

Functional Outcome After Internal Fixation Combined with External Fixation in Severe Comminuted Distal Radius Fracture: A Case Report

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ABSTRACT

Introduction: It has been 192 years since Colles first demonstrated distal end fracture of radius. Nowadays, this type of fracture still became challenging fractures treated by orthopaedic surgeons. Even this type of fractures was common of the upper limb, the appropriate management still remain debateable. Various types of management have been demonstrated, it's included immobilized with cast, closed reduction and fixation with percutaneous Kirschner wires and other methods for external and internal fixation.

Case Presentation: Patient is female 16 years old complained pain on her left wrist after traffic accident on (October 2019). Patient was diagnosed in Singaraja Hospital with Open Fracture Left Distal Radius and Ulna distal third grade 3A, Patient was performed debridement and open reduction external fixation at the distal radius. Patient was referred to Orthopaedic polyclinic at Prof IGNG Ngoerah hospital due to inadequate alignment after evaluation of 3 weeks post operation. In Prof IGNG Ngoerah Hospital, we performed additional ORIF T-Plate 6 holes with 6 screws on radius and ulnar percutaneous pinning in order to provide additional stability to the comminuted distal radius fracture.

Conclusion: Combination of external fixator with T-plate internal fixation decreased re-shifting postoperatively of broken bones chances and kept the stability of fractures to sustain radial height and prevent radial shortening. Thus, it is a safe and effective

method for comminuted-type fracture of distal radius.

Keywords: External Fixation, Comminuted Fracture, Distal Radius

INTRODUCTION

It has been 192 years since Colles first demonstrated distal end fracture of radius. Nowadays, this type of fracture still became challenging fractures treated by orthopaedic surgeons. Even this type of fractures was common of the upper limb, the appropriate management still remain debateable. Various type of management have been demonstrated, it's included immobilized with cast, closed reduction and fixation with percutaneous Kirschner wires and other methods for external and internal fixation.(Al Khudairy et al. 2013) The main goal when planning the management was to stabilize the fracture, because non-surgical methods can be administered to stable fracture. Therefore, if instability present, surgical approach required, such as internal fixation, external fixation, or percutaneous methods. Nowadays, still no gold standard of management and no evidences in the effectiveness among those methods.

Comminuted-type fracture of distal end radius are commonly cause by higher energy trauma younger people and on elderly people with trauma of low energy, and came as cut and impacted of articular

surface of the distal radius with displaced bone fragments, which emphasize the damage to distal radius and disturbed restoration of articular congruity. Disruption of ligaments and carpus displacement and/or the triangular fibrocartilage complex (TFCC), would affect functional outcome. Patients whom functional recovery is a priority, then reduction and stable fixation were accomplished by using surgical reduction with either percutaneous pinning or internal fixation or external fixation. (Obert et al. 2013; Alm-Paulsen et al. 2012; Arora et al. 2007) Functional outcome will be assessed using Quick DASH score (Disabilities of the Arm, Shoulder and Hand), which consist scoring on different physical activities of upper limb, and severity of each symptoms such as pain, tingling, weakness, stiffness, and activity related pain but on shorter version from the original DASH score. Research from Gummesson *et al*, shown that QuickDash score provide similar result as the original DASH score. (Williams 2014; Gummesson, Ward, and Atroshi 2006)

CASE PRESENTATION

Patient is female 16 years old complained pain on her left wrist after traffic accident on (October 2019). Patient was riding motorcycle suddenly collided with a car from the front side and fell to the asphalt. Patient was diagnosed in Singaraja Hospital with Open Fracture Left Distal Radius and Ulna distal third grade 3A, Patient was performed debridement and open reduction external fixation at the distal radius. Patient was referred to Orthopaedic polyclinic at Prof IGNG Ngoerah hospital due to

inadequate alignment after evaluation of 3 weeks post operation. On physical examination, we found external fixation at the dorsal side left forearm and stich wound without discharge and swelling at the left wrist. Tenderness palpable at distal part of the forearm, radialis and ulnar artery palpable, capillary refill time was normal and normal sensory. Range of motion of the wrist can't be evaluated, Laboratory infection marker evaluation was found still within normal range.



Figure 1. Clinical Picture at Left Forearm First Operation

We found severe comminuted fracture at left radius distal and ulna distal third with displacement. After debridement and external fixation on X-Ray radius distal and ulna distal third the bone fragment unstable. In Prof IGNG Ngoerah Hospital, we performed additional ORIF T-Plate 6 holes with 6 screws on radius and ulnar percutaneous pinning in order to provide additional stability to the comminuted distal radius fracture.



Figure 2. X-ray of First Operation Debridement with Open Reduction External Fixation

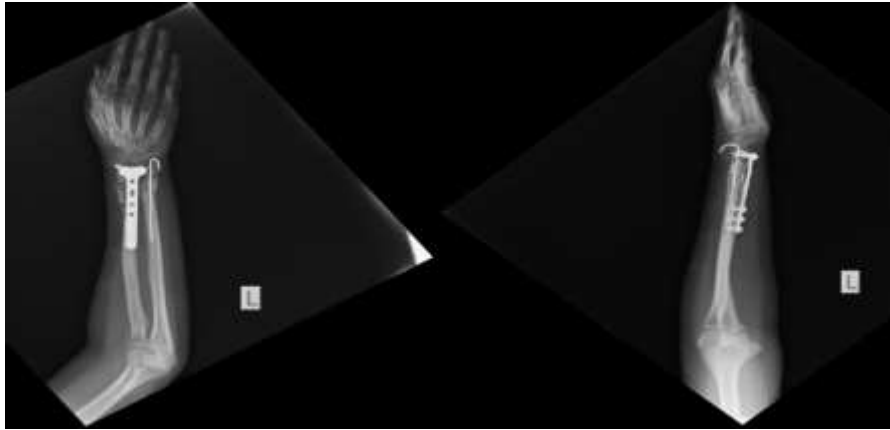


Figure 3. Clinical and X-ray Images of Post Operation Additional T-Plate on Radius with Ulnar Percutaneous Pinning



Figure 4. X-ray Images of 1 month post operation, evaluation shows no sign of infection and the fracture is stable with mild callus. External Fixator was removed



Figure 5. Clinical images of 6 months post operation additional T-plates on radius with ulnar percutaneous pinning showing adequate Range of Movement of left wrist

DISCUSSION

Comminuted-type fractures of distal radius commonly were not stable which caused by higher energy trauma and direct axial compressed injuries. Unsuitable management could trigger wrist joint

degeneration, pain and stiffness. Moreover, changes in distal radius articular surface, palmar and ulnar angle deviation, and abbreviation of radius could affected rotation of forearm and movement of wrist.

Anatomical reduction of articular surface was not only a proper management of distal radius intra-articular fractures, it also for gain better outcome. If radial abbreviation surpass 5 mm, articular surface shift surpass 2 mm, or palmar angle tilts dorsally more than 20°, then position and wrist joint movement became disturbed; the condition can elevated local stress by 27-51%, which could triggered osteoarthritis caused by trauma (Kilic et al. 2009). After administration of gypsum and splint for fixation, there will no power persisted against contraction of isometric muscle. Though early reduction was recommended, there still chances to be a re-shift. Moreover, incision of surgery could reset the surface of articulation and fracture which could obstruct visualization, for anatomy correction of wrist and to regain its biomechanical function. Shorten of radius fundamentally decreased wrist movement and pain while on movement, which were factors affecting wrist activities. Motorized external fixators would not affected fracture stability during post operation wrist movement (Dienst, Wozasek, and Seligson 1997). Fixation externally can sustain radial length, but longitudinal traction force parallel to the radius can't regain palmar angle of the articular surface of distal end radius. Administration of external fixator can't stop collapse of dorsal distal, it would triggered backward sloping of the articular surface, according to Vakhshori *et al*, 2020 showed the usage of external fixator only in comminuted-type fracture of distal radius is correlated with higher chances of infection compared to stabilization using radiocarpal distraction plate or volar locking plate. (Vakhshori et al. 2020; Gehrmann, Windolf, and Kaufmann 2008)

Study nowadays confirms that combination of external fixator with palmar plate administration can regain angle of palmar and avoid radial collapse effectively. Moreover, a simple external fixator is inadequate to treat severe comminuted-type fracture of distal radius. Ruch *et al*, 2005 concludes the administration of cross-wrist

supporting plate in management of severe comminuted-type fracture of radius on distal end could trigger better result clinically with least obstacle. However, the cross-wrist supporting plate fixation restricted early movement of wrist, because the wrist joint must be fixed in this method; moreover, the recovery process was longer for comminuted-type fractures, studies from Han *et al*, 2015 and Hegazy *et al*, 2019 also reported similar result, where patient whom managed with external fixator combined with T-plate Internal fixation showed palmar flexion and dorsiflexion of wrist, radial height, and palmar angle were satisfactorily significant than those whom treated with simple plate, consequently patient can attain good outcome with excellent functional score. (Ruch et al. 2005; Han et al. 2015; Hegazy et al., 2020). However, using this fixation technique means the surface articulation can't adjusted according to healing process of patient to provide early functional movement. Furthermore, this fixation needs to create incision dorsally and breaks fractured end for supply of vascular. Thus, this type of fixation method was rarely used in practice than external fixator. The cross-wrist supporting plate fixation also restricted early movement of wrist, because the joint must be fixed in this method; moreover, recovery was longer in comminuted-type fracture. (Ruch et al. 2005; Han et al. 2015) Targeted outcome of operative procedure in comminuted distal radius fracture includes wrist flexion, extension, pronation, and supination outcomes. Time frames for removal of the external fixator at 3 months, then ROM training and removal of pinning at 6 months, patient is expected to able achieve functional ROM at 9 months post operation, which will be assessed using the Quick DASH score. (Ikpeze et al. 2016)

CONCLUSION

This paper reports treatment for comminuted distal radius fracture with combination of external fixator and T-plate internal fixation gain better outcome.

Combination of external fixator with T-plate internal fixation decreased re-shifting postoperatively of broken bones chances and kept the stability of fractures to sustain radial height and prevent radial shortening. Thus, it is a safe and effective method for comminuted-type fracture of distal radius.

Declaration by Authors

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