

## Original Article

# Comparative study of InterTAN and Dynamic Hip Screw in treatment of femoral intertrochanteric injury and wound

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**Abstract:** The aim of this study is to compare the effects and complications of InterTAN nail versus Dynamic Hip Screw (DHS) in treatment of femoral intertrochanteric fractures. Between January 2006 and December 2013, a total of 75 patients with femoral intertrochanteric fractures were retrospectively reviewed. There were 16 cases of type A1, 51 cases of type A2, and 8 cases of type A3. 37 patients treated with InterTAN nail, and 38 with DHS. The clinic data of surgical trauma, postoperative function and complications were statistically compared in this study. This results indicated that 31 cases by InterTAN and 30 cases by DHS had obtained follow-up with mean time ( $11 \pm 5.6$ ) months. Operative time of InterTAN group is ( $23.1 \pm 9.2$ ) min, and of DHS group is ( $55.2 \pm 14.5$ ) min ( $P < 0.05$ ). Intra-operative active blood loss is ( $70.1 \pm 30.7$ ) ml in InterTAN group, and ( $205.7 \pm 40.7$ ) ml in DHS group ( $P < 0.05$ ). Fluoroscopy frequency of InterTAN group is ( $16.3 \pm 4.4$ ) times, and of DHS group is ( $25.1 \pm 3.1$ ) times ( $P < 0.05$ ). Complications occurred in 3 cases (9.7%) in InterTAN group compared 6 cases (20%) in DHS group ( $P < 0.05$ ). Two cases had hip varus in InterTAN group, and three cases in DHS group. One case had deep venous thrombosis (DVT) in InterTAN group, and one case in DHS group. In conclusion, InterTAN significantly reduce the operative time, fluoroscopy frequency, intra-operative active blood loss and postoperative complications. The InterTAN technical features make it applicable to the aged patient with variety of medical basic diseases and cases of osteoporotic and unstable fracture types.

**Keywords:** InterTAN, Dynamic hip screw, nail, internal fixation, femoral intertrochanteric injury

## Introduction

Old patients often have intertrochanteric fracture after slight injury [1]. Due to osteoporosis, it often becomes comminuted fracture characterized as unstable fracture types [2, 3]. In order to reduce complications, make the patients get out of bed early and reduce death rate, it is necessary to fix the bones. However old patients with a complex condition often suffer medical disease at the same time, they need higher requirement for surgical technique, operation and perioperative management [4]. From January 2006 to December 2013, we use Dynamic hip screw (DHS) and proximal femoral nail to treat intertrochanteric fracture 75 times, shown as follows.

## Materials and methods

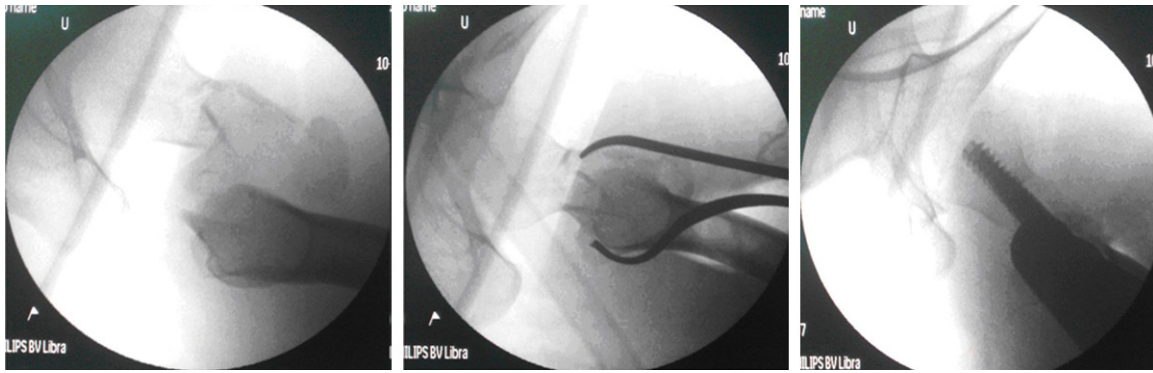
### General information

There are 75 cases all together, including 37 cases in InterTAN group, 38 cases in DHS

group. In InterTAN group, there are 18 males and 19 females ageing from 22 to 91 years old, average of 61 years old. Causes: traffic injury in 7 cases, fallen down in 27 cases and high falling injury (3 cases). Fracture according to AO classification, A1 type 7 cases, 27 cases A2 type, type A3 (3 cases). DHS group, 27 cases of male, female in 11 cases, aged from 20 to 85 years old, an average of 57. Causes: traffic injury 11 cases, fallen down in 22 cases and high falling injury in 5 cases. Fracture according to AO classification, A1 type 9 cases, and 24 cases A2 type, type A3 in 5 cases.

### Therapeutic method

After getting in to hospital, we arranged preoperative examination as soon as possible such as routine blood, liver and kidney function, electrolyte, fasting blood glucose, blood coagulation routine, electrocardiogram, and chest radiograph. In order to rule out heart disease and deep venous thrombosis, we arrange color



**Figure 1.** Using acetabulum retractor to pry pull and reset with minor trauma.



**Figure 2.** Female, 82 years old, left femur fracture between rotators, AO-A2.3 type. Image after surgery, fracture got well and the position of intramedullary nailing located accurately.

sonography and double lower limb vascular ultrasound for old patients beyond 60 years old. Those who also suffered medical disease, we arranged expert consultation. All patients got surgery within 2-14 d after injury. There are 55 patients who got in neuronal block anesthesia including Lumbar hemp and continuous epidural anesthesia, and 20 patients who got general anesthesia. After the anesthesia and lied on traction bed, patients got mild adduction neutral straightly and the contralateral limb reached out as far as possible, flexed hip and bended their knees. Close traction reduction aided by C arm. When the effect of closed reduction was not good, we can combine small incision minimally invasive acetabulum retractor pry pull reset (**Figure 1**). In InterTAN groups, we use greater trochanter to cut the longitudinal incision around 4 cm. After cutting open fascia, we touched the top of greater trochanter and injected the needle under the C arm fluo-

roscopy. After satisfied with perspective, reamed the proximal femur and inserted intramedullary nailing the main nail. Inject guide pin to femoral head and neck according guider. After identified the desired position from C arm, we fixed lag screw and locking screws to femoral head and neck in turn and also placed intramedullary nail using the remote static to lock screw (**Figure 2**). For DHS group, cut 6-8 cm at outer thighs under the plane of small rotor and. Open fascia and vastus lateralis muscle, expose the upper of the femur and inject guide pin to neck-shaft angle and femoral angle. After satisfied with perspective, we installed DHS internal fixation system.

#### *Postoperative management*

Use 1-3 d the second generation cephalosporin antibiotics (cefuroxime or cefotiam) after operation for prevention of infection. After 6-8 h,

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**Table 1.** Comparison of clinical effects and complications between InterTAN and DHS groups

	InterTAN	DHS
Operating time	(23.1 ± 9.2) min*	(55.2 ± 14.5) min
Amount of bleeding during operation	(70.1 ± 27.7) ml*	(205.7 ± 40.7) ml
Intraoperative fluoroscopy	(16.3 ± 4.4) times*	(25.1 ± 3.1) times
Healing time of Fractures	(11.9 ± 1.8) weeks	(13.1 ± 2.8) weeks
Harris Hip Score	(88.3 ± 7.4) scores	(86.5 ± 10.2) scores
Post-operative complications	3 cases (9.7%)*	6 cases (20.0%)

Tips: \*compared with DHS, P < 0.05.

drink Rivaroxaban 10 mg to prevent deep venous thrombosis. After 2 days, let the patients sit down and turn over, and pay attention to the lower limb muscle and joint functional exercise. After 2-3 days, we encouraged the patients to walk or stand with crutches. At first the broken part cannot bear the body and then can bear the body at a degree. Postoperative, we follow up at 1, 3, 6, 12 months.

### Observation and measurement

Intraoperative recording operation time, intraoperative bleeding, intraoperative fluoroscopy time. Record fracture clinical healing time, postoperative follow-up the hip joint function score and postoperative complications. The hip joint function score at 3 months after fracture clinical healing rate.

### Statistical treatment

All of the data are treated with SPSS 16.0. Measurement data was using mean  $\bar{X} \pm s$ , t test. Count data was using rate and  $\chi^2$  to compare groups, P < 0.05 stands for the significance difference.

### Results

Sixty-one cases received follow-up, 31 cases in InterTAN groups and 30 cases in DHS group. The average follow-up time was (11 ± 5.6) months. Mean operating time: InterTAN group (23.1 ± 9.2) min, DHS group (55.2 ± 14.5) min (P < 0.05). Amount of bleeding during operation: InterTAN group (70.1 ± 27.7) ml, DHS group (205.7 ± 40.7) ml (P < 0.05). Intraoperative fluoroscopy: InterTAN (16.3 ± 4.4) times, DHS group (25.1 ± 3.1) times (P < 0.05). Healing time of Fractures: InterTAN group (11.9 ± 1.8) weeks, DHS group (13.1 ± 2.8) weeks (P >

0.05). Harris Hip Score: InterTAN group (88.3 ± 7.4), DHS group (86.5 ± 10.2) (P > 0.05). Post-operative complications: InterTAN group occurs 2 coxa vara and 1 deep venous thrombosis (Postoperative Complications 9.7%). DHS group occurs 3 coxa vara, 1 femoral neck cutting, 1 deep venous thrombosis and one case had broken plate. (Postoperative Complications 20.0%) (P < 0.05) (Table 1).

### Discussion

Old patients who suffer intertrochanteric fracture often got internal basic diseases. Due to the senile osteoporosis, the fracture type usually is comminuted fracture. When we treated such complex hip fracture cases, we often meet many difficulties such as the management of the operation period, the stimulation of surgical trauma, and comminuted fractures often can't get effective internal fixation. Operative treatment needs fixed strong enough, shorter operation time, minimally invasive and then the patient can get better soon and reduce the complications. InterTAN intramedullary nail is a new generation of proximal femoral intramedullary nailing. It is first published in 2009 [5]. InterTAN is well designed, easy to operate and has short learning curve. I finished the whole operation in 23.1 min with the help of traction bed. It is very helpful for old patients. While it spend longer time in DHS, it is not good for the recovery of patients. Interestingly, the number of perspective in InterTAN is less than DHS. Theoretically, it is difficulty to operate for InterTAN. However, the learning cure for InterTAN is shorter. Once get the skill of operation, it becomes easy and the number of perspective is reduced.

InterTAN intramedullary nail can be injected with minimally invasive. We only need to cut 4cm above greater trochanter and cut open fascia. We do not need to stripping muscle. When the guide needle is located in the right position, we can use reamers to deal with the proximal part of the femur. During the operation, there is less interference on the soft tissue and bone tissue, so we get less bleeding.

For our research, the average amount of bleeding in Inter TAN group is 70 ml. It might be on account of the minimally invasive surgery and the short duration of operation. Whereas DHS Internal fixation requires peeling part of the vastus lateralis muscle, which leads to big incision, long duration and more bleeding. In our study, the amount of bleeding in the DHS group is about 205 ml. There is significant difference of the bleeding amount between the TAN group and the DHS group. However, InterTAN surgery requires expansion of femoral proximal marrow and may cause bleeding within the pulp cavity [6, 7]. Thus, we need to focus on patients with their hemoglobin data after the operation. Once the patients have severe anemia, we need to deal with in a timely manner. The common complications of DHS are cut-out, secondary fracture shift, coxa vara and loosening or breakage of internal fixator. While the complications of PFN are cut-out and distal femoral fracture. Cut-out relates to osteoporosis, poor reduction of fracture, rotational instability [8], coxa vara, and bad position and sliding of the nail [9]. There is little report on the complications of InterTAN perhaps for the reason that the apparatus is new and not so many people have used it. The InterTAN uses thick double-nails. These nails allow larger interface between the bone and fixator, protect against twist, and provide linear pressure. Therefore, InterTAN is superior to DHS in internal fixation stability, thus better applies in cases of osteoporosis and unstable fractures. Though the thick double-nail used in InterTAN reduces cut-out frequency, it removes more bone marrow from femoral. Therefore, we should be cautious when using it to treat young patients.

The first generation of Gamma nail, although showing a role in unstable fractures, caused greater incidence of fractures at the distal femoral [10], at the rate of 2.6%. After many times of improvement in design, such complications has been reduced to an acceptable level, almost equal to the level in DHS [11, 12]. InterTAN intramedullary nail has a tuning fork opening at distal end and can reduce the stress concentration, thus decreases the incidence of fractures. In this study, the complication rate of InterTAN is lower than that of DHS. Both groups of patients did not show femoral fracture around the internal fixator. But the sample is not enough. We need to increase the sample

and study further in the future. Also, we may need to consider the classification of fracture and the influence of different degree of osteoporosis fracture, in order to reduce the deviation.

In our research, InterTAN and DHS were conducted under closed reduction of traction bed. We tried our best not to open the fracture side and reduced disturbance to the blood supply in fracture. Our follow-up study found that the clinical healing time of fracture showed no difference between the two groups. This indicates that we should apply minimally invasive surgery as far as possible in treating intertrochanteric fracture in clinical work, so as to shorten fracture healing time and reduce damaging blood supply and infection risk.

How to select proper fixators during intertrochanteric fracture treatment? Proof from literature analysis of evidence-based medicine [13, 14] showed that DHS has more advantage for stable fractures due to its low complication rates. For unstable fractures, intramedullary system may be more suitable. DHS internal fixation can easily cause external wall fracture for elderly patients. Due to the fragility of the bone of the elderly patients, it may make fracture between the trochanter into unstable fracture during the operation. As reported [15], there were 46 patients suffered external wall fracture in a group of 214 having DHS internal fixation surgery, with 34 cases (74%) happened during the surgery. So it is proper to choose intramedullary fixation for aged patients with osteoporosis. Intramedullary fixation has a variety of theoretical advantages, such as minimally invasiveness, stable centricity, better mechanical performance, and more prevalent [16, 17]. But all kinds of internal fixation methods and instruments have advantages and disadvantages. Doctors need to have sufficient theoretical foundation and practical ability, and choose their familiar and reliable technology and route according to the characteristics of patients. Also, they should make adequate preparation and individualized treatment scheme in order to achieve the ideal treatment effect.

### Disclosure of conflict of interest

None.



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