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Original article

Distal femoral fractures treated with condylar buttress plate in a West African hospital

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ABSTRACT

Objectives: The aim of this retrospective study was to present our experience using condylar buttress plate in the treatment of distal femoral fractures.

Patients and methods: Thirty-two patients underwent open reduction and internal fixation with condylar buttress plates for distal femoral fractures from October 2000 through May 2010. Patient demographics, type of fracture, treatment, complications, results achieved, and follow-up assessment were reviewed. The fractures were classified with the AO system. The functional outcome was rated according to Schatzker and Lambert criteria.

Results: There were 22 men and 10 women with an average age was 44 (range 19–87) years. The fractures were classified as A1 (n = 7; 21.8%), A2 (n = 4; 12%), A3 (n = 5; 15.6%); C1 (n = 4; 12.5%), C2 (n = 6; 18.8%), and C3 (n = 6; 18.8%). The mean delay from injury to operation was 15 (range 1–27) days. Iliac bone graft was performed in four patients. Postoperatively, a posterior splint or a plaster cast was applied for 3 weeks. No patient had an intra-articular step-off of more than 2 mm. Sepsis of the operative wound occurred in two patients. Fractures healed in 22 (91.7%) patients with a mean duration of 4 (range 3–8) months. Twenty-four patients were followed up on an average of 15 (range 7–28) months. Varus deformity ($>10^\circ$) was observed in five (20.8%) patients. Knee flexion was less than 90° in 11 (45.3%) cases. Non-union occurred in two (8.3%) patients. Functional results were good to excellent in 11 (45.8%) patients and considered as fair or failure in 13 (54.2%).

Conclusion: The current report also identifies varus deformity as a major concern of this implant. The main finding of this study was the ensuing knee stiffness after a prolonged immobilization and delay in performing surgery and rehabilitation program due to socio-economic and logistic reasons.

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1. Introduction

Distal femoral fractures (DFFs) are treated using several devices.^{1,2} Utilizing multiple techniques 70%–85% of good to excellent results reported for open reduction and internal

fixation.³ However no one implant is suited for all fractures. We routinely use the Judet–Letournel screw plate which is an extramedullary hardware.⁴

From 2000 on, DFFs are also fixed with condylar buttress plates (CBPs).⁵ The aim of this study was to present our

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experience using this implant in a setting with limited financial resources and operating facilities.

2. Patients and methods

Patients undergoing open reduction and internal fixation with CBP for DFF from October 2000 through May 2010 were identified and their charts reviewed retrospectively. We included adult patients treated initially for isolated distal femoral fracture. Patients with CBP as a revision procedure to correct previous internal fixation were excluded. Polytrauma patients with ipsilateral lower limb fractures or concomitant fractures of the other limbs were also excluded because these injuries later interfere with evaluation of weight-bearing and other outcomes. The initial study population was 45 but 13 patients were excluded owing to the aforementioned criteria. Thus the final population was 32 patients. The notes and imaging findings were reviewed with particular attention to patient demographics, injury mechanism, treatment, complications, results achieved, and follow-up assessment. The fractures were classified using the AO system. Open fractures were described with the criteria of Gustilo. Data obtained were analyzed using simple statistics. Surgical procedure had been described in many reports.^{6–9} Emphasis was given to our tactics. All operations were performed under general anaesthesia.

The patients were positioned supine on a standard operating table, the ipsilateral buttock supported by a pad in order to flex slightly the knee. The ipsilateral iliac bone was draped for autographing. Tourniquet was not used in any of the patients. A standard lateral approach to the distal femur was used, with the distal portion of the incision extending anteriorly across the lateral femoral condyle ending at the level of the Gerdy's tubercle.

The vastus lateralis was reflected forwards. Arthrotomy was performed in all cases so that the patella could be dislocated medially. Meticulous care was taken to avoid excessive mobilization of the metaphyseal fragments to prevent further stripping of periosteum and blood supply. The multifragmentary fragments lying medially were left undisturbed. In extra-articular fractures which were not severely comminuted, reduction gained to be maintained temporarily by two crossed K-wire. A plate with proper length and suitable to the body side was selected. A plate bender was used to contour the plate to conform to the distal femoral condyle. The plate was centred along the midlateral line of the cortex with its lateral flare seated directly over the lateral flare of the condyle. The distal end of the plate should be applied too distal as possible but not extend below a point 1 or 1.5 cm above the joint line (Fig. 1). Rotation and length of the distal femur were checked. Fragments over the anterior and lateral cortex were used as a guide for restoring the proper length and rotation of the distal femur especially when they were not too comminuted. The distal portion of the plate was then fixed to the femoral condyle with at least four AO 6.5-mm partially threaded cancellous screws. Manual traction was applied to reduce the fracture. The plate lied against the shaft and was moulded to fit the shaft snugly. Posterior displacement of the distal fragment was checked. After alignment, length and rotation were checked, at least three bi-cortex 4.5-mm cortical

Fig. 1 – (A) Preoperative AP X-ray of type C fracture. (B) AP postoperative X-ray of the same fracture. Bone grafting was not performed. The plate inserted too proximally did not fit correctly the lower end of the femur. There was no intra-articular step-off but a varus malignment.

screws were inserted proximal to the fracture site. Bone graft was performed in four patients. The wound was closed in layers over a suction drain, the knee being flexed. Postoperatively, the limb was supported in a posterior splint or in a plaster cast for 3 weeks, after which exercises of the quadriceps and the knee were started. The patient was maintained non-weight-bearing on the injured lower limb with crutches for 3 months then progressed gradually to full weight-bearing depending upon clinical and radiological progress. There was no protocol for routine follow-up of the patients. In general, after discharge from the hospital patients were seen every 2 weeks for a minimum of 8 weeks and monthly interval. Anteroposterior and lateral radiographs were reviewed with regard to fracture reduction, assessment of union by callus or trabeculae crossing the fracture site on both views. The articular reduction was anatomic for a step-off of least than 2 mm.¹⁰ Mainly anterior projection of the knee was used to demonstrate angulation. An angulation of less than 10° was considered as acceptable.¹¹ Fracture union was defined as ability to walk without pain and presence of bridging calus on at least three cortices on the radiographs. The lower limb length discrepancy was assessed by measuring the distance between the anterior iliac crest spine and the medial malleolus on each side. The functional outcome after the index operation was rated according to Schatzker and Lambert criteria¹¹ (Table 1).

3. Results

There were 22 men and 10 women with a mean age of 44 years (range 19–87). The fractures were the result of a road traffic

Table 1 – Outcome Schatzker and Lambert criteria.

Excellent	Full extension Flexion loss less than 10°, no varus, valgus or rotary deformity
Good	No pain, perfect joint congruency Not more than one of the following: Flexion loss not more than 20°, less than 10° varus or valgus Minimal pain, loss of length not more than 1.2 cm
Fair	Any 2 of the criteria in good category
Failure	Any of the following: Flexion to 90° or less, varus or valgus deformity exceeding 15° Disabling pain no matter how perfect the X-ray, joint incongruence

accident ($n = 20$; 62.5%), a fall ($n = 9$; 28.1%), a pathological fracture ($n = 1$; 3.1%), and a gunshot injury ($n = 2$; 6.3%). The fractures were classified as A1 ($n = 7$; 21.8%), A2 ($n = 4$; 12%), A3 ($n = 5$; 15.6%); C1 ($n = 4$; 12.5%), C2 ($n = 6$; 18.8%), and C3 ($n = 6$; 18.8%). These were closed in 29 patients and open in 3 cases (2 Gustilo I, 1 Gustilo II). The mean delay from injury to operation was 15 (range, 1–27) days.

The mean operation time was 50 (range, 35–60) min. The average stay in hospital was 28 (range, 4–77) days. No patient had an intra-articular step-off of more than 2 mm. Sepsis of the operative wound occurred in two patients. In one patient, this was a superficial wound infection which responded well to standard treatment local wound care with intravenous antibiotics followed by oral antibiotics. In the other case, it was a septic arthritis complicating an open fracture, in an old patient who finally died of decubital

complications. Seven patients were lost to follow-up. Thus twenty-four patients with a mean follow-up delay of 15 (range, 7–28) months were available for final evaluation. Fractures healed after the index procedure in 22 (91.7%) patients with a mean duration of 4 (range, 3–8) months (Fig. 2). Failure of implant was noticed in three patients. In the first patient, fracture healing was achieved and loosening was noted 5 months after the operation. The second patient was the one who had suffered from a sepsis during hospitalization. In the third patient reoperation 7 months after the index operation consisted of use of Judet screw plate and iliac bone grafting leading fracture union. The plate was improperly contoured in one patient but fracture union occurred uneventfully.

Varus deformity was observed in five (20.8%) patients. Knee flexion was less than 90° in 11 (45.3%) patients. All these patients had unsatisfactory results. The hardware was removed. The outcome of the third patient was uneventfully until a non-union was noticed 8 months after osteosynthesis. The patient was not re-operated. Implant was removed in 4 patients. After the index operation results were good to excellent in 11 (45.8%) patients and considered as fair or failure in 13 (54.2%).

4. Discussion

The main drawback of the CBP which is not a fixed-angle device is the varus deformity. Varus angulation rate of 20.8% in our series falls within the range reported by literature varying from 16.7% to 42%.^{12–15}

Fig. 2 – (A) Preoperative AP X-ray of type A fracture (B) AP and lateral (C) views showing fracture union but the plate was inserted too proximally.

Therefore this implant is not frequently used. Of a total of 60 fractures in the series of Siliski et al,¹⁶ CBP was used for 7 (11.67%) fractures while the condylar blade plate was utilized for 42 (70%). The satisfactory results achieved in terms of fracture union and functional outcome may appear to temper the concerns raised considering the stability of constructs with CBP. After the index operation, fracture union is obtained in 89.5%–100% of cases without the need for bone grafting while satisfactory results rates vary from 50% to 84%.^{6,8,12,14} DFFs are commonly comminuted and intra-articular. Surgery with traditional fixed-angle devices (blade plate and dynamic condylar screw) is difficult and fracture fixation sometimes unstable. By creating a fixed-angle construct and increasing the stability of the plate screw implant, locking plating modalities tend to replace the classic implants.¹⁷ Locked plates are more expensive than conventional fixed-angle devices.

CBP is readily available and suitable for severely comminuted fractures especially when the fracture line is very low, rendering difficult the fixation of the distal fragment to a plate with at least one cancellous screw.⁷

Alternatives overcoming varus angulation include modification of the angulation of screws,¹⁸ additional plates,^{10,19} bone graft,²⁰ and use of locked buttress plate.²¹ Bolhofner et al⁶ recommended biological or indirect reduction technique especially in the setting of medial metaphyseal comminution. This procedure is helpful in preserving the healing potential of the fracture. Bone grafting is in most cases avoided and good alignment is achieved.⁶ In a preliminary study, this hardware was employed for extra-articular fractures since we were unaccustomed to this implant.⁵ In the current study type C fractures were also managed using this implant.

This is in line with report by Bolhofner et al.⁶ Bone union rate was 91.7% in our series but overall final results were good and excellent in 45.8% of patients. Unsatisfactory results were observed in both extra-articular and articular fractures. The main factor affecting the outcome was the postoperative management protocol. Postoperative continuous passive motion machines lack and most patients wore plaster cast for a long time for fear of manipulation by traditional bonesetters and untimely weight-bearing. Physiotherapy after withdrawal of the cast was always delayed as patients have to pay for their care. There is also need for a rehabilitation program over a long period to overcome the stiffness of the knee. Manipulation of the knee under anaesthesia and quadricepsplasty to increase range of motion could not be performed since they lead to incremental cost.

All these factors explained the knee stiffness observed in the current study. Delay in the management was another weak point of the current study. Patients presented to hospital as soon as possible but their surgical intervention was not performed from their admission for socioeconomic and logistic reasons. One theatre was dedicated to orthopaedics. This was used to cater for both trauma and elective procedures. Planned elective lists were carried out in the morning and the rest of theatre time was used for trauma surgery. Delay was identified by Nagy et al¹³ as a factor contributing to unsatisfactory functional outcome due to difficulties during operation correlated to adhesion. In their study performed in settings similar to ours patients operated upon within the first week after injury had satisfactory results in 88.9% of cases

while those postponed for more than 2 weeks after trauma had satisfactory results in only 33.3% of cases.¹³ There were limitations to the present study.

This was a retrospective study with several surgeons performing the procedure. Clinical and radiographic evaluations were performed by the attending surgeon but not an independent examiner not involved in the patients' care. These factors are source of bias and could explain complications observed. The strength of this report relies on the advantage of this implant. It is a cost effective device requiring no special equipment.

5. Conclusion

The literature review and the experience reflected in the current report have emphasized that condylar buttress plate inserted with skilled surgical technique can yield satisfactory results. The current report also identifies varus deformity as a major concern of this implant. The main finding of this study was the ensuing knee stiffness after a prolonged immobilization and delay in performing surgery and rehabilitation program due to socioeconomic and logistic reasons.

Conflicts of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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