Intertrochanteric Fractures of the Femur: Results of Treatment with 95 Condylar Blade Plate

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The aim of the present study was to analyze patients treated with 95 Condylar Blade Plate and to describe the technique that can prevent complications. 69 patients with closed intertrochanteric femoral fractures were treated by one surgeon using the 95 Condylar Blade Plate, and it was found that 56 of them met the minimum 10 months follow up requirement. 53 patients (94%) healed after the procedure. There were 4 patients (7%) requiring surgical intervention. One patient required bipolar arthroplasty because of the cutting through of the implant, two patients needed repeated open reduction and internal fixation (ORIF) with bone graft due to delayed union and broken implant, and one patient had an infection which was resolved after debridement and a course of antibiotics. The surgical time averaged 45 minutes and blood loss averaged 150 ml. It appeared that open reduction and internal fixation using the 95 Condylar Blade Plate was effective in treating patients with intertrochanteric femoral fractures. The surgical time and blood loss were minimized. Early patient rehabilitation was initiated, and the complications were decreased.

Keywords : *Intertrochanteric femoral fractures, 95 Condylar Blade Plate*

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The incidence of intertrochanteric femoral fracture has been estimated to occur in more than 200,000 patients each year in the United States, with reported mortality rates ranging from 15% to 20%[1].

Surgical stabilization of the intertrochanteric femoral fracture is one of the most currently performed orthopaedic procedures. Four major categories of operative treatment can be distinguished, including nail plates and blade plates with a fixed angle, sliding screws and plates devices, rigid intramedullary devices and flexible intramedullary devices. Each method has recognized advantages and disadvantages which will be discussed later. All four categories have yielded acceptable results but no single treatment option has generally become accepted as the method of choice.

Despite numerus variety of different implants, including intramedullary devices and varius side-plate and screw constructions, none of the device has a clear clinical advantage over 95 Condylar Blade Plate in the treatment of stable intertrochanteric fracture. Infact, from a cost-benefit point of view and nonfluoroscopic guided procedure, the 95 Condylar Blade Plate has distinctly more advantages than the other implants.

For the treatment of unstable intertrochanteric femoral fractures, avoidance of implant failure in the form of blade superior cutout remains a function of the surgeon's ability to correct position of the blade in the appropriate position in the femoral head. The functional outcomes are complicated from a variety of comorbidities.

This communication reports results of the treatment technique for the intertrochanteric femoral fractures obtained from the Arbeitsgem nschaft f r Osteosynthesefragen/Association for the Study of Internal Fixation (AO/ASIF) 95 Condylar Blade Plate by using a conventional fixation[2]. The blade provided more surface area to resist cutting out through the femoral head.

Objective

The present study was aimed at analysing data from patients treated with 95 Condylar Blade Plate and to describe a treatment technique that can prevent common complications and yield good results.

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Material and Method

Between January 1, 1990 and December 31, 2002, 69 patients with 69 intertrochanteric femoral fractures were treated by one surgeon with open reduction and internal fixation (ORIF) by using 95 Condylar Blade Plate.

A retrospective review of the clinical charts and preoperative, perioperative and final radiographs was performed. Data were collected with respect to age, gender, mechanism of injury, side of injury, associated injuries and medical conditions, the interval between injury and surgery, and length of hospital stay. The need for ambulatory assist devices preoperatively and postoperatively was also documented. Surgical blood loss, length of the surgical procedures, implant sizes, and the number of units of blood transfused perioperatively were recorded. Intraoperative and postoperative complications were documented. The immediate postoperative and femoral neck-shaft angle was compared with that of the contralateral hip to assess for varus deformity.

The average age of the 17 males and 52 females was 70 years (range 30-92 years). 42 patients had one or more pre-existing medical conditions (Table 1).

The mechanism of injury consisted of falling down in 52 patients and results of motor-cycle accident in 17 patients. All patients were evaluated preoperatively with standard plain film of the pelvis in anteroposterior (AP) view, AP and lateral views of the affected hip. Fracture hips were graded according to the AO classifications[2] (Fig. 1).

Fractures were classified as shown in Table 2. The left hip was affected in 37 patients but the right hip was affected in 32 patients. Preoperatively, 40 (57%) patients did not require ambulatory aids, only 25 patients (38%) required cane on walking, and 4 patients (5%) required wheel chair.

Preoperative internal medicine and anesthesia consultation were obtained as necessary according to the patients' conditions.

Table 1. Pre-existing medical condition of the study patients

Condition	Number
Cardiac disease	38
Hypertension	39
Diabetes mellitus	17
Genitourinary tract disease	12
Gastrointestinal disease	20
Cerebrovascular disease	13
Dementia	9

One patient may have one or more condition(s)

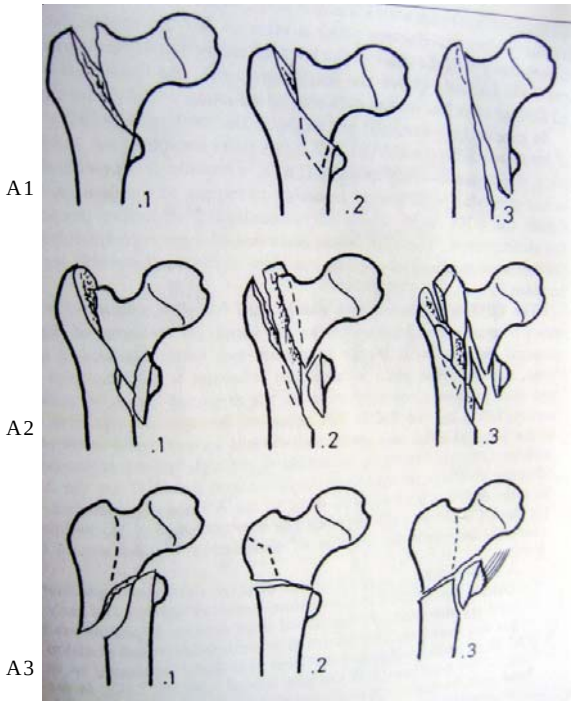


Fig. 1 Classification of trochanteric fractures
Group A1 represents the simple two-part fractures. Subgroup A1.1 includes the fractures ending on the medial side just above the lesser trochanter. Subgroup A1.2 embraces all two-fragment fractures with impaction of the calcar into the distal fragment. Subgroup A1.3 is in principle a two-part trochanterodiaphyseal fracture.
Group A2 fractures extends over two or more levels of the medial cortex. They are subdivided according to the number of fragment and the posterior fragmentation.
Group A3 is characterized by a fracture through the lateral cortex of the femur. The so-called reversed fracture runs from lateral distal to medial proximal of the lesser trochanter (A3.1). Quite often there is an undisplaced fractures separating the greater trochanter from the neck-head fragment. A3.2 fractures are true intertrochanteric fractures, occasionally with a lateral fracture of the proximal main fragment. A3.3 fractures are in principle A3.1 fractures with an additional fracture of the medial cortex including the lesser trochanter.
In conclusion:

A1 Trochanteric, simple
A1.1 Cervicotrochanteric
A1.2 Pertrochanteric
A1.3 Trochanterodiaphyseal
A2 Pertrochanteric, multifragmentory
A2.1 One intermeiate fragment
A2.2 Two intermediate fragments
A2.3 More than two intermediate fragments
A3 Intertrochanteric
A3.1 Reversed, simple
A3.2 Transverse, simple
A3.3 With additional fracture of medial cortex

Table 2. Number of the patients classified according to types of trochanteric fractures

AO Classification of trochanteric fractures	Number
Type A1 Trochanteric, simple	-
Type A1.1 Cervicotrochanteric	3
Type A1.2 Pertrochanteric (stable)	11
Type A1.3 Trochanterodiaphyseal	-
Type A2 Pertrochanteric, multifragmentory	-
Type A2.1 One intermediate fragment (3 part)	5
Type A2.2 Two intermediate fragments (4 part-unstable)	48
Type A2.2 Two intermediate fragments plussubtrochanteric & diaphyseal fracture	2
Type A2.3 More than two intermediate fragments	-
Type A3 Intertrochanteric	-
Type A3.1 Reversed, simple	-
Type A3.2 Transverse, simple	-
Type A3.3 With additional fracture of medial cortex	-
	N=69

During the follow-up evaluation, range of motion, presence of thigh pain, leg length discrepancy, and needs for ambulatory aids were documented.

The time of fracture healing was evaluated according to radiographic and clinical evidence. Radiographical healing was defined as the presence of bridging callus involving at least three cortices on AP and lateral views of the hip. Clinical union was defined as the absence of tenderness or pain in full weight-bearing.

Operative technique

The patients were placed in the supine position on a standard operating table. The fracture site was approached using Watson-Jone's (anterolateral) technique.

The fractures and the femoral neck were exposed. Next, the Hohmann retractors were positioned one around the calcar, one posterior to the greater trochanter, and a small one halfway around the femoral neck. The blade was then inserted into the proximal fractured fragment at the level about 2 cm from the tip to the greater trochanter. The accuracy of the blade placement was verified visually, as the anterior arthrotomy allowed visualization of the femoral head properly (Fig. 2). The seating chisel was inserted, followed by the blade. Sometimes in more osteoporotic bone the blade could be inserted with the introduction of only a large drill bit (4.5 mm) and the router.

The tip of the blade was in the posterior half of the femoral head, below and as close as possible to the point of trabecular pattern. One cancellus screw was intersecting inserted superiorly to reinforce the blade in the femoral head. This screw triangulated the plate in the proximal fragment and thus improved the rigidity of the fixation (Fig. 3).

Image fluoroscopy or intraoperative roentgenography were not peformed and not necessary.

After manipulating the fracture freely to the anatomical position, as the leg was draped freely and

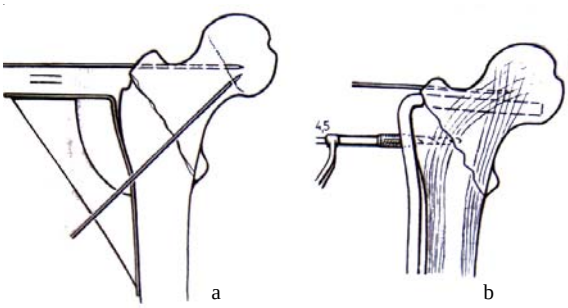


Fig. 2 Insertion of the condylar plate into the proximal femur
a. Determination of the neck axis and the blade direction which was easily done by arthrotomy and direct visualization.
b. In order to triangulate the fixation of the condylar plate and compression effect in the proximal femur, a cortex or cancellous screw as a lag screw was inserted into the calcar.

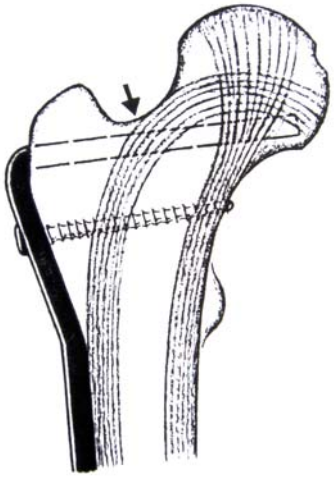


Fig. 3 Ideal position of the condylar plate in the proximal femur. Note the tip of the blade in the lower half of the femoral head. The blade passes below the superior cortex of the neck. A cortical screw has been used to fix the plate to the calcar. There is a zone within the head where the tension and compression trabeculae intersect. This is the only area which is filled with bone and the only one to offer resistance and purchase.

no fracture table was used, the plate was fixed to the femoral shaft with at least four cortical bone screws. In osteoporotic bone, six screws were necessary. Attempt was made to obtain interfragmentary fixation through the plate or outside it and to avoid further periosteal stripping.

Most patients received perioperative parenteral first generation *Cepharosporin* that was continued for 48 hours after surgery.

Post-operative treatment

In management of intertrochanteric fracture, the 95 Condylar Blade Plate fixation was not adequate to permit early full weight bearing. Most of such fractures required 3-6 months for adequate healing. For stable fractures in non-osteoporotic bone, partial weight bearing was permitted with walking aids as soon as soft tissue healing had taken place. In elderly patients, mobilization from bed to chair was permitted, but partial weight bearing with crutches or a walker was often difficult or impossible. In unstable fractures with comminution, radiographic signs of callus formation had been presented before partial weight bearing was instituted. This was generally 6-12 weeks after fracture fixation. Frequency, percentage, range and average were used to summarize retrospective results.

Results

56 patients met the follow-up criteria of 10 months with an average follow up of 18 months (range 10-102 months). Of the 13 patients who had insufficient follow up, one died within 2 weeks postoperatively (10 days) and the other 12 patients were excluded because they could not be followed up for the period of 10 months. 50 fractures (89%) healed at an average of 12 weeks postoperatively (range 8-28 weeks).

The average surgical time was 45 minutes (range 35-85 minutes) with an average blood loss of 150 ml (range 100-500 ml). The average immediate postoperative neck-shaft angle was 130 degrees (range 125-135 degrees) as compared to 135 degrees (range 130-139 degrees) of the contralateral uninjured side.

By assigning acceptable blade position in the femoral head as central or inferior on the AP-view and central or posterior on the lateral view, appropriate positioning was achieved in 54 patients (96%). The neck-shaft angle did not have any varus deformity greater than 10 degrees, compared with the contralateral side in any patient.

The blade length averaged 67 mm (range 60-70 mm).

45 patients (80%) required average perioperative blood transfusion at 1.5 units (range 0-3 units), mostly due to preoperative anemia.

The length of hospital stay averaged 14 days (range 7-20 days). 19 patients had stable fractures and were allowed to bear weight as tolerated in the early postoperative period.

50 patients (forty-eight were typeA2.2 intertrochanteric fracture and two were typeA2.2 intertrochanteric fracture with associated subtrochanteric and diaphyseal fracture) had unstable fractures and only partial weight-bearing was attempted during the first 6 weeks postoperatively. Time to full weight-bearing averaged 9 weeks (range 2-16 weeks). Of the 20 patients who did not use ambulatory aids preoperatively, eight required a cane or a walker at an average follow up of 11 months (range 6-15 months). No obvious shortening of more than 1.5 cm was noted compared to the contralateral normal limb.

5 patients (8%) who were ambulatory preoperatively with or without ambulatory aids required a wheel chair at the final follow up, due to post-existing medical condition, including cardiac disease and cerebrovascular disease.

Range of hip motion averaged 34 degrees of abduction (range 15-58 degrees), 20 degrees of adduction (range 10-28 degrees), 85 degrees of hip flexion (range 50-135 degrees), -2 degrees of extension (range 0 to -8 degrees), 18 degrees of internal rotation (range 10-35 degrees) and 35 degrees of external rotation (range 18-58 degrees) (Table 3).

There were 4 complications in these 56 patients (7%) (Table 4). One patient required bipolar arthroplasty because of the cutting through the implant, two patients required repeated open reduction and internal fixation with bone graft due to delayed union and broken implant, the other one patient had an infection developed which was resolved after debridement and a course of antibiotics. All of them were more than 50 years old and had unstable fracture with loss of medial calcar continuity.

Discussion

The present report documents the success in treating patients having sustained intertrochanteric fractures with 95 Condylar Blade Plate, and also describes a technique that has avoided the complications. Proper positioning of the blade in the femoral head, combined with the use of a minimum dissection technique, had generated successful results with few complications.

Table 3. Post-operative range of hip motion

Range of hip motion	Degree
Flexion	85 (50-135)
Extension	-2 (0- -8)
Abduction	34 (15-58)
Adduction	20 (10-28)
Internal rotation	18 (10-35)
External rotation	35 (18-58)

The number in bracket indicates range of movement

Table 4. Age distribution of 69 patients with intertrochanteric fracture treated by 95 Condylar Blade Plate

Age group (years)	Number	Percentage	Implant failure	Delayed union & Broken implant
20-30	1	1.45		
31-40	1	1.45		
41-50	3	4.35		
51-60	15	21.74	1	1
61-70	35	50.73		1
> 70	14	20.28		
Total	69	100.00	1	2
Range	30-92			
X ± SD	70±24			

There was no need for use of the image intensifier and no radiation hazard to the patients, surgeons and operating room personnel.

In the current study, the union rate was 98%, excluding the single case of nonunion with blade cutting out in the early year of the presen study. No intra-articular blade penetration, late varus deformity exceeding 10 degrees compared to the normal side or failure of fixation were found in the present study.

The previous reports[3-8] show that the incidence of mechanical complication of the patients treated of intertrochanteric femoral fracture by compression hip screws is approximately 25%, and cutting out of the femoral head screws is the main cause of the primary failure because of poor position of the devices in the osteoporotic bone.

Despite the shortened lever arm, screw cutting out rate of 1-25% has also been reported with the use of gamma nails, and the incidence of secondary fractures at the tip of the gamma nails is found up to 6%[9-19].

The AO 95 Condylar Blade Plate, which was introduced in the 1970's, is effective if the medial buttress can be restored and the plate could be used as a tension band. This technique requires accurate realignment. The blades provide more surface area to resist cutting out through the femoral head. Even nonunion of the intertrochanteric femoral fractures can also be successfully treated with 95 Condylar Blade Plate[20,21]. Although 95 Condylar Blade Plate places high stress on the blade plate junction, there were two cases of plate failure at this point in the present study. Plate fracture due to failure in a bending mode has been reported only rarely in true intertrochanteric fractures. The most important step in the fixation of the intertrochanteric fracture is the proper placement of the blade into the femoral head. The safe zone for the entry point of the 95 Condylar Blade Plate is more than the 95 dynamic condylar screw, which was an alternative to the fixed 95 Condylar Blade Plate for the surgeon who only occasionally uses this device. The blade of the 95 Condylar Blade Plate must be inserted in an area between 16.5 and 23.2 mm below the tip of greater trochanter[22]. If an error is made in choosing the entry point, it will not be possible to correct the malalignment of the implant in bone until the point of entry is corrected. In most small size female patients, the author used the Asiatic type of the 95 Condylar Blade Plate with the cross section of the blade in T-shaped which gave more safe zone to the blade insertion (Fig. 4).

The benefits in cost and time of using 95 Condylar Blade Plate is clear when compared with the more sophisticated implants used nowadays. It is the cheapest implant for treatment of intertrochanteric fracture when compared with dynamic hip screws or

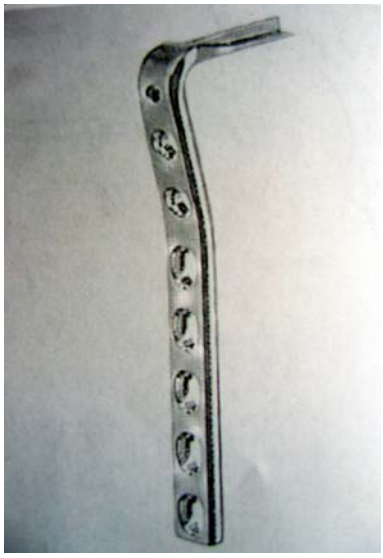
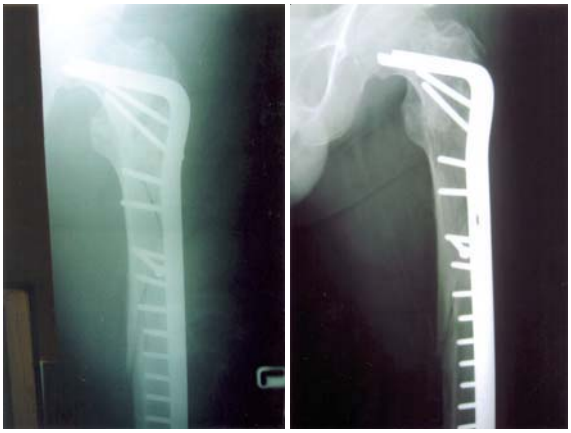


Fig. 4 Asiatic type of the 95 Condylar Blade Plate



a b

Fig. 5 Intertrochanteric fracture with subtrochanteric and diaphyseal involvement (typeA2.2) treated with indirect reduction and internal fixation with 95 Condylar Blade Plate (70 mm, 12 holes).
a. Immediate post-operative AP-radiograph
b. AP-radiograph in one year after surgery

a b

Fig. 6 Intertrochanteric fracture of the right femur with two intermediate fragments (typeA2.2) treated with conventional 95 Condylar Blade Plate (70 mm, 7 holes)
a. pre-operative radiograph
b. AP-radiograph in eight years after surgery

gamma nails. The implant is easily available at all centers that have the basic set of AO instruments.

The ability of severely osteoporotic bone to bear a substantial segment of the load is impaired even when a collapsible device is used. For this case, many of the unstable fractures must be protected with limited weight bearing postoperatively until the healing is evidenced.

As generally assumed, results will improve with experience and possible complications can occur in the first 20 cases. It can achieve a high rate of healing in good position, despite a high number of unstable fractures, in a patient population prone to high complication rates. In the author's opinion, this is a simple and effective method for treating patients with intertrochanteric fractures.

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ผลการรักษากระดูกต้นขาส่วนต้นหักด้วย 95 Condylar Blade Plate

วิชัย สุริยจักรยุทธนา

วัตถุประสงค์ *: เพื่อศึกษาผลของการรักษาผู้ป่วยกระดูกต้นขาหักบริเวณ intertrochanter ด้วยวิธีการผ่าตัดโดยใช้ 95 Condylar Blade Plate*

ประชากรตัวอย่างและวิธีการศึกษา *: ศึกษาย้อนหลังผู้ป่วยกระดูกต้นขาหักบริเวณ intertrochanter ที่เข้ารับการรักษาในโรงพยาบาลตากสินด้วยวิธีผ่าตัดโดยใช้ 95 Condylar Blade Plate ทั้งหมด 69 ราย ตั้งแต่วันที่ 1 มกราคม 2533 ถึง 31 ธันวาคม 2545 เป็นผู้ป่วยชาย 17 ราย ผู้ป่วยหญิง 52 ราย อายุเฉลี่ย 70 (30-92) ปี 52 ราย มีกลไกการบาดเจ็บจากการหกล้มบนพื้นราบ 17 ราย เกิดจากอุบัติเหตุรถจักรยานยนต์ เกิดกับต้นขาซ้ายและขวา 37 และ 32 ราย ตามลำดับ ผู้ป่วยส่วนใหญ่ (42 ราย) มีภาวะหรือโรคอื่นร่วมด้วย โดยเฉพาะภาวะหรือโรคทางอายุรกรรม 48 ราย จัดเป็น 4-part-unstable fractures (type A2.2), 11 ราย เป็น stable fracture (type A1.2), 5 ราย เป็น 3-part-unstable fractures (type A2.1), 3 รายเป็น cervicotrochanteric fracture (type A1.1) และอีก 2 รายเป็น type A2.2 associated with subtrochanteric and diaphyseal fracture ก่อนผ่าตัด 40 ราย (57%) ไม่ต้องใช้เครื่องช่วยเดิน 25 ราย (38%) ต้องใช้ไม้เท้า และ 4 ราย (5%) ต้องใช้ wheel-chair ในการช่วยเดิน และเคลื่อนไหว*

ผลการศึกษา *: ผู้ป่วยทั้ง 69 รายได้รับการผ่าตัดโดยแพทย์คนเดียวกันด้วย 95 Condylar Blade Plate มี 56 ราย เท่านั้นที่สามารถติดตามผลการรักษาได้นานกว่า 10 เดือน (ระหว่าง 10-102 เดือน) 53 จาก 56 ราย (94%) พบการงอกประสานของกระดูกอย่างดี โดยในจำนวนนี้ 1 รายเกิดภาวะติดเชื้อแทรกซ้อนที่สามารถรักษาให้หายได้ด้วยการตัดแต่งแผลและการให้ยาปฏิชีวนะ 3 จาก 56 ราย (6%) ต้องผ่าตัดเพิ่มเติม 1 ราย โดยต้องใส่ bipolar arthroplasty เนื่องจากเกิดการทะลุหลุดจากหัวกระดูกต้นขาที่ยึดตรึง ส่วนอีก 2 ราย ต้องผ่าตัดใส่โลหะดามกระดูกใหม่ และปลูกกระดูกเนื่องจากกระดูกติดช้าและโลหะดามกระดูกหัก ระยะเวลาในการผ่าตัดเฉลี่ย 45 นาที (35-85 นาที) ผู้ป่วยเสียเลือดระหว่างผ่าตัดเฉลี่ย 150 ลบ.ม.ม. (100-500 ลบ.ม.ม.) ระหว่างและหลังผ่าตัดผู้ป่วยได้รับเลือดเฉลี่ย 1.5 หน่วย (0-3 หน่วย) Neck-shaft angle หลังผ่าตัดเฉลี่ย 130 (125-135) องศา ใช้ blade ยาวเฉลี่ย 67 (60-70) ม.ม. ผู้ป่วยต้องอยู่ในโรงพยาบาลนาน 14 วัน (7-20 วัน) 27 ราย (48%) ได้รับการอนุญาตให้ลงน้ำหนักได้ 29 ราย (52%) สามารถลงน้ำหนักได้บางส่วน ภายใน 6 สัปดาห์หลังการผ่าตัด โดยเฉลี่ยผู้ป่วยสามารถลงน้ำหนักได้เต็มที่ภายใน 9 (2-6) สัปดาห์หลังผ่าตัด การเคลื่อนไหวของข้อตะโพกหลังผ่าตัดโดยเฉลี่ย 34 (15-58), 20 (10-28), 85 (50-135), -2 (0 to -8), 18 (10-35) และ 38 (18-56) องศาในท่า abduction, adduction, flexion, extension, internal และ external rotation ตามลำดับ*

วิจารณ์และสรุป *: กระดูกต้นขาหักบริเวณ intertrochanter พบได้ค่อนข้างบ่อย มักจะเกิดกับผู้สูงอายุที่มีโรค หรือภาวะอื่นทางอายุรกรรมร่วมด้วย ก่อให้เกิดปัญหาในการรักษาด้วยวิธีผ่าตัด ผู้รายงานได้เสนอการผ่าตัดรักษา โดยใช้ 95 Condylar Blade Plate ซึ่งให้ผลการรักษาดี เป็นเครื่องมือราคาถูก มีวิธีการผ่าตัดที่ไม่ยุ่งยาก ใช้เวลาผ่าตัดไม่นาน เสียเลือดระหว่างผ่าตัดน้อย หลังผ่าตัดผู้ป่วยสามารถเคลื่อนไหวลุกจากเตียงได้เร็ว และมีภาวะแทรกซ้อนต่ำ*