DP. The biomechanical effects of angulated boxer's fractures. J Hand Surg Am. 1999;24(4):835-44.

[7] Margic K. External fixation of closed metacarpal and phalangeal fractures of digits: A prospective study of one hundred consecutive patients. J Hand Surg Eur. 2006;31(1):30-40.

[8] Black D, Mann RJ, Constine R, Daniels AN. Comparison of internal fixation techniques in metacarpal fractures. J Hand Surg Am. 1985;10(4):466-72.

[9] Firoozbakhsh KK, Moneim MS, Doherty W, Naraghi FF. Internal fixation of oblique metacarpal fractures: A iomechanical evaluation by impact loading. Clin Orthop Relat Res. 1996;(325):296-301.

[10] Curtis BD, Fajolu O, Ruff ME, Litsky AS. Fixation of metacarpal shaft fractures: Biomechanical comparison of intramedullary nail, crossed K-wires, and plate-screw constructs. Orthop Surg. 2015;7(3):256-60.

[11] Dyrna FGE, Avery DM, Yoshida R, et al. Metacarpal shaft fixation: A biomechanical comparison of dorsal plating, lag screws, and headless compression screws. BMC Musculoskelet Disord. 2021;22(1):335. doi:10.1186/s12891-021-04200-0

[12] Kapandji AI. L'ostéosynthèse par broches perpendiculaires dans le traitement des fractures et cals vicieux du col du cinquième métacarpien. Ann Chir Main Memb Super. 1993;12(1):45-55.

[13] Kermad F, Cazeneuve JF, Hassan Y, Rihan B, Boustani H. Embrochage en L, à deux broches, des fractures du col du cinquième métacarpien. Acta Orthop Belg. 2002;68(3):231-4.

[14] Gonzalez MH, Igram CM, Hall RF. Flexible intramedullary nailing for metacarpal fractures. J Hand Surg Am. 1995;20(3):382-7.

[15] Margic K. External fixation of closed metacarpal and phalangeal fractures of digits: A prospective study of one hundred consecutive patients. J Hand Surg Eur. 2006;31(1):30-40.

[16] Page SM, Stern PJ. Complications and range of motion following plate fixation of metacarpal and phalangeal fractures. J Hand Surg Am. 1998;23(5):827-32.

[17] Winter M, Balaguer T, Bessière C, Carles M, Lebreton E. Surgical treatment of the boxer's fracture: Transverse pinning versus intramedullary pinning. J Hand Surg Eur. 2007;32(6):709-13. doi:10.1016/j.jhse.2007.07.011

[18] Ozer K, Gillani S, Williams A, Peterson SL, Morgan S. Comparison of intramedullary nailing versus plate-screw fixation of extra-articular metacarpal fractures. J Hand Surg Am. 2008;33(10):1724-31. doi:10.1016/j.jhsa.2008.07.011

[19] Facca S, Ramdhian R, Pelissier A, Diaconu M, Liverneaux P. Fifth metacarpal neck fracture fixation: Locking plate versus K-wire? Orthop Traumatol Surg Res. 2010;96(5):506-12. doi:10.1016/j.otsr.2010.02.015

[20] Oh JR, Kim DS, Yeom JS, Kang SK, Kim YT. A comparative study of tensile strength of three operative fixation techniques for metacarpal shaft fractures in adults: A cadaver study. Clin Orthop Surg. 2019;11(1):120-5.

[21] Cha SM, Shin HD, Kim YK. Comparison of low-profile locking plate fixation versus antegrade intramedullary nailing for unstable metacarpal shaft fractures: A prospective comparative study. Injury. 2019;50(12):2252-8. doi:10.1016/j.injury.2019.10.018

[22] Fusetti C, Garavaglia G, Papaloïzos M. Plate fixation in closed ipsilateral multiple metacarpal fractures. J Hand Surg Eur. 2008;33(6):740-4.

[23] Boussakri H, Elidrissi M, Azarkane M, Bensaad S, Bachiri M, Shimi M, et al. Fractures of the neck of the fifth metacarpal bone, treated by percutaneous intramedullary nailing: Surgical technique, radiological and clinical results study (28 cases). Pan Afr Med J. 2014;18:187.