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Results of Subtrochanteric Fractures Treated with Dynamic Hip Screw and Dynamic Condylar Screw

Key Words

Subtrochanteric fractures
Internal fixation
Dynamic hip screw
Condyle hip screw

Abstract

Objective: To study the results of 48 patients with subtrochanteric fractures of the femur, treated surgically with fixation by dynamic hip screw (DHS) in 25 patients (52%), and by dynamic condylar screw (DCS) in 23 patients (48%), at Al-Razi Orthopaedic Hospital in the period between January 1990 and June 1995. **Methods:** The patients were reviewed with the mean follow-up of 16 months (range 6–30 months). **Results:** The mean duration of union was 4 months in 46 patients (95.8%). Non-union was evident in 2 patients (4.2%). Two patients (4.2%) developed delayed union, which was successfully united after re-operation by autogenous bone graft. One patient (2.1%) had wound infection. Metal failure occurred in the 2 non-union patients (4.2%). Excellent and good clinical and radiological scoring was achieved in 41 patients (85.4%), fair in 5 (10.4%), and failure in 2 patients (4.2%). **Conclusions:** We concluded that DHS and DCS are among the best fixation devices in the armamentarium for subtrochanteric fracture management. Although all the complications in our series occurred in the DCS group, with better clinical and radiological scoring in the DHS group, we could not conclude that DHS is better than DCS because more complex and unstable subtrochanteric fracture types were treated by DCS (8 patients with type B and 8 patients with type C, 69.6%), comparable to 19 patients with type A (76%) and only 6 patients (24%) in type B in the DHS group. The small number of patients in each group makes also the difference between them statistically insignificant.

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Introduction

Subtrochanteric fractures constitute 10–15% of the fractures affecting the proximal femur [1]. They are fractures at risk with a high incidence of complications in their treatment which could be attributed to the characteristics of the subtrochanteric area that include a biomechanically high stress concentration, a predominantly cortical bone quality and a frequent incidence of fracture comminution [2–5]. These features contribute to a high metal failure rate (20–33%), with breakage or bending of the implants [6], and bone failure rate with non-union in 12.5–20% [3, 7–9]. Various types of fixation implants were used for treatment of the subtrochanteric fractures including nail-plate [10, 11], angled blade-plate [12, 13], flexible intramedullary nails [14–16], rigid intramedullary nails [17–20] and interlocking nails [2, 21–24]. However, there is still a lack of the implant which fits all the variations of subtrochanteric fractures, and which has to be accepted as a method of choice. The aim of this study is to analyse the results of treating subtrochanteric fractures by fixation with dynamic hip screw (DHS) and dynamic condylar screw (DCS) devices.

Materials and Methods

Between January 1990 and June 1995, 48 patients with subtrochanteric fractures were treated at Al-Razi Orthopaedic Hospital of Kuwait. The male patients numbering 37 (78%) constituted the majority, compared to 11 female patients (22%). The mean age was 36 years (ranging from 24 to 78 years). Forty patients (83.3%) were under the age of 50 years and only 8 patients (16.7%) were older than 50 years. In 43 patients (89%), the fractures were due to high energy trauma including road traffic accidents in 26 cases (54.2%), and falling from height in 17 patients (35.4%). In only 5 patients (10.4%), the trauma was of low energy (simple fall at home), and the mean age of

Table 1. Types of subtrochanteric fractures according to AO classification

Type of fracture	Patients
Type A, simple fractures	25
A1, simple spiral	12
A2, simple oblique (>30)	10
A3, simple transverse (<30)	3
Type B, wedge fractures	15
B1, spiral wedge	8
B2, bending wedge	7
B3, fragmented wedge	0
Type C, complex fractures	8
C1, complex spiral	5
C2, complex segmental	3
C3, complex irregular	0

those 5 patients was 72 years. For the purpose of this study, the subtrochanteric fracture is defined as a proximal femoral fracture involving the area from the lesser trochanter to 5 cm distally [3, 25]. The AO fracture classification [26] was applied (table 1) and included 25 patients with type A fractures (52.1%), 15 patients with type B (31.3%) and 8 patients with type C (16.6%).

Surgical Technique

The operation was carried out with the patient lying supine on the fracture table. The fracture was exposed by lateral approach. The dissection was only limited to the reduction of the main fragments with no attempt at the medial cortical anatomical reconstruction (indirect reduction). Interfragmentary screws were used to fix the comminuted large fragments. With the aid of the image intensifier, the guide pin was inserted into the femoral head and neck in the appropriate site, followed by insertion of the DHS or DCS. A suitable side plate with at least four holes distal to the main fracture line was engaged to the hip lag screw, and secured proximally and distally. Basically no bone graft was applied in this primary procedure. The choice between the DHS or DCS was left to the preference of the attending surgeon. Prophylactic intravenous antibiotic routinely started with the induction of anaesthesia. A dose of 1 g of a third-generation cephalosporin was given and repeated after 24 h.

Fig. 1. a Subtrochanteric fracture after road traffic accident in 32-year-old male. **b** Fixed initially by static interlocking intramedullary nail and complicated by delayed union and broken nail 3 months later. **c, d** Revision surgery of removal of the broken nail, fixation by DHS and autogenous bone graft ended successfully by bone union 3 months later.

Post-Operative Care

Early mobilization of either non- or partial weight bearing with crutches started on the 2nd or 3rd post-operative day, according to the type of fracture, and the rigidity of the fixation. Protected full weight bearing was only allowed with early appearance of callus in the X-ray films.

Follow-Up

The patients were seen regularly at the out-patient clinic after the operation. The mean follow-up was 16 months (range 6–30 months) post-operatively. The final clinical assessment was done including pain, walking ability, hip motion and leg length. A-P and lateral radiographs were obtained for signs of fracture

Fig. 2. a, b Ipsilateral subtrochanteric and middle third femoral shaft fractures in a 24-year-old female patient who had been involved in a car accident, fixed by DCS and resulted in sound union 4 months later.

healing, deformity at the fracture site and implant failure. The clinical and radiological scoring was counted, using the method described by Schatzker and Lambert [27], reproduced in table 2 with minor modification [28].

Results

Twenty-five patients (52%) had been fixed by DHS, and 23 patients (48%) by DCS. Forty-one patients (85%) got an excellent and good score with 23 patients (92%) of the DHS group and 18 patients (78%) of the DCS group. Fair results were achieved in 5 patients (10%), including 2 patients (8%) of the DHS group and 3 patients (13%) of the DCS group. The union had been achieved in 46 patients (95.8%), 25 patients of the DHS group (100%) and 21 patients of the DCS group (91.3%). The mean duration of union in 46 patients (95.8%) was 4 months (range 3–8 months). Two patients (4.2%) of the DHS group were

re-operated by autogenous iliac bone graft for delayed union (no trace of bone healing at 3 months post-operatively). In both cases, the implants were found rigidly fixed to the bone, and no evidence of infection either clinically and by negative cultures. After bone graft, both cases successfully proceeded to fracture union at 6 and 8 months post accident. In 2 patients (4.2%) from the high energy trauma (road traffic accidents) and DCS group, the fractures failed to unite primarily up to 6 months after surgery. In the beginning, there was starting callus in both cases but it failed to proceed to solid union, and further got complicated by the breaking of the side plate in one and backing out with breaking of the screws in the other. Revision surgery was carried out with replacing of the failed implants and supplementary autogenous iliac bone graft. Wound infection occurred early post-operatively in 1 patient (2.1%) of the DCS group, and was treated by wound debride-

Table 2. Modified Schatzker-Lambert score [27] for clinical and radiological assessment

Clinical and radiological criteria	Score
No pain Less than 1 cm leg shortening No varus, valgus or rotatory deformity Perfect hip congruency	excellent
Not more than one of the following: Minimal pain Loss of leg length up to 2 cm Loss of flexion up to 20° Less than 10° varus or valgus deformity	good
Any two of the criteria in the good category	fair
Disabling pain (no matter how perfect the radiograph) Flexion to less than 90° Varus or valgus deformity exceeding 15° Joint incongruency	failure

Table 3. Complications

Complications	DCS group		DHS groups	Overall %
	n	%		
Non-union	2	8.6	–	4.2
Delayed union	2	8.6	–	4.2
Metal failure	2	8.6	–	4.2
Infection	1	4.3	–	2.1

ment, local antibiotic beads and systemic antibiotics. Control of infection was achieved and fracture was healed within 5 months post-index surgery, and without recurrence of the infection at the latest follow-up. One of the included patients was treated originally by interlocking intramedullary nail. The fracture failed to unite up to 3 months post-operatively and complicated further by breaking of the

Fig. 3. A non-union and broken DCS side plate 6 months after subtrochanteric fracture fixation in a 48-year-old male.

nail. In revision surgery, the nail had been removed, and the fracture was fixed by DHS device with autogenous bone graft and successfully united 3 months later. The 2 patients with non-union and metal failure and the 1 with wound infection all occurred in the DCS device group. Complications have been shown in table 3. The results of clinical and radiological assessment according to modified Schatzker and Lambert [27] score have been shown in table 4 [28].

Discussion

A variety of methods of treatment have been described for the subtrochanteric fractures. Non-operative management is difficult because of the characteristic flexion deformity of the proximal fragment [28]. Fielding and Magliato [25] reported 40% complications in

Fig. 4. a-c A spiral subtrochanteric and upper third femoral shaft fracture in a polio lower limb patient, fixed by DHS and resulted in a sound union in 4 months.

Table 4. Scoring of the patients according to modified Schatzker-Lambert criteria [27]

Patients	Score	Device	Type of fracture
17	Excellent	DHS 10	A1 (n = 7), A2 (n = 3)
		DCS 7	A1 (n = 5), A2 (n = 2)
24	Good	DHS 13	A2 (n = 5), A3 (n = 3), B1 (n = 5)
		DCS 11	B1 (n = 2), B2 (n = 3), C1 (n = 5), C2 (n = 1)
5	Fair	DHS 2	B1 (n = 1), B2 (n = 1)
		DCS 3	B2 (n = 3)
2	Failure	DHS 0	0
		DCS 2	C2 (n = 2)

64 subtrochanteric fractures that had been treated by Hewett fixed angled pin-plate [10]. Kuntscher [29] in 1939 reported on the concept of intramedullary fixation of those fractures, but the first intramedullary device known to be used successfully was developed by Zickel [30] in the 1960's, but Zickel nail had its limitations, with shortening of the femur occurring unless cerclage wiring or interfragmentary fixation was used. There were also technical difficulties during insertion, and possibility of refracture during the extraction of the nail [31, 32]. Benz [33] reported unacceptably high rates of malunion, shortening, proximal and distal migration in 130 subtrochanteric fractures fixed by Ender's flexible nails.

The AO angled blade-plate was effective providing the medial buttress could be restored, but it yielded non-union rate up to 18%, a healing time of roughly 6 months, and biomechanical disadvantages of higher bending under loads which could lead to fatigue and failure, if there were no adequate medial support [8, 12, 34]. In spite of the favourable results with the interlocking nails in subtrochanteric fractures, other experts with this device have noted high complication rates, technical difficulties, troubles in controlling rotation and shortening besides the limited indication of the interlocking nails for only the lower subtrochanteric fractures with intact piriformis fossa and greater trochanter.

Chi-Chuan et al. [2] reviewed 31 subtrochanteric fractures treated with interlocking nailing. There was a 13% rate of non-union, 3.2% nail breakage and the authors concluded that the interlocking nails are useful only in the fractures below the lesser trochanter and without involvement of the greater trochanter [1, 35]. Tencer et al. [36] compared the rigidity of subtrochanteric fractures stabilized with various intramedullary and plate implants. They concluded that plate systems would be

better for being more rigid in torsion and equal in bending and loading to the intramedullary nails [36]. During fixation of subtrochanteric fractures for the patients in this study, we adopted the method of Kinast et al. [8] of indirect reduction with preservation of the medial soft tissue. Although medial reconstruction is desirable and advantageous biomechanically, it could not be achieved without much soft tissue stripping and devascularization. Kinast et al. [8] reported distinctly faster healing time, lower non-union and lower rate of infection using this biological reduction technique. Our results of 95.8% union rate within an average of 4 months and infection rate of 2.1% confirmed the results reported by Kinast et al. [8] and the usefulness of their technique. Trafton [6] attributed the earlier high failure rates to poor reduction and fixation using flimsy implants rather than to inherent inadequacy in this portion of the femur. This hypothesis is supported by the results of our study of 85.4% excellent and good results, and failure in only 4% using the advantageous DHS and DCS devices.

After an overall analysis of many literature studies for the treatment of subtrochanteric fractures by DHS, Chi-Chuan et al. [2] reported 0–4% rate of non-union, no implant failure, 0–8% rate of infection and 4.4% lag screw cut-out. In our series we had no complications using DHS in 25 patients, with 88% excellent and good result in this group. In 1992, Radford and Howell [28] reported 64% good results with DCS. We were more successful in using DCS, with 82% excellent and good results, and in spite of the previous reports that DCS implant is stronger biomechanically than DHS, because it allows additional screw fixation to the proximal fragment [35]. Our results of using DCS were inferior to those of DHS in both complication rate and the overall clinical and radiological score. But because the number of patients in both groups

is small, the difference in the results is far from being statistically significant. Moreover, the groups are not comparable since the DCS device has been used for more unstable and complicated subtrochanteric fractures.

Conclusion

We conclude that both DHS and DCS devices compare favourably with other methods of subtrochanteric fracture fixation. Good results with fracture union could be achieved

in both. If used properly, especially in combination with the method of indirect fracture reduction of Kinast et al. [8], DHS and DCS devices are among the successful instruments in the management of subtrochanteric fractures.

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