

## VIDEO OF ORTHOPAEDIC TECHNIQUE

# Accurate Placement of Cannulated Screws in Femoral Neck Fractures: Screw and Guide Wire Combined Technique

Yu-feng Chen, MD, Dong Ren, MD, Shuang-quan Yao, MD, Lin-dan Geng, MD, Yun-shan Su, MD, Bo-yang Kang, MD, Peng-cheng Wang, MD

*Department of Traumatology, Hebei Medical University Third Affiliated Hospital, Shijiazhuang, China*

Cannulated screw fixation is widely used in the treatment of femoral neck fractures. During surgery, we often face the situation that a guide wire needs to be adjusted because of poor positioning in the femoral neck. It is difficult to adjust the direction of the guide wire in the neck of the femur due to its elasticity. This study developed a practical technique to adjust the guide wire to the correct position. When the direction of insertion of the guide wire has deviated, first, measure the length of the guide wire. Second, select the appropriate cannulated screw based on the measurement, and screw the cannulated screw in along the direction of the guide wire to Ward's triangle. Then return the guide wire to the front of the cannulated screw. At this time, the cannulated screw can be used as a built-in guide, and a screwdriver can be used to fine-tune the position of the screw to the optimal direction under the X-ray guidance. Finally, the cannulated screw is screwed in in this direction until it passes through the Ward triangle area, and the guide wire is inserted. This technique can help doctors insert a guide wire more quickly and accurately, reducing intraoperative injury and the operation time.

**Key words:** Cannulated screw; Femoral neck fracture; Fracture fixation, internal; Guide wire; Technique

## Introduction

Femoral neck fractures are common injuries, accounting for approximately 42.2% of proximal femur fractures<sup>1</sup>. With the development of transport technology and the increase in the number of traffic accidents, the incidence of femoral neck fractures has increased significantly, and these fractures are occurring more in younger individuals<sup>2</sup>. For young adults with femoral neck fractures, the standard treatment is internal fixation surgery<sup>3,4</sup>. Cannulated screws have been widely accepted by surgeons for clinical use because their application causes little additional injury, involves a simple operation, and has little influence on the blood supply of the femoral head. Multiple cannulated screws should be distributed in the femoral neck in a parallel fashion.

Usually, a predrilled tract is made with a guide wire to ensure correct insertion of the cannulated screw. In

clinical practice, although there is an external guiding device, the guide wire can easily slide on the bone surface, and it is difficult to adjust the direction in the femoral neck due to its elasticity, especially when the direction of the guide wire needs to be adjusted slightly. The guide wire is likely to slip into the incorrect, previous track after withdrawing the guide wire completely. Therefore, it is often necessary to adjust the guide wire several times to achieve the correct position. This can lead to the formation of multiple incorrect tracks in the femoral neck, which can prolong the operation time and increase intraoperative injuries and X-ray fluoroscopy times.

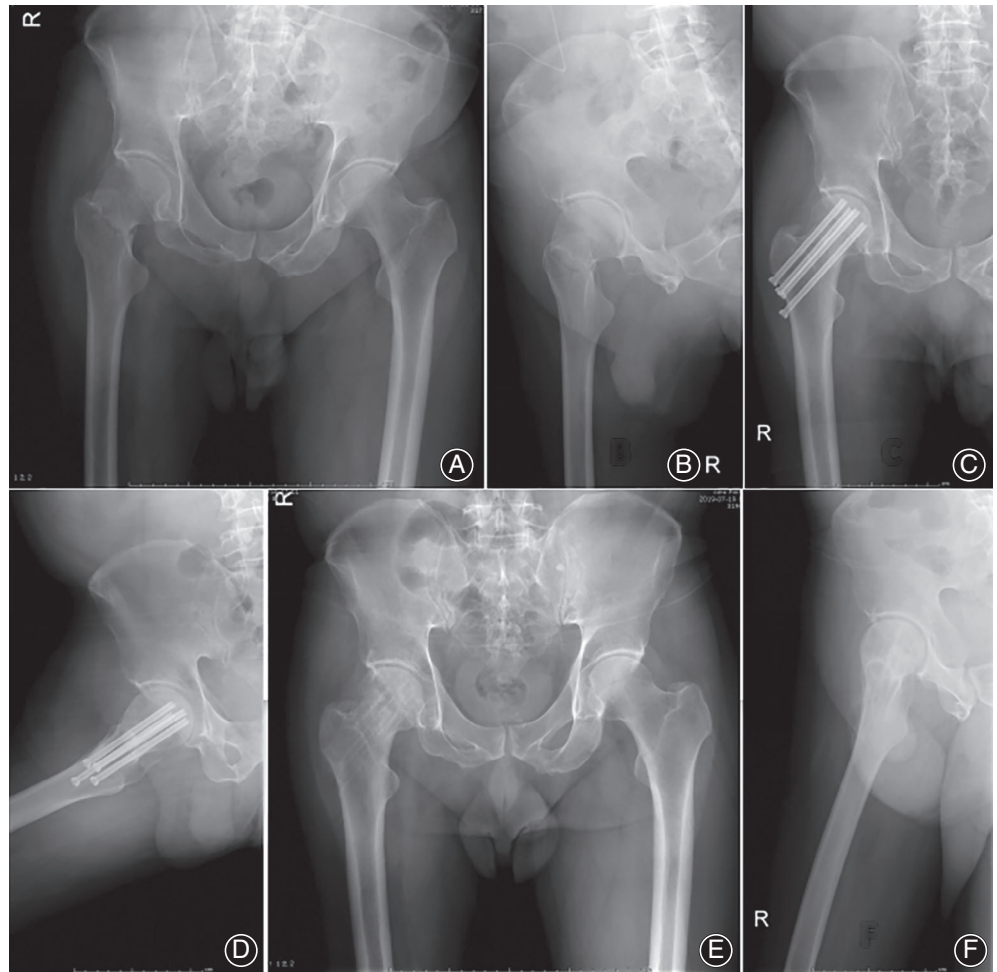
For this operation, rapid and accurate placement of the guide wire is crucial. The present study describes a surgical technique to direct the guide pin to the correct track to allow placement of the cannulated screw in the correct position.

**Address for correspondence:** Peng-cheng Wang, MD, Department of Traumatology, Hebei Medical University Third Affiliated Hospital, 139 Ziqiang Road, Shijiazhuang, Hebei, China 050051; Tel:(+86)-18533113088; Fax:(+86)-0311-87023626; Email: zhengzainingmeng@163.com

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**Fig. 1** (A–F) A 59-year-old man had a right-sided femoral neck fracture due to a serious fall. (A, B) Anteroposterior and lateral X-rays show a femoral neck fracture of the right hip. (C, D) One year after the operation, the fracture was completely healed without osteonecrosis. (E, F) One and a half years after the operation, the cannulated screws were taken out.

### Typical Case

A 59-year-old man was admitted to our hospital for treatment 10 h after a falling injury. A shortened deformity, swelling, and tenderness in the proximal portion of the right thigh were found on physical examination. The patient was considered to have a closed fracture of the right femoral neck. Plain X-ray images showed a right femoral neck fracture (AO 31. B2) (Fig. 1B).

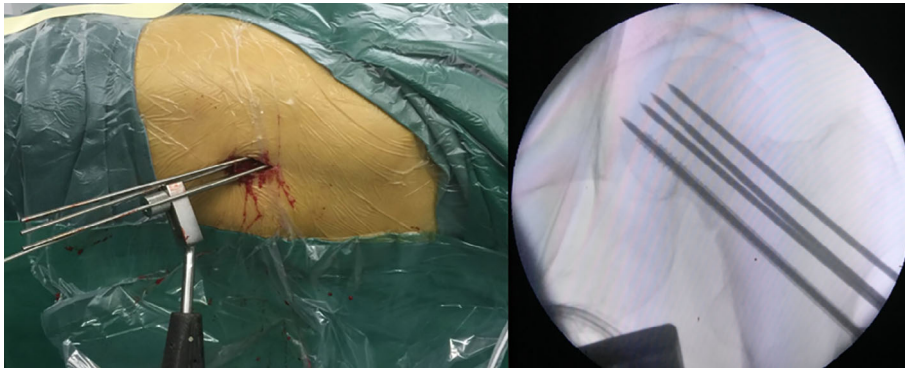
Relative contraindications were excluded before closed reduction and internal fixation of the femoral neck fracture. Antibiotics were routinely used to prevent infection 24 h after surgery. Stitches were removed 2 weeks after surgery. X-rays were taken for review at the end of the surgery and at 6 weeks and 3, 6, and 12 months postsurgery (Fig. 1C,D). After 18 months, the patient asked for the cannulated screws to be removed (Fig. 1E,F); the patient's Harris hip score was 93. During the follow-up period, there was no fracture non-union or necrosis of the femoral head, and no other complications occurred.

### Surgical Technique

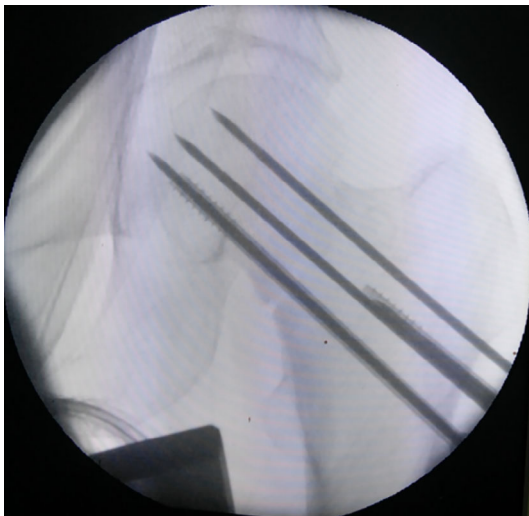
The surgery was performed with the patient under anesthesia and in the supine position. The fracture was reduced on an

orthopaedic table. The appropriate entry point was selected with the help of C-arm fluoroscopy. The distal entry point was located at the center of the lateral femur, which was parallel to the femoral tubercle. The guide wire was placed parallel to the inner cortex of the femoral neck. The proximal guide wire was inserted through the external guide device, and the two guide wires were positioned parallel to the neck of the femur. Next, the remaining guide wires were inserted at the center of the two guide wires in front of and behind the center of the lateral femur through an external guide device. However, in practice, even with the correct insertion point in the lateral wall and the correct orientation of the femoral neck on the lateral view, the guide wire easily migrated away from the correct position in the neck of the femur on the anteroposterior (AP) view (Fig. 2).

To solve this problem, we developed a practical technique to control the direction of the guide wire. When the direction of insertion of the guide wire has deviated, the length of the guide wire can be measured. Slight adjustment of the direction of the guide wire will not significantly affect the measurement results. Second, the appropriate cannulated screw is selected, based on the measurement of the guide wire; the cannulated screw is screwed in along the direction



**Fig. 2** Even with the correct insertion point, the guide wire easily migrates away from the appropriate position on the anteroposterior view.



**Fig. 3** The guide wire is returned to the front of the screw.



**Fig. 4** The cannulated screw can be used as a built-in guide to fine-tune the position of the guide wire to the optimal direction.

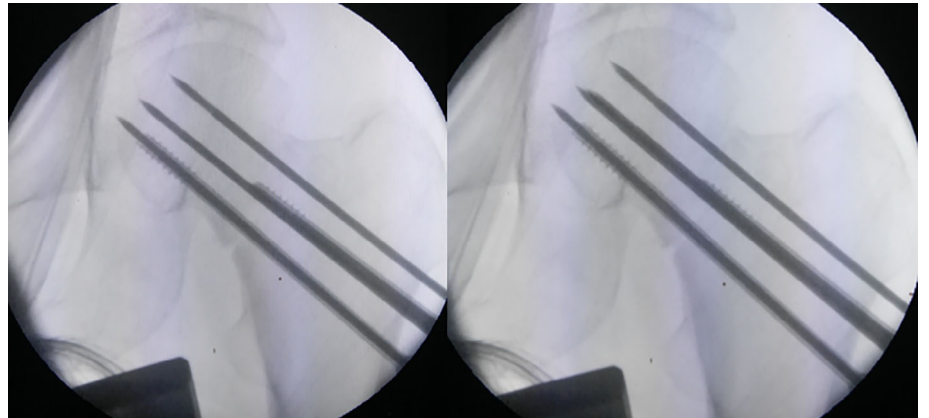
of the guide wire to the Ward triangle; and then the guide wire is returned to the front of the cannulated screw (Fig. 3). At this time, the cannulated screw can be used as a built-in guide, and a screwdriver can be used to fine-tune the position of the guide wire to the optimal direction under the X-ray guidance (Fig. 4). Finally, the cannulated screw is screwed in this direction until it passes through the Ward triangle area, and the guide wire is inserted (Fig. 5). At this time, it is screwed in along the direction of the guide wire, which can prevent the screw from deviating again, and the cannulated screw insertion can be completed accurately. Diagrams of the technique are shown in Fig. 6F. We can simply introduce the guide wire at an optimal position in the femoral head not only on the lateral view but also on the AP view (Fig. 7).

### Discussion

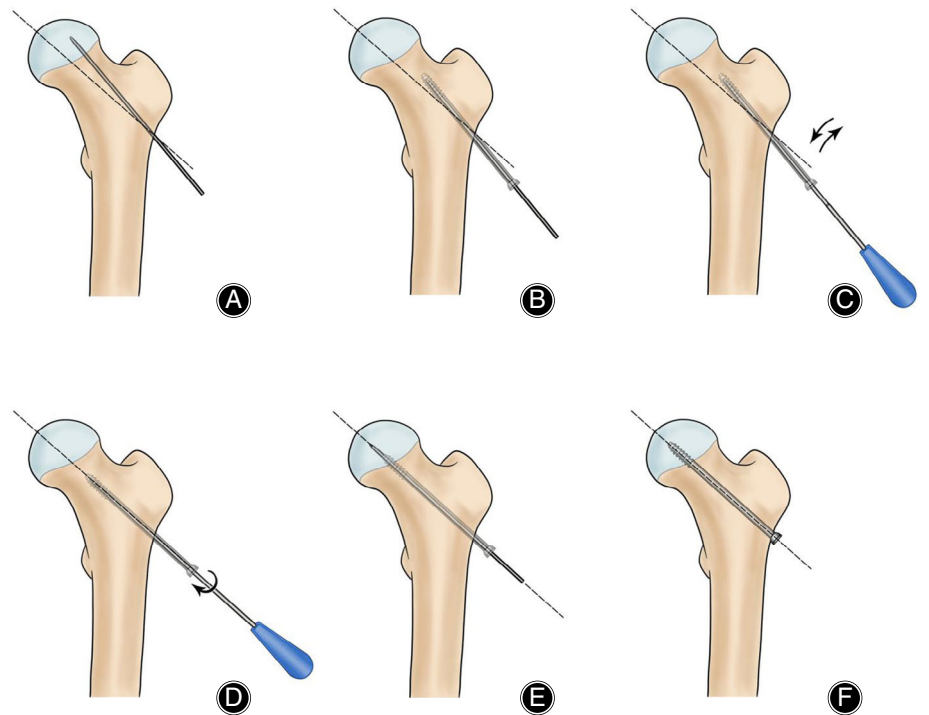
Our novel technique of adjusting wires slightly in the femoral neck has been used successfully and safely for the past 3 years on over 20 patients at our hospital. During the follow-up period, there were no cases of fracture non-union or necrosis of the femoral head, and there were no other complications. The above outcomes indicate that the preliminary clinical application results for this technology are reliable. Although the procedure for femoral neck fracture internal fixation is simple, the technical requirements are extensive. Rapid and accurate placement of the guide wire is the most essential step, and it is also the most technically demanding. Different trauma surgeons achieve ideal positioning of the guide wire for cannulated screws using various adjustments. Babis *et al.* described an aiming device for PFNA blades<sup>5</sup>. This technique is only used for insertion of the guide wire at the center of the femoral neck and is not suitable for cannulated screws. Li *et al.* reported an “inverting electric drill” technique, which reverses the direction of the electric drill to ensure optimal placement of the guide wire when the first insertion attempt has failed<sup>6</sup>. It is not suitable for fine-tuning, and the guide wire needs to be completely removed from the femoral cortex.

The technique introduced in this paper can achieve fine-tuning of the guide wire in the neck of the femur, prevent injury caused by repeated entry of the guide wire into

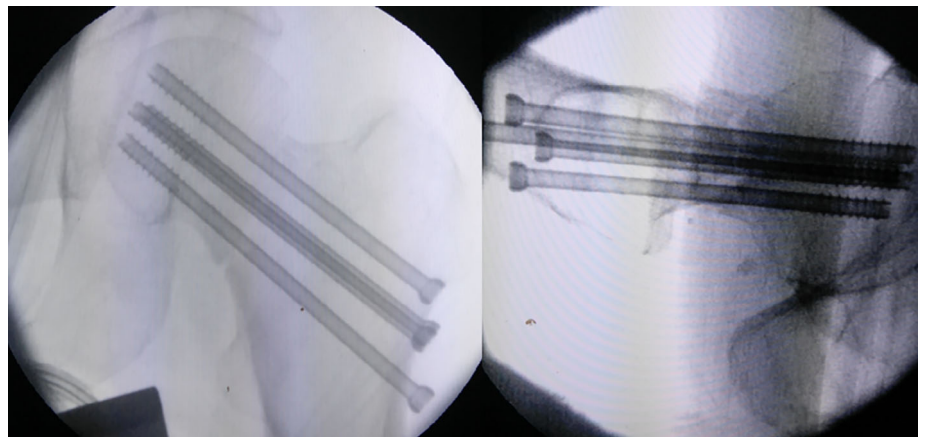




**Fig. 5** The cannulated screw is screwed in this direction and the guide wire is inserted.



**Fig. 6** (A–F) Technique diagrams. (A) The direction of insertion of the guide wire has deviated. (B) The cannulated screw is screwed in along the direction of the guide wire to the Ward triangle, and then the guide wire is returned to the front of the cannulated screw. (C) A screwdriver is used to fine-tune the position of the screw to the optimal direction. (D) Screw the cannulated screw in this direction until it passes through the Ward triangle area. (E) Insert the guide wire. (F) Insert the cannulated screw.



**Fig. 7** The cannulated screw insertion can be completed accurately not only on the lateral view but also on the anteroposterior view.

the bone, reduce the use of X-ray fluoroscopy, and shorten the operation time. The cannulated screw should be screwed into the Ward triangle area before the direction is adjusted. This is because the Ward triangle area has the lowest bone density of any area in the neck of the femur, 85% of which is cancellous bone<sup>7</sup>. Cannulated screws encounter less resistance in the Ward triangle area, making it easier to adjust the direction and causing less stress changes on the end of the fracture. In this study, a diamond configuration of cannulated screws was used to fix the fracture; that is, a screw was added on top of the traditional inverted triangle configuration. Studies have found that compared with the traditional inverted triangle configuration, the diamond configuration is associated with more dispersed stress at the end of the fracture and more biomechanical advantages<sup>8</sup>. When four cannulated screws are used, more precision is required for guide

pin insertion, so it is often necessary to use this technique to adjust the guide wire accurately. This technique would also be useful for three cannulated screw fixation.

### Highlights and Pitfalls

1. This technique can achieve fine-tuning of the guide wire in the neck of the femur and prevent injuries caused by repeated entry of the guide wire into the bone.
2. This technique can help doctors to insert a guide wire more quickly and accurately, reducing intraoperative injury and the operation time.
3. Although the results of the clinical experiment are promising, we still need to include more cases to evaluate its efficacy, which can be verified in clinical practice in the future.

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