

# Clinical Observation of External Fixation Stent Combined with Limited Open Reduction and Kirschner Wire Internal Fixation for Comminuted Distal Radius Fracture

Chaochao Ji, Xudong Sun

Department of Traumatic Orthopedics, Maanshan People's Hospital, Maanshan 243000, China.

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**Abstract: Objective:** To investigate the clinical effect of external fixation stent combined with limited open reduction and Kirschner wire internal fixation in the treatment of comminuted distal radius fracture. **Methods:** A total of 40 patients with comminuted distal radius fractures from January 2018 to December 2021 were selected, including 15 males and 25 females. Age 35-74 years old; AO type: C2 type 26 cases, C3 type 14 cases. External fixation stent combined with limited open reduction and internal fixation with Kirschner wire were used for the surgery. Wrist function was evaluated by Dienst score at the last follow-up. **Results:** In this study, all patients were followed up for 6-12 months after surgery, with an average of 8.5 months. Bone union was achieved in all patients. Complications: 1 case of nail tract infection, 2 cases of Kirschner wire withdrawal, 1 case of traumatic arthritis; According to Dienst score of wrist joint function, 25 cases were excellent, 12 cases were good, and 3 cases were fair. The excellent and good rate of wrist joint function was 92.5% (37/40). **Conclusions:** External fixation stent combined with limited open reduction and Kirschner wire internal fixation for the treatment of comminuted distal radius fracture can effectively fix, avoid the second incision and removal operation, can be performed according to the early stage of functional exercise, postoperative functional recovery of the wrist, providing an effective treatment method for the clinical treatment of this kind of fracture.

**Keywords:** Comminuted Fracture of the Distal Radius; External Fixation Bracket; Kirschner Wire

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## Introduction

Distal radius fractures are the most common type of fracture in the long dry bones of the extremities, accounting for approximately one in six emergency department fractures, and approximately 20% of these fractures are unstable fractures. With the aging of the population, the incidence of distal radius fracture is increasing. It is the third most common osteoporotic fracture<sup>[1]</sup>. In addition to low energy injuries, there are more and more patients with high energy injuries, mostly young people, most of them are intraarticular comminuted fractures. At present, about 32% of fractures are AO type C fracture. In the past, the preferred treatment was manual reduction plaster fixation or Kirschner wire fixation, but most unstable fractures will be displaced again in the later stage. With the continuous improvement of living standards and patients' functional requirements for the affected limb, surgery has gradually become the mainstream way to treat distal radius fractures. Restoring the smooth articular surface is very important to improve the functional effect of the wrist and improve patient satisfaction<sup>[2]</sup>. In order to explore a better treatment plan, our department selected 40 patients with comminuted distal radius fractures from January 2018 to December 2021, and treated them with external fixation stent combined with limited open reduction and internal fixation with Kirschke wire. All of them achieved good short-term efficacy, and the analysis is reported as follows.

## **Materials and methods**

### **Subjects**

A total of 40 patients with comminuted distal radius fractures were included in this study from January 2018 to December 2021. There were 15 males and 25 females; The age range is 35-74, with an average age of 59.25. AO type: C2 type 26 cases, C3 type 14 cases. Causes of injury: 17 cases were injured by car accident, 19 cases were injured by falling, 4 cases were injured by high fall. This study has been approved by the Ethics Committee of the hospital, and all patients signed informed consent.

### **Surgical methods**

After the brachial plexus block anesthesia was satisfied, the patient was placed in the supine position, the forearm pronated 20° ~ 30°, the ulnar side was placed high, so that the wrist joint was ulnar offset and metacarpal flexion, 2 external fixation needles were placed vertically before the middle part of the second metacarpal body and the axis of the metacarpal, and then 2 external fixation needles were placed vertically at the proximal end of the fracture 3cm and 6cm from the fracture line, and attention was paid to the protection of the superficial branch of the radial nerve. The fracture was then reduced by manual traction along the long axis of the radius, assisted reduction of the palmar or dorsal incision was performed according to the fracture situation, bone grafting was performed at the fracture collapse if necessary, and 1 to 3 Kirschner wires were used to maintain the broken end of the fracture according to the fracture situation. After the fracture was confirmed to be well reduced by fluoroscopy with C-arm X-ray machine, the wrist joint was then maintained in the functional position of the affected limb to be connected with the external fixation rod and fixed.

### **Postoperative management**

The active and passive functional exercise of interphalangeal joint and metacarpophalangeal joint was performed 24 h after the operation. Three weeks after surgery, the wrist joint was fixed in neutral position. Four weeks after surgery, the wrist joint was loosened. The patient was instructed to perform active flexion and extension training of the wrist with the assistance of external fixation bracket, 3-4 times a day, 15 minutes each time. The movable screw of the stent was released 6 weeks after operation, which was convenient for wrist flexion and extension function exercise. The external fixation stent was removed 8 weeks after surgery, and the Kirschner wire was removed 8 to 10 weeks after surgery, and the patients were instructed to carry out weight-bearing exercise.

### **Typical cases are shown in Pictures 1**

### **Results**

In this study, all patients were followed up for 6-12 months after surgery, with an average of 8.5 months. Bone union was achieved in all patients. Complications: 1 case of nail tract infection, 2 cases of Kirschner wire withdrawal, 1 case of traumatic arthritis, no other serious complications. According to Dienst score of wrist joint function, 25 cases were excellent, 12 cases were good, and 3 cases were fair. The excellent and good rate of wrist joint function was 92.5% (37/40).

### **Discussion**

With the aging of the population and the increase of high-energy injuries such as traffic accident injuries and high fall injuries in modern society, distal radius fracture has gradually affected the elderly and young people<sup>[3]</sup>, especially the

compostulated fractures of C2 and C3 distal radius, which means that the injury is more serious and the joint may face many serious complications in the later stage, such as wrist joint function limitation, traumatic arthritis, etc. Therefore. The surgical treatment of C2 and C3 fractures is difficult, because they involve articular surface separation, collapse, and comminuted displacement of metaphyseal fractures. Simple open palmar approach plate internal fixation may not be able to effectively fix all fractures, especially the collapsed articular surface, which cannot be adequately supported by screws. For patients with senile osteoporotic fractures, plate screws may not maintain effective reduction, and may easily lead to screw removal, aggravating the wear of the articular surface. For young patients with high-energy injuries, these fractures are associated with severe soft tissue damage, and open reduction plate internal fixation requires extensive dissection, which can aggravate soft tissue damage and increase the risk of wound infection<sup>[4]</sup>.

External fixation scaffold has its advantages in the treatment of comminuted distal radius fracture. (1) External Fixator is a minimally invasive surgery, the main reduction principle is through ligament traction reduction<sup>[5]</sup>; (2) It does not compress the surrounding soft tissue, small damage to the local hematoma and periostosis of the fracture, and maximally retains the blood supply at the fracture end, fast postoperative recovery, in line with the "BO" principle of modern fracture treatment; (3) The external fixation stent is elastic fixation, and early functional exercise can be performed after surgery, so the functional recovery is good, and the complications are far lower than the traditional plaster, splint and plate fixation; (4) Fixation was removed in vitro after fracture healing to avoid a second operation and reduce the chance of infection.

For C2 and C3 comminuted fractures, external fixation supports can provide some reduction and support, but auxiliary incisions and additional Kirschner wires are also necessary. Our own experience is that the conventional palmar-approach assisted small incision reduction of fracture blocks, prying up the collapsed articular surface, suggesting sufficient intraoperative bone grafting to prevent re-collapse, reduction of the remaining metaphyseal free and overturned fracture blocks, and multi-angle fixation with multiple Kirschler wires. Kirschner is extremely important for the adjustment and fixation of such fracture blocks, which can provide additional stability. To prevent small displacement of the fracture block, Kapandji technique can be used to reduce the displacement of the dorsal fracture block during the operation. If the overall line of force and stability are seriously affected by the crushing of the dorsal fracture, the dorsal incision can be assisted and reduced and fixed under direct vision<sup>[6]</sup>.

## Conclusion

External fixation stent combined with limited open reduction and Kirschner wire internal fixation for the treatment of comminuted distal radius fracture can effectively fix, avoid the second incision and removal operation, can be performed according to the early stage of functional exercise, postoperative functional recovery of the wrist, providing an effective treatment method for the clinical treatment of this kind of fracture.

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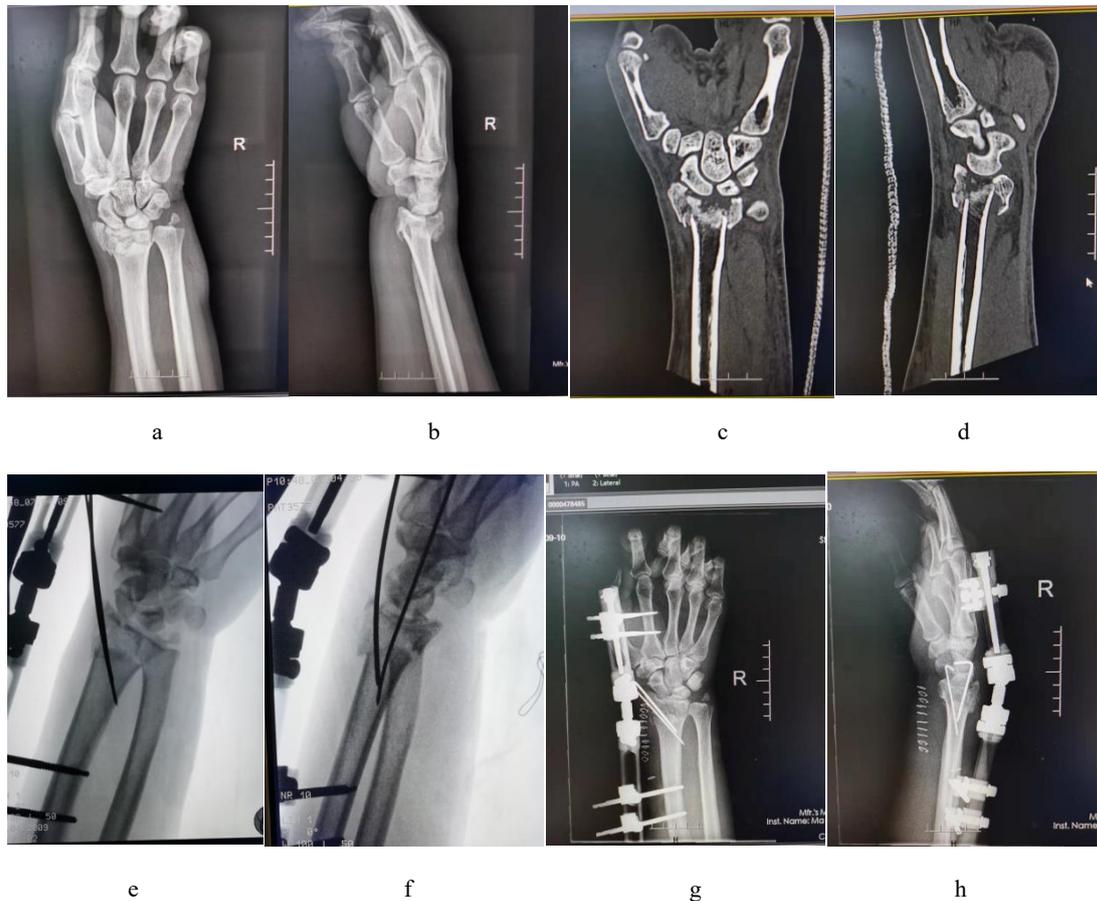


Figure 1. The patient, a 50-year-old male, AO type C3;(a,b,c,d) Preoperative plain radiographs and three-dimensional CT showed comminuted fracture of the distal right radius; (e,f) Intraoperative reduction using kapandji technique; (g,h) Postoperative radiographs showed good fracture reduction.

**Corresponding author :**

Chaochao Ji , Department of Traumatic Orthopedics , Maanshan People's Hospital , No.45, Hubei Road , P.R.China