



## "DOUBLE TENSION BAND OSTEOSYNTHESIS IN DISTAL HUMERUS FRACTURE IN OSTEOPOROTIC ADULTS AND INFECTED NONUNIONS"

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### ABSTRACT

**Background:** It is a challenge for orthopedic surgeon to fix osteoporotic distal humerus fracture rigidly for early mobilization because holding power of plate and screws is low in osteoporotic bone fracture and have higher failure rate. Second challenge is to fix an infected nonunion of distal humerus fracture because of restriction to use plate and screw. To achieve a stable, pain free and mobile joint require appropriate planning, systematic approach and anatomical reduction. **Aim:** To evaluate effectiveness of double tension band osteosynthesis in distal humerus fracture of osteoporotic adult bone and infected nonunions. **Method:** Ten patients presenting six fractures and three nonunion of the distal humeral, treated with double tension band wiring between 2018 and 2023 were retrospectively evaluated, two fracture were type A2, two were type C1, remaining two were type C2 and rest are previously operated infected nonunions. Patients age averaged about 55 years. There are 5 males and 5 females. **Results:** Out of 10 cases treated with this method, rigid fixation and union was achieved in all of them. Radiological union was achieved at an average of 10.8 weeks (8-14 weeks). Average range of motion was 104.5 degrees with maximum range of motion 120 degrees (10-130) and minimum of 70 degrees (30-100). Excellent or good results were obtained in 80% of the patients in our study. **Conclusion:** Double tension band is a reliable, less demanding and cost effective method of fixation of distal fractures of humerus in osteoporotic adults and infected nonunions.

**KEYWORDS :** Distal Humerus Fracture, Doble Tension Band Wiring, Osteoporotic Adults, Infected Nonunions.

### INTRODUCTION:

Distal humeral fractures accounts for approximately 2% of all fractures and nearly one-third of humeral fractures in adults. The incidence of distal humerus fractures is due to the high-energy trauma among the younger population or minor falls in older individuals. A large number of suggested therapeutic approaches for this issue include closed reduction, external fixation, open reduction and internal fixation, and arthroplasty<sup>1</sup>. Open reduction and internal fixation is recommended in the case of unstable and displaced fractured in patients with good function in their upper limb. This approach aims to achieve stable anatomic reduction, which allows the early gentle range of motion<sup>(2,3)</sup>. According to the literature, double-sided plate for fixation is biomechanically preferred, compared to other methods<sup>(4,6)</sup>. In this technique we utilized the principle of tension band wiring to achieve rigid fixation of both the columns of the fracture. This principle applies to the conversion of tensile forces to compression forces on the convex side of an eccentrically loaded bone. Although double tension band osteosynthesis has provided acceptable outcomes regarding the fixation of distal humeral fractures in osteoporotic adults and infected nonunions, the current study aimed to evaluate this technique in terms of early movement and complications in the fixation of the distal humeral fractures. This technique is technically less demanding, cost effective and utilises minimal implant which is easy to place.

### MATERIALS AND METHODS:

The present study was a set respective study carried out from 2018 to January 2023; 10 patients of distal humerus fractures were operated at SRGH hospital Jhalawar medical college Jhalawar Rajasthan. All Patients underwent open reduction and internal fixation using double tension band osteosynthesis. The inclusion criteria were distal humeral fractures type A2, C1 and C2 classification (AO) in osteoporotic adults and infected nonunions.

The exclusion criteria included vascular involvement, poor

skin condition, and reluctance of the patients to participate in the study or follow-ups.

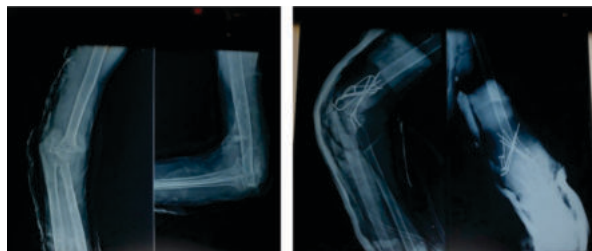
### Approach:

Under general anesthesia in lateral position (shoulder, elbow 90°-90°) without a tourniquet and sidearm, elbows were operated with posterior approach (Triceps reflecting anconeus pedicle without olecranon osteotomy). At first, the ulnar nerve was released. The medial edge of the triceps muscle from intermuscular septum were isolated and reflected at this stage with anconeus pedicle like a book cover. Without olecranon osteotomy articular aspects of distal humerus was exposed. Following that the distal humeral articular fracture (if present) was fixed by partial threaded cancellous screw perpendicular to fracture line, medial to lateral, or vice versa.

The reconstructed articular surface was fixed to medial and lateral columns with 2 K-wire (size: 2-2.5 mm) as the tip of the pin protruded about 5 mm from the opposite cortex. Therefore, 2 pins that penetrate medial-distal, protrude lateral-proximal as well as 2 pins that penetrate lateral-distal, protrude medial-proximal. In medial side, 2 pins proximally and 2 pins distally tied with wire and symmetrically compressed. The same procedure was repeated for the lateral side; in addition, distal tips were bent and cut in this procedure. After washing the surgical site, Finally the range of motion, varus, and valgus stability of the elbow were tested at the end of fixation. Furthermore, ulnar nerve was protected in its place by one suture to soft tissue. In case of any preoperative neurological symptoms, the nerve was transferred to the anterior part. Triceps anconeus pedicle sutured back to olecranon process (proximal ulna) with absorbable sutures. Subcuticular skin were sewn and arm splinted at 70-90°.

The patients were trained for gentle passive and active assisted movement. After 10-14 days, sutures were removed. Considering the follow-up sessions, the investigate patients were visited every two weeks during the 4-12 postoperative weeks, and at months 4, 6, and 12. The surgeon recorded the

outcomes of the surgery at the given times. The incidence of complications, including stiffness, infection, haematoma, wound dehiscence, pin loosening and movement, loss of reduction, failure of fixation, non-union, malunions, vascular injury, heterotopic ossification, and nerve damage were examined in the follow-up sessions .



Preoperative Xray

Postoperative Xray



Range Of Movemants



Another patient 12 WEEK union xray had type C2 FRACTURE

**RESULTS:**

A total of 10 patients with a mean age of 53.7 years (range: 35-85 years) participated in this study. Female to male ratio was 5 to 5. Out of 10 patients, two fracture were type A2 , two were type C1, remaining two were type C2 and rest are previously operated infected nonunions. The mean time to union was 12.24 weeks (range: 8-16 weeks) and the mean duration of follow-ups was 13.72 months (range: 6-24 months). ). Average range of motion was 104.5 degrees with maximum range of motion 120 degrees (10-130) and minimum of 70 degrees (30-100). Excellent or good results were obtained in 80% of the patients in our study.

Although wound haematoma and dehiscence were observed in two patients, they were treated after the evacuation of haematoma and conservative therapeutic procedures. The incidence of ulnar neuropathy was reported in two cases due to trauma and one case after the surgery. During 15-90 days, there were no signs of neurapraxia injuries. Since the range of motion was less than 100° in 4 patients, device removal was performed 6 months after.

The surgery when the range of motion was increased by nearly 120°. Moreover, patients were diagnosed with no

serious complications, such as nonunion of the fracture site, malunions, and deep infection. The radiological examination of the patients revealed the success of their treatment.

**Post Operative Average Motion Of The Patients According To Morrey's Concept**

Average Motion	Satisfaction	Patients
> 1200	Excellent	7
1000-1190	Good	1
800-990	Fair	1
< 800	Bad	1

**DISCUSSION :**

In general, Locking Compression Plate is a standard method for fracture fixation due to its high mechanical strength, as well as orthogonal or parallel plating; however, this technique increases the cost of treatment, operation time, soft tissue injury, and periosteal stripping<sup>(4,6)</sup>. On the other hand, tension band wiring aims to convert tensile force to compressive force across the reduced fracture plane<sup>(12)</sup>. Although various methods of fixation and limited internal fixation with screws, pins, or one plate have been introduced, these methods were not successful to maintain the early range of motion<sup>(12-15)</sup>. For instance, the cross-pinning fixation of the supracondylar humeral fracture has excellent results in children; however, this method of fixation is not effective for adults<sup>(3,16)</sup>. The MTBW is a cost-effective, strong, and secure method to allow gentle early motion regarding the fixation of distal humeral fractures type A2,C1 and C2 (AO Classification) in osteoporotic adults and infected nonunions. This technique reduces the duration of the surgery, tourniquet time, and the damage caused by soft tissue stripping (commonly occurred in plate fixation). Moreover, it requires simple methods of surgery and tools. Morrey et al. found that average motion (flexion, lack of extension) of at least 100° is enough for doing about 15 daily activities, which was in line with the obtained results of the current study<sup>(7)</sup>. According to Morrey, approximately 8 (80%) patients achieved good range of motion and the pins in the majority of cases, such as the internal fixation of the patella or olecranon, were removed. Pin removal is more convenient than plate removal; however, in some patients plate removal is not possible and may lead to morbidly. In a study conducted by Huoben et al., the surgical outcomes of the patients with plates and patients with the tension band wiring were similar<sup>(8)</sup>. The obtained results of a study performed by Zhao et al. demonstrated good to excellent outcomes in the majority of patients with intraarticular comminuted fracture by using crossed K-wires and double tension band osteosynthesis<sup>(9)</sup>. Allende et al. found that tension band wiring accompanied by other fixation technique can significantly improve the status of patients with osteoporosis<sup>(7)</sup>. Patients in the present study revealed no major complications, including non-union of fracture site, malunion, deep infection, and permanent nerve injury were observed. However, it should be noted that the present study suffered from some limitations, including its retrospective nature, relatively small number of participants, and the lack of a control group. Based on the obtained results, it can be concluded that TBW is an effective technique in fracture fixation, which allows gentle early motion in osteoporotic adult and infected nonunions. Moreover, this costeffective technique decreased the surgery duration, tourniquet time, and damage caused by soft tissue stripping.

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