Intramedullary screw fixation for metacarpal delayed Union: A case report

Abstract

Metacarpal fractures are common hand injuries that often require surgical intervention for significant displacement or instability. Various fixation methods such as Kirschner wires, plates, external fixators, and intramedullary screws are used, each with potential complications. Understanding the anatomy and biomechanics of the metacarpal is crucial for successful management. We present a case of a 36-year-old man with a second metacarpal fracture following a motorcycle accident.

Keywords: Metacarpal Bones, Fracture Fixation, Hand Injuries, ununited fractures

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Introduction

Metacarpal fractures are common hand injuries. Surgery is recommended when fractures have significant displacement or are unstable. Various options, including Kirschner wires, plates, external fixators, and intramedullary screws, are used to fix metacarpal fractures. Potential complications include joint stiffness, tendon irritation, malunion, non-union, Delayed union, and cartilage damage [(1)]. Delayed union is defined as the failure to achieve radiographic evidence of healing within the expected timeframe. To select the most beneficial and secure method for each fracture, a thorough understanding of the anatomy of the metacarpal, musculotendinous attachments, and surrounding neurovascular structures is necessary. Various deforming forces act on the head, neck, shaft, and base of the digits, making managing metacarpal fractures more challenging [(2)]. In this study, we report a case with a metacarpal fracture, some complications, and the outcome.

Case presentation

This work has been reported in line with SCARE criteria [(3)]. A 36-year-old man was admitted to our hospital with pain and swelling in his right hand after a motorcycle accident. The patient's examination results were normal. The past medical history was significant only for psychotic disorders. Radiography of the injured hand revealed a second metacarpal fracture (Figure 1).

After the initial assessment, the patient was admitted to the operating room (OR). Three transverse pins were percutaneously inserted into the second and third metacarpal bones (Figure 2).

Two weeks after surgery, standard follow-up radiographs showed failure of the fracture

Figure 1: Anterior-posterior radiography shows a second metacarpal fracture.

reduction. In the second surgery, the pins were removed and open reduction and internal fixation were performed to fix the fracture. Three weeks later, the patient was referred to our department after another trauma that caused a fixation failure (Figure 3).

Clinical examination revealed swelling at the site of the previous surgery and decreased total active motion. The plate and screws were removed and the fracture was fixed with an intramedullary headless screw. Hand physiotherapy was initiated immediately after the final surgery range of motion and 2 weeks later. Postoperative visits were performed at 2,4,6,12 weeks and the final visit was performed at 6 months. The ultimate achievement was a normal total active range, accompanied by the successful union (Figure 4, 5).

Discussion

Most metacarpal fractures can be treated with external immobilization and rehabilitation, while internal fixation is favored for unstable fracture patterns and patients requiring early motion. The structure of the metacarpal bone and soft tissues provides functional stability for many fractures, making non-surgical treatment successful. Surgical techniques include pinning, plating, and intramedullary (IM) devices[2, 3].

The most commonly used surgical methods are closed reduction and percutaneous pinning. This approach offers advantages such as low cost, flexibility in availability, lower technical difficulty, and a well-established track record. Disadvantages include potential pin tract infections, irritation of the extensor tendons, and the need for additional immobilization. A small open approach can also be used, either retrograde, transversely, or antegrade. Transverse pinning is usually only used for border digits, particularly when comminution is present and requires a stable adjacent metacarpal [4].

Plating is the ideal option for treating transverse, long oblique, or spiral fractures of the metacarpal shaft. Dorsal plating with locking or non-locking plates is typically used in these circumstances. When the fracture is spiral or long oblique, interfragmentary compression screws may also be utilized. Plating is usually reserved for cases where there is some diaphyseal bone loss, comminution, serious soft tissue injury, or nonunion. The advantages of plating include early range-of-motion exercises, reduced need for immobilization, and no

Figure 2: Anterior-posterior radiography after initial surgery.

Figure 3: Anterior-posterior radiography shows device failure.

Figure 4: Anterior-posterior radiography 4 months after surgery.

Figure 5: Range of motion 4 months after surgery.

exposed hardware. However, there are some drawbacks such as higher surgical costs, greater technical difficulty, and the possibility of irritating the surrounding extensor tendons[5, 6].

IM fixation devices, including IM compression screws, IM rods and nails, and IM K-wires, have become a good option for treating length-stable metacarpal fractures. This method permits less immobilization and allows for an early range of motion, with minimal hardware exposure or irritation by the extensor mechanism. However, there are some drawbacks, including the cost of the implant (which varies depending on the chosen implant), the technical demands, and the limitations of certain fracture locations and patterns[1, 7, 8].

Additionally, this technique has previously been employed in a restricted number of cases for treatment of metacarpal non-union. In the present study, we utilized this approach to address metacarpal delayed Union, yielding satisfactory results [9]. In this case, we utilized all three methods of metacarpal fixation surgery, each of which has its advantages and disadvantages. However, finally, the intramedullary technique was used and it can be said that this technique is applicable in cases with metacarpal delayed or non-union which a few cases have been reported so far.

This study has notable limitations, including the limited number of cases examined. To substantiate the claim of the effectiveness of the intramedullary screw for metacarpal delayed Union, a larger-scale clinical trial is warranted. Furthermore, it would have been advisable to consider an alternative treatment approach for the patient right from the outset due to the second metacarpal fracture.

Conclusion

Intramedullary screw fixation was a good alternative method for metacarpal delayed or non-union treatment, especially when previous techniques had failed. More research with more cases is required to determine the complications and benefits of this approach.

Patient informed consent

Written informed consent was obtained from the patient for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Conflict of interest

None.

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