Results of Lateral Condylar Blade Plate Fixation of Supracondylar Fractures of the Femur in an African Tertiary Hospital in Nigeria.

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Background: ***The concerns about operative stabilization of supracondylar femoral fractures are complications, especially hardware infection and disturbance of normal knee function. We reviewed the results of operative fixation of supracondylar femoral fractures using the lateral condylar blade plate device in our centre.***

Methods*: All patients operatively treated using a lateral condylar blade plate device within a 13-year period were reviewed.*

Results: ***There were thirty two fractures. Mean age was 47.3±21.5 years. There were 22 AO type 33-A, 4 type 33-B and 6 type 33-C fractures.***

Traffic crashes accounted for 15 cases (46.9%). Six were open (Gustilo type IIIa). Surgery was delayed for an average of 21.3 days. Length of hospitalization was 69.7±43.5 days. Follow up averaged 23.6 weeks and average time to fracture union was 17.8±1.0 weeks. All fractures united during follow up with an excellent outcome in 22 (68.8%), good in 5 cases (15.6%), moderate in 4 (12.5%) and a poor outcome in one patient using the Schatzker and Lambert criteria. Complications included knee stiffness (15.6%), bone infection (9.4%) and loosening of an implant. The infections subsided after removal of the hardware.

Conclusions: ***Treatment of supracondylar femoral fractures with the lateral condylar plate usually promises good results. However, high energy injuries are often prone to complications.***

Keywords: Supracondylar femur, fracture, operative treatment, injuries, Nigeria.

Introduction

The treatment of distal femoral fractures remains a significant surgical challenge. This is due to the need to achieve anatomic and functional restoration of the bone and articular surface against the unbalanced pull of thigh and calf muscles.Neer et al recommended a nonsurgical approach to supracondylar fractures of the femur[1] noting a high rate of local complications and low patient satisfaction rates. Early conversion to cast bracing after a period of traction was later introduced[2] with the offer of better functional outcomes compared with prolonged casting across the knee.

Conservative methods however may be complicated by knee stiffness, malunion and nonunion. Improved implants, instrumentation and extensive surgical experience have made operative treatment the standard care for the management of these fractures as several studies have confirmed the superior results of surgical treatment compared to conservative management[3,4]. Open reduction and internal fixation has been advocated using various implants including lateral condylar blade plates, Rush rods and intramedullary nails, as well as dynamic condylar screws[5]. These devices are technically demanding and none combines interfragmentary compression with good purchase in osteopenic bone. Soft tissue disruption with open reduction and periosteal stripping for placement of the implant may interfere with the healing process resulting in a delay in union or outright non-union. Bone grafting was frequently indicated although wound infection was not uncommon with this approach[6].

Closed intramedullary nailing minimizes the extent of soft-tissue dissection and devitalization, such that the fracture haematoma is not disturbed. Early fracture healing is predictable because of abundant callus formation, and complications are few. Biological osteosynthesis maintains the blood supply by preserving the soft tissue envelope and also minimizes surgical trauma to the zone of initial injury. Therefore, successful management of distal femoral fractures is possible with adherence to the basic principles of operative fracture fixation. Implant selection is determined on the basis of the characteristics of the fracture, bone quality, experience of the surgeon, as well as the available range of hardware. No implant or surgical technique shows clear superiority over the other under all circumstances in distal femoral fracture[7]. We have employed the AO principles of internal fixation of

common long bone fractures in our hospital for 18 years and we now review the cases of supracondylar fractures of the femur operatively treated using the lateral condylar blade plate.

Patients and Methods

All patients who underwent open reduction and internal fixation for supracondylar fractures of the femur using a lateral condylar (95-degree angle) blade plate device during the period between January 1996 and December 2008 were identified using the operating theatre diary after which the case notes and radiographs were retrieved. Patients were excluded if the case notes or the radiographs were not available for review. Patients' biodata, aetiology of the fractures as well as details of the fracture were pulled from the case records and entered into a proforma. The fractures were classified according to the AO method[8] after reviewing the radiographs and this was cross-checked with the documentation in the patients' case notes. Other details relating to the operation, duration of hospitalization, time to union and complications were all obtained from the case records and documented. Range of knee motion, presence of any deformities, shortening, joint incongruence, pain or radiological evidence of any of these after fracture union were specifically documented in the proforma. Four patients with incomplete information were called up and evaluated.

Open fractures were graded according to the method proposed by Gustilo, Mendoza and Williams[9]. The standard technique employed in our centre for lateral condylar blade plate fixation of supracondylar fractures of the femur places the patient supine under subarachnoid block or general anaesthesia. Intravenous ceftriaxone prophylaxis is given at induction of anaesthesia and a second dose 24 hours later. The approach to the fracture is lateral although an anterior midline approach is employed in cases where the fracture extends into the condyles. A wound debridement is carried out after obtaining deep wound swab and tissue biopsy specimens for microbiological studies in case of open fractures. The fracture is reduced and held with clamps while the implant is inserted into the lateral condyle according to the technique described by Müller[10]. The wound is closed leaving a vacuum drain deep to the fascia. Postoperatively, the patient is ambulated non weight-bearing within 72 hours unless the fixation is unstable when a plaster-of-Paris (POP) slab is applied before ambulation. However, in these cases (unstable fixations), the slab is replaced with a cast brace at 4 weeks. Antibiotics are continued for six weeks in open fractures. The wound drain is removed not later than 48 hours after surgery.

Our practice is to obtain radiographs on presentation for these fractures and subsequently repeat immediately after operative fixation and thereafter at 6-weekly intervals until clinical and radiological union. Clinical union is assumed when there is no pain or abnormal movement at the fracture site on full weight-bearing while radiological union is deemed to have taken place when there is evidence of bone continuity or bridging mature callus at the site of the fracture on radiographs that are taken in two different views at right angles to each other.

The functional results of treatment were graded according to the Schatzker and Lambert criteria [6] into excellent, good, moderate or poor.

Data obtained was transferred to a computer spreadsheet and analysed using the Statistical Package for the Social Sciences Software version 17.

Results

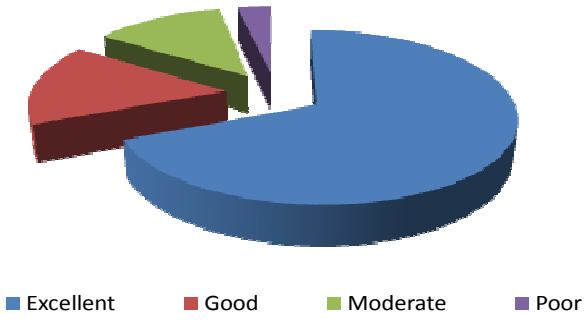
A total of 32 fractures of the supracondylar region of the femur in 32 patients operatively stabilized using a lateral condylar (95-degree angle) blade plate device in 14 males and 18 females were reviewed. The mean age of the patients was 47.3±21.5 years (range 23-100 years). The right femur was involved in 20 cases while 12 occurred on the left. Based on the AO classification of fractures, there were 22 cases (68.8%) of type 33-A, 4 (12.5%) of type 33-B and 6 (18.7%) type 33-C fractures. 58% of the fractures were associated with varying degrees of comminution.

Passenger vehicular road traffic crashes was responsible for 15 fractures (46.9%), followed by pedestrian knockdowns (9 patients; 28.1%), falls in 6 cases (18.8%) and gunshot injury in 2 (6.2%). Twenty six of the fractures were closed; six were open (Gustilo type IIIa). Associated injuries occurred in 13 patients. These included 2 polytrauma (one patient with fractures of the left femur, right ankle, right humerus and left radioulnar fracture; a second patient had an ipsilateral right femoral fracture, left radial fracture and patellar tendon rupture). Other injuries involved the head, upper limb fractures, acromioclavicular joint dislocation, an open tibial fracture, fractures of the contralateral femur and a hip dislocation.

Table 1. Injury characteristics of patients who had complications following operative treatment

Cause of Injury	Soft tissue	Morphology	Complication	Associated injuries
Gunshot	IIIa	Comminuted	Knee stiffness	-
Pedestrian traffic crash	Closed	Comminuted	Knee stiffness	-
Vehicular traffic crash	IIIa	Comminuted	Delayed union	-
Vehicular traffic crash	Closed	Comminuted	Knee stiffness	-
Vehicular traffic crash	Closed	Comminuted	Osteomyelitis	Multiple fractures
Vehicular traffic crash	IIIa	Comminuted	Osteomyelitis	Radial fracture
Pedestrian traffic crash	IIIa	Comminuted	Osteomyelitis	-
Pedestrian traffic crash	Closed	Comminuted	Implant failure	Psychosis
Vehicular traffic crash	Closed	Comminuted	Knee stiffness	-

Figure 1. Pie chart showing the results of treatment using Schatzker and Lambert Criteia



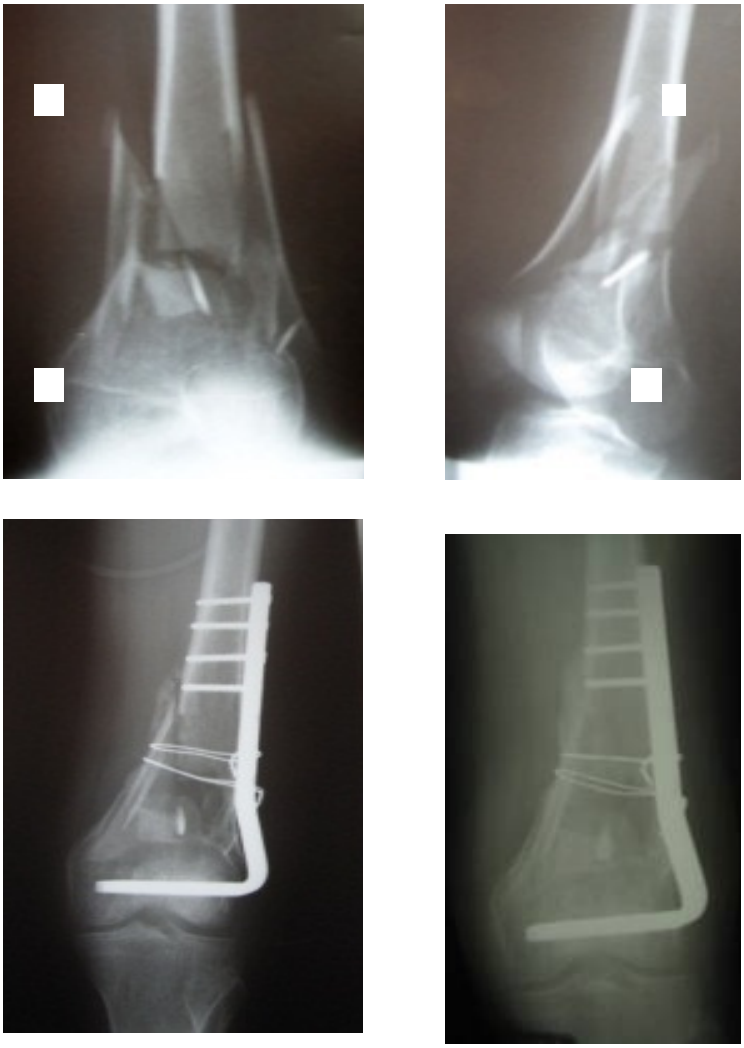


Figure 2: (a) Preoperative anteroposterior radiograph of an A3 fracture. (b) Preoperative lateral view. (c) Immediate postoperative anteroposterior view of the same fracture. (d) Radiograph taken after fracture union.

These included 2 polytrauma (one patient with fractures of the left femur, right ankle, right humerus and left radioulnar fracture; a second patient had an ipsilateral right femoral fracture, left radial fracture and patellar tendon rupture). Other injuries involved the head, upper limb fractures, acromioclavicular joint dislocation, an open tibial fracture, fractures of the contralateral femur and a hip dislocation.

The interval between injury and surgery averaged 21.3 days (range 2-55 days) while patients were on admission for 69.7±43.5 days. Follow up duration averaged 23.6 weeks while mean time to unite was 17.8±1.0 weeks (range 6.5-52 weeks). One patient had primary bone grafting. All fractures united within the period of follow up with an excellent functional outcome in 22 (68.8%), good result in 5 cases (15.6%) using the Schatzker and Lambert criteria. Details are shown in Figure 1. Treatment was complicated by knee stiffness in 5 cases (15.6%), bone infection in 3 patients (9.4%) and loosening of the implant in one patient. Table 1 shows the injury characteristics of patients who had complications following operative treatment. The infections subsided after removal of the hardware.

All the complications occurred in fractures that were associated with some degree of comminution or the other. Delay before operative treatment appeared not to be a determining factor for complications. Two of the 3 bone infections occurred in open fractures. However, no gunshot case was complicated by infection.

Discussion

Fractures of the distal femur often pose challenges to the trauma surgeon because of the proximity to the knee joint. In the younger age group, the injury is usually a result of high velocity vehicular crashes. In older patients with osteoporotic bone, it is often due to low energy injuries especially falls. In either case, the fracture is usually comminuted. Treatment requires skill and meticulous technique for good outcome[11]. The main challenge is obtaining and maintaining adequate reduction of both shaft and articular fragments while allowing early function of the knee.

The use of fixed angle lateral condylar blade plate for the fixation of these fractures is very popular especially in third world countries. This method of fixation is technically difficult and requires accurate insertion of the blade in 3-planes simultaneously.

In recent years great advances have been made in understanding the techniques of internal fixation. Operative treatment achieves anatomic reduction, encourages early range of motion and avoids most of the complications of non-operative treatment. Angle blade plate osteosynthesis has been reported to give good results, but the technique is demanding and the need to hammer the implant into position carries a risk of separating the femoral condyles [12]. Even in the elderly with osteoporotic bone, a lateral condylar blade plate device has a good biomechanical purchase. Intraoperative imaging was not employed during the insertion of the blade plate as that facility was not available when the lateral condylar blade plate was popularized in our hospital.

None of the patients were operated within the first twenty-four hours of arrival because of the need for the patients to provide funds both for the implants and to cover the surgery fees due to lack of comprehensive National Health Insurance Scheme (NHIS) cover. In the western world, most fracture(s are operated within 24 hours due to the availability of facilities for early fixation and medical insurance[13,14] although Phillip etal recorded a delay of 4 days before surgery[15].They noted that delay was not an independent predictor of mortality which was also the case in this series.

Our functional results of treatment are comparable to those reported by Christodoulou et al[11], Wu et al[16] and Huang et al[17] although these series utilized the minimally invasive technique and they showed that open fractures was associated with poor outcomes.Comminutionalso appears to be a predictor for poor outcome in our series. However, open fractures and comminution have a common denominator which is high energy injury as the causative factor. It is a fact that the energy transmitted at the time of the fracture is also dissipated to the surrounding soft tissue and this would explain the propensity of affectation of the knee resulting in knee stiffness.

The average time to union was 4.1 months (17.8 weeks), with 100% union rate. Bolfner et al[18] reported union time of as low as 10 weeks, using the condylar screw[15]. These figures agree with the report of supracondylar femoral nailing by Christodoulou et al[11], and Sawet al[19] who emphasized the need for meticulous dissection and minimal soft tissue stripping. Huang et al reported an average time of union of 18.5 weeks for lateral condylar plates and dynamic condylar plates [17]. Ingman[20] reported in another study an average time of union of 12.0 weeks, using open reduction and internal fixation with condylar screws and plate. We did not find any case of non union and this was similar to results from antegrade intramedullary nailing of supracondylar femoral fractures [17,21].

Our functional results are comparable to those published for minimally invasive procedures as well as the dynamic condylar screw[7,11]. Complications requiring secondary procedures were less common with the lateral condylar blade plate compared to the locking condylar plate[22]. In addition, another study showed no single reoperation in the lateral condylar blade plate group compared with retrograde

intramedullary nailing which also exhibited greater occurrence of knee pain [23]. Non union reported in these series was prevented by primary bone grafting[24]. Only one patient had bone grafting in our series and there was no associated complication.

Complications appeared to be related to high energy injuries. Yang et al, in their series reported stiffness of the knee among the commonest complications and this was corroborated by a similar study[24]. Knee stiffness is usually worse in the elderly who sometimes have background osteoarthritis. Prevention is achieved by early conversion to cast bracing[25]. Closed knee manipulation helps to improve knee motion in patients who develop this complication. The use of local antibiotic carriers (antibiotic-impregnated polymethyl methacrylate bone cement) is now employed at our centre in open fractures particularly in cases where the surgery has been delayed beyond 24 hours.

Gunshot injuries (two in this study) were not associated with postoperative infection as complications probably because local antibiotic carriers were placed at the time of fracture stabilization. However, Poyanli et al[26] also reported the absence of infectious complications in gunshot injuries without skin defects who had their fractures stabilized by retrograde nailing within 7 days.

Limitations of this study include its relatively small size and the fact that it is retrospective. However, a review of the literature shows that studies on internal fixation of supracondylar fracture are small and the average size in ten of such studies was 28.2 patients (between 13-39 subjects) [7,11,19,21-23,27-30]. The lateral condylar plate is being phased out at our centre; hence, a prospective study may not be likely. The condylar buttress plate is now the implant of choice in the surgical management of supracondylar fractures in our centre.

Conclusion

Internal fixation of supracondylar femoral fractures using the lateral condylar blade plate produces good results in most cases. Our results compare favourably with what obtains in other centres around the world. However, the incidence of bone infections is high in open fractures. We introduced implanting of antibiotic-impregnated bone cement beads at the primary surgery in open fractures whenever operative treatment has been delayed beyond 24 hours.

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