

A Novel Double Incisions Surgical Approach In The Treatment Of Late Presentation Of Supracondylar Femoral Fracture: A Comparative Study With The Conventional Lateral Only Incision Approach

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Abstract: Late presentations of supracondylar femoral fractures are not uncommon in our environment. In these cases, the conventional lateral approach to the lower femur is a difficult exposure especially to osteoclase and reduce a medially positioned mal-uniting fracture and place a hardware accurately with the intent of achieving a stable fixation. A combined lateral and limited anterior incisions approach helps to obviate this difficulty and ensures a timely reduction with minimal blood loss and without a shortening osteotomy and most importantly to achieve less limb length discrepancy.

Keywords: double incisions, surgical approach, supracondylar femoral fracture, limb length discrepancy, osteotomy

I. Introduction

Supracondylar fracture of the femur in young people, usually follows high energy impact and the fracturing forces pull the proximal fragment through the quadriceps and abut it onto the patella medially (Fig.1). It is also a common orthopaedic knowledge that the distal fragment is frequently pulled into flexion by the gastrocnemius force. It is therefore, almost impossible to manage this fracture conservatively because of the inability to reduce the proximal fragment through the apparent hour glass perforation in the quadriceps and the inability to counteract the gastrocnemius pull. This area is mainly cancellous bone and the fracture haematoma is filled with cells that have high osteogenic potentials. Healing soon starts in mal-aligned position with secondary callus formation. This is associated with painful stiff knee and limb length discrepancy (LLD). It was in these conditions that most of the patients who presented 4-6 weeks after the fractures, were admitted. The difficulty in osteo-clasing and fibro-lysing the medially located mal-uniting or sometimes non uniting fractures through a lateral approach as well as overcoming the tight contracted quadriceps and reducing the fracture adequately for hardware placement often prolong the operation time. This may increase blood loss and thus the need for transfusion and may also increase post-operative wound infection. To achieve reduction in some patients via the conventional lateral only incision, one sometimes needs to do a shortening osteotomy of the proximal fragment and risk LLD. This was the case with the first two patients, and this formed the spring-board on which we considered an additional anterior incision for the subsequent patients and for this study. We randomized the patients into two groups and each group served as a control for the other. The conventional lateral incision is about 10 cm long, placed on the lower part of the thigh and can be extended upwards or downwards and also curved anteriorly towards the knee joint according to need (Fig. 2). There is no major structure at risk except in the lowest part where the genicular vessels are usually transected. The anterior incision starts from the superior end of the patella and extended upwards to the musculo-tendinous part of the quadriceps. This can also be extended according to need. The major structures that are at risks are the branches of genicular vessels to the patella. Special precaution should be taken for the protection of the popliteal vessels and placing the bone levers sub-periosteally keep these vessels out of harm's way. It is for the avoidance of injuries to the femoral vasculature that the lateral approach to the femur is the gold standard. However, some authors have reported in a cadaveric study, a medial approach for minimally invasive plate osteosynthesis (MIPO) treatment of a distal femoral fracture when the lateral approach is contraindicated [1].

This is a preliminary report on the use of double incisions approach in comparison with conventional lateral incision in the surgical treatment of patients presenting late with supracondylar femoral fractures. The objective is to compare the results of double incisions approach and conventional lateral only approach in the treatment of supracondylar femoral fractures that present late, using parameters of operation time, blood loss, LLD and infection rate.

II. Patients and Methods

2.1. Ethical approval

The ethical committee of Imo State University Teaching Hospital where the patients were treated approved this study and the patients were recruited after informed consent. The patients' confidentialities were maintained and there are no conflict of interests.

2.2. Study Design

This is a prospective assessment of 16 patients seen and treated between Sept 2010 and Aug 2015 and who were randomized into two groups of surgical approaches namely combined lateral and limited anterior incisions on one hand and theconventional lateral incision on the other.

2.3. Setting

All patients were treated by the same surgical team and under similar theatre and anaesthetic conditions in a level III tertiary health institution. Patients with supracondylar femoral fracture who presented late with clinical evidence of LLD, mal-uniting fracture or non-union and knee stiffness were included in the study. Patients who had co-morbid medical conditions like Diabetes Mellitus, Rheumatoid arthritis, hypertension and HIV/AIDS as well as those patients who presented early were excluded from the study.

2.4. Technical consideration

The patients gave consent for the operationswhich were all done under generalanaesthesia and under aseptic conditions. A lateral incision was made to expose the fracture site and usually the quadriceps is seen perforated by the proximal fragment, contracted and with fibrosis and callus around it. The challenges in osteoclasia and subsequent reduction were much, associated with the difficulty in handling the short distal fragment from this approach. These difficulties encountered in reducing the fractures in the first two patients who were treated via the conventional lateral approach informed our decision to add an anterior approach to facilitate osteoclasia and reduction.To expose the fracture site adequately, the quadriceps were split in Z-plasty form and this further helped to manipulate the knee into flexion after hardware placement for those patients with severe knee stiffness. To avoid bias, the subsequent fourteen patients were randomized into four more lateral only approach and ten double incisions approach by a coin toss selection.

2.5. Statistical Analysis

The patients' information were recorded in their case files and were later collated for analysis using the Statistical Package for Social Science by International Business Machine (IBM SSPSStatistics for windows) version 20.0 Armonk, NY, 2011. Statistical inferences were taken as significant when the p value is < 0.05.

III. Results

The mean age of the lateral only group is 34.17 years with a standard deviation (SD) of 7.33. The mean age of the double incisions group is 39.2 years (SD 9.5). There is no statistical difference in the mean ages, p value=0.258. Five males and one female were in the lateral only group while six males and four females were in the double incision group. Four right femoral fractures and two left femoral fracture were involved in the lateral only approach while five right and five left femoral fracture were in the double incision group. Mean hospital stay for lateral only approach is 3.83 weeks SD 1.17. For the double incision approach, mean hospital stay is 4.1 weeks SD1.2. There is no statistical difference in mean hospital stay p value=0.667. Eighty percent of the patients in the double incisions approach did have post-operative infection while 66.7% of the lateral only group did not have post-operative infection.

Table 1. Demographic characteristics and mean hospital stay for patients who had lateral only and double incisions approaches for the treatment of supracondylar femoral fractures that presented late.

variable	Lateral only n=6	Double incisions n=10	P value
Mean age (SD)	34.17 (7.33)	39.2 (9.5)	0.258
sex	M 5, F 1	M 6, F 4	
side	R 4, L 2	R 5, L 5	
Mean hospital stay (SD)	3.83 (1.17)	4.1 (1.2)	0.667

There is no apparent difference in the age and sex of the patients, side of the femoral fracture and mean hospital stay. The operation time was shorter in the double incision approach, see Table 2.

Table 2. Comparison of operation time (in minutes) for lateral only and double incisions approaches for operative treatment of late presenting supracondylar femoral fractures.

Approach	Lateral only incision (n=6)	Double incisions (n=10)
	130	87
	127	105
	117	94
	110	92
	140	96
	120	83
		102
		96
		100
		99
Mean (SD)	124 (10.60)	95.4 (6.74)

T-value =5.93 p-value =0.001

n= sample size

Blood loss was smaller in the double incisions approach. See Table 3 below.

Table 3. Comparative blood loss (in milliliters) during surgeries for lateral only and double incisions approaches for treatment of late presenting supracondylar femoral fractures.

Approach	Lateral only incision (n=6)	Double incisions (n=10)
	400	400
	280	200
	300	450
	380	300
	430	300
	480	250
		200
		270
		300
		210
Mean (SD)	378.33 (76.53)	288 (83.32)

T-value=2.21, p-value=0.045

The limb length discrepancy was also statistically less in the double incisions approach. See Table 4.

Table 4. Comparison of limb length discrepancy (in centimeters) for the lateral only and double incisions approaches for treatment of late presenting supracondylar femoral fractures.

approach	Lateral only incision (n=6)	Double incisions (n=10)
	2.0	1.5
	3.0	1.0
	2.0	0.5
	3.5	1.0
	3.0	1.0
	2.5	1.5
		0.5
		1.0
		1.0
		1.5
Mean (SD)	2.67 (0.606)	1.05 (0.369)

T-value =5.91, p-value =0.001

IV. Discussion

In this era of minimal access surgery, it seems out of place to suggest two incisions as against one incision for treating a fracture. However, considering the fact that a surgeon needs an adequate exposure and nearness to the field of operation, it is a good surgical decision to consider an additional incision if it does enable adequate exposure with the view to carrying out a speedy but careful and result oriented operation. It will also obviate the difficulties and time consumption caused by maneuvering a medially placed mal-union or non-union around the knee from a distant lateral incision (Fig. 1). It is practically difficult to osteoclase this mal-union from a lateral incision and then achieve reduction without some form of shortening osteotomy. The complementary anterior approach enables exposure and reduction while the lateral incision is used for placement of hardware in the correct alignment so as to ensure a stable fixation and thus a good chance of union. Any form of hardware can be used depending on surgeon's choice and experience. This includes condylar blade plate, condylar locking plate, buttress plate, distal femoral locking plate, distal femoral interlocking nail

and Dynamic Condylar Screw [2]. To reduce extraneous factors that may impact on the outcome of the result, we used either the buttress plate or the contoured 95 degrees angle blade plate (Fig.3, 4 and 5).

Some of the callus harvested during osteoclasis can be used as bone grafts but if needed, iliac crest with rich osteogenic potentials is a good source of autogenous cancellous bone grafts [3].

The use of double incisions has the advantage of shortening the operation time, decreasing the need for shortening osteotomy and so avoiding LLD as much as possible. The disadvantage of the two scars is the cosmetic defect, but this is often over-shadowed by the satisfaction of the near equal leg length achieved and the acceptable gait.

The primary purposes of surgical management of supracondylar femoral fracture are to achieve union by ensuring a stable fixation and to achieve a painless mobile knee and equal leg length in order to preserve function. In highly selected cases, surgery is associated with early motion and good knee function [4]. In some cases when there are inter-condylar extensions of a supracondylar fracture, ensuring joint congruity by achieving near perfect reduction and stable fixation will reduce the incidences of post-traumatic osteoarthritis and knee pain. The choice of the standard lateral approach when the fracture is recent and there are no soft tissue contractures, fibrosis and callus formation that would be deterrent to reduction is a sound surgical decision. On the other hand, when a patient with supracondylar fracture presents late as is often the case in our environment, we have found it worth-while to combine the limited anterior incision to complement the conventional lateral incision to ensure adequate reduction and hardware placement without losing significant bone length within the shortest possible operation time. Exposure method has been cited as a major reason for successes in operations in many surgical cases [5]. When indicated, double incisions can be sited around the knee and distal femur for the purposes of good exposure and to enable efficient tissue handling and ultimately good surgical result within the shortest operation time [6]. Nearness to the operation field means less rigorous tissue retraction and thus less tissue injuries and faster tissue recovery and healing. All of our patients had soft tissue contractures and knee stiffness before surgeries. Quadriceplasties were done at the same time as open reduction and internal fixation for some of the patients in the double incision group [7] and the complementary anterior incision was a major advantage for this procedure.

There is a significant loss in bone length in the lateral only approach when compared to the double incisions approach. The average LLD is 2.70 cm and 1.05 cm respectively (p value=0.001). This accounted for patients' satisfaction with gait. Some authors have reported no significant limb length discrepancy while others reported discrepancy greater than 2 cm via the lateral approach in the treatment of supracondylar femoral fractures [2, 7].

The average operation time for the lateral only approach was 124 minutes and 95 minutes for the double incisions approach (p value=0.001). Other authors reported an average operation time of 154 minutes for the conventional approach [2]. The mean operation time was shorter by 29 minutes in the double incisions approach and this also means less dose and duration of anaesthesia. The impact of surgery and anaesthesia as second hit phenomena on the inflammatory response of the patient is well known and this response is directly related to length of surgery and dose and duration of anaesthesia [8]. The longer and severer the inflammatory response, which is directly proportional to the dose and duration of the stimuli, the higher the chance of tipping the patient to organ dysfunction and organ failure especially if this response is not adequately controlled by fluid management during and immediate post-operation.

There is also a higher blood loss and thus the need for blood transfusion in the lateral only approach when compared to the double incisions approach. All of the patients in the lateral only incision approach had blood transfusion while half of the patients in the comparative group were transfused. The mean blood loss was 378mls in the conventional approach as against 288mls in the double incisions approach (p value=0.045). Some authors reported mean blood loss of 322 mls in their lateral approach for the treatment of twenty consecutive patients with non-union of supracondylar femoral fracture [2]. This may seem unusual as more tissues were incised in the double incisions approach and so more bleeding was expected. However, with the added ease of operation the nearness to the surgical field avails the surgeon especially during the osteoclasis and/or fibrolysis of the medially located callus, any bleeding vessel can easily be identified and ligated or cauterized. It is more difficult to see a bleeding vessel in this medial position if one is operating from the lateral side. This usually creates a scenario in which the assistant surgeon keeps suctioning out blood and as the operating field becomes frequently bloody, more time is spent and sometimes anxiety and tiredness may cloud surgeon's sound intra-operative reasoning.

Infection rate of 20% has been reported as a major complication in a series of thirty consecutive patients with long standing supracondylar femoral fractures treated surgically. Three had septic pseudo-arthritis and were finally managed by above knee amputation and three died from systemic sepsis [4]. The infection rate in our study of 33% for the lateral only approach compared to 20% for the double incisions approach may not be significant because of the small patients' population in addition to the fact that many uncontrollable factors will influence infection rate following surgery.

V. Conclusion

The two incisions approach to the operative treatment of patients who present late with supracondylar fractures from this preliminary report is better than the conventional lateral only approach because there are less leg length discrepancy, less need for blood transfusion and less operation time. However, more patients' inclusion in the study is necessary to expand the population and to test the validity of this preliminary report.

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Figure 1. Plain radiograph of the knee. Note the anterior and medially displaced proximal fragment



Figure 2. Left lower limb, third day post-operation showing double incision approach and placement of surgical wounds.



Figure 3. Post-operative AP plain radiograph showing T buttress plate and screws



Figure 4. Lateral view plain radiograph, T buttress plate with screws in situ, progressing union 12 weeks post-operation



Figure 5. Plain radiograph showing 95 degrees angle blade plate in situ and radiological union 14 months post operation