ESTIMATION OF ADULT FEMORAL SHAFT FRACTURE HEALING TIME FOLLOWING OPEN REDUCTION AND INTERNAL FIXATION BY CONVENTIONAL METHODS

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DECLARATION

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ABSTRACT

Background: Fracture healing begins as early as possible in the immediate post injury period. Although the processes leading to eventual repair of fractures are well understood, the exact point of union is difficult to define. This is also despite the deployment of clinical and radiological parameters in the individual cases.

This study was aimed at estimating the time of adult femoral fracture union following treatment.

Patients and Methods: A prospective study of seventy (70) adult patients treated for femoral shaft fractures between December 2004 and November 2005 at the National Orthopaedic Hospital, Igbobi, Lagos, Southwest Nigeria is presented. The patients were grouped according to the treatment modality and were studied for such clinical and radiographic parameters as the time of disappearance of fracture site tenderness, time of earliest radiologic callus activity, and time of weight bearing.

Results: Sixty two (62) patients had open reduction and internal fixation, while eight (8) had non operative treatment with skeletal traction. The average estimated time of disappearance of fracture site tenderness was 9.13 + 1.4weeks postoperatively. Initial radiologic callus activity was estimated at 9.25 + 1.6weeks postoperatively. Partial weight bearing was allowed at the average time of 16.5 + 4.2weeks, while full weight bearing was allowed at 22 + 5.5weeks.Fracture healing was estimated to have occurred at about 16 to 22 weeks postoperatively.

Conclusion: Operative treatment remains the most popular treatment modality for femoral shaft fractures but the rate of healing of the fracture is probably not influenced by the choice of treatment.

Key words: Femoral shaft, fracture, treatment and healing time.

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Introduction

Fracture healing occurs in phases which overlap to some extent. Healing in untreated fractures is very efficient in terms of the union process itself. Therefore, the role of the surgeon is to ensure that when the fragments do unite, they are in a position consistent with restoration of full function1.

Healing in the absence of internal fixation is characterized by external callus formation, a phenomenon which is enhanced by movement at the fracture site. On the other hand, under internal fixation (especially rigid fixation with plate and screws) primary bone healing proceeds without much external callus formation1-3. Intramedullary nailing does not necessarily produce a completely stable fixation especially when unlocked devices are used. Fractures fixed by such intramedullary devices may also heal by abundant external callus formation1,2.

Clinical and radiological parameters assist in assessing fracture healing. Absence of demonstrable abnormal movements at the fracture site, and absence of local tenderness upon palpation and weight bearing are among the clinical parameters of assessing fracture healing. Radiologically, bridging of all cortices on the anteroposterior and lateral radiographs of the fracture site, and perhaps disappearance of the fracture lines suggest fracture healing4. The adult femoral shaft fracture may take 12-24 weeks to unite5,6, but the exact point of union is very difficult to define7.

This study is a basic clinical research which has been done severally elsewhere, but however, similar work has not been done in our centre before now. It is, therefore, expected that this study would contribute to local data in our environment.

Patients and Methods

Seventy (70) adult patients with seventy femoral shaft fractures were studied prospectively for healing time at the National Orthopaedic Hospital, Igbobi, Lagos- Nigeria between December 2004 and November 2005. Exclusion criteria were age less than 16years, bilateral femoral shaft fractures, associated tibial fractures, pathological femoral shaft fractures, and open fractures of the femur.

Basic demographic data and history of injury were obtained, and fracture characterization was done using anteroposterior and lateral radiographs of the fractured femur.

Patients treated conservatively had transtibial skeletal traction for 6weeks, following which they were discharged on functional knee cast brace. Methods of open reduction and internal fixation were chosen based on the patterns and levels of the fractures. Postoperative X-rays were used to

assess the adequacy of fixation. All patients were reviewed forthnightly to determine when fracture site tenderness disappeared. Follow up check X-rays were arranged every forthnight to assess time of initial radiologic callus activity, and presence or absence of fracture line. Patients were followed up until weight bearing was allowed. The estimated time of disappearance of fracture site tenderness, of initial radiologic callus activity and time of allowing weight bearing were recorded. All data were analyzed on SPSS 10 statistical software.

Limitations of the study

The sample size appears small, but this is probably because the study was designed to exclude patients with old fractures, bilateral femoral shaft fractures, associated tibial fractures, pathological fractures and open femoral shaft fractures. Also, the presence of other tertiary and specialist centres in Lagos, which also receive trauma patients, might have affected the number of patients seen at our centre in the course of this study.

Irregular clinic attendance on the part of some patients coupled with loss of some to follow up also constituted a limitation to the study.

Results

A total of seventy patients with seventy (70) femoral shaft fractures were studied. 62(88.6%) patients had open reduction and internal fixation and constituted the study group, while 8(11.4%) patients had conservative treatment with skeletal traction and were used as control. The age range of the patients varied between 16years and 75years, with the age bracket of 26-35 years accounting for 45.16% of the operative group (Table 1a). The mean age of the patients was 36.6+6.0 years for the operative group and 35.5+6.0 years for the control. The male to female ratio was 1:1 in the study group and 1.7:1 in the control (Table 1b). 27(43.6%) of the 62 operated patients had Kuntscher intramedullary nailing.17 (27.4%) had fracture fixation with broad dynamic compression plates (BDCP), while 18(29.0%) had fracture fixation with 95degrees condylar plates for proximal and distal third fractures not amenable to Kuntscher nailing and BDCP fixation (Table 2).

Disappearance of fracture site tenderness was observed from about the 6th week post operatively in the operative group, with a peak at about 9-11 weeks post operatively (Table 3). The overall average time of disappearance of fracture site tenderness in the operated group was 9.1 + 1.4 weeks and 10.2 + 2.0 weeks in the control.

The earliest radiologic callus activity was observed at 6-8weeks post operatively in 55% of the operative group. Callus activity was observed as early as 3-5 weeks in the control group (Table 4). The mean estimated time of earliest radiologic callus activity was 9.3+1.6 weeks in the operated patients and 6.2+1.6 weeks in the control group. The overall average time of commencing partial weight bearing was 16.5+4.2 weeks postoperatively. Full weight bearing was allowed at the mean time of 22+5.5 weeks postoperatively (Figure 1). Four (4) of the eight patients in the control group were lost to follow up. The time of weight bearing could not be reasonably established in the remaining four patients due to erratic clinic visits.

Discussion

The parameters for assessing fracture healing include absence of abnormal movements at the fracture site, absence of tenderness upon palpation of fracture site and upon weight bearing, and presence of bridging callus across the cortices of the fracture fragments on anteroposterior and lateral radiographs of the fractured bone8. Although it is difficult to define the exact time of union7, some authors have reported that adult femoral shaft fractures heal in 12 to 24 weeks5,6. This is similar to our deduction of 16 to 22 weeks as the probable time of union of femoral shaft fractures in our study.

Fracture repair starts in the immediate post injury period, but tangible evidence of healing activities is not immediately obvious. Our study showed that radiologic callus became noticeable at about 9weeks postoperatively. It was, however, observed at about 3-6weeks in the control group (Table 4). Movements at fracture site enhance primary callus response in the absence of rigid internal fixation. Under rigid internal fixation, primary bone healing proceeds without much external callus formation2,3. This phenomenon probably explains the earlier callus response in the control group. Also, in the course of open reduction and internal fixation, the initial attempt at healing by the fracture is disrupted by evacuation of

fracture haematoma and by the varying degree of periosteal stripping around the fracture. This, perhaps, explains the appearance radiologic callus at a later time in the operative group than in the control (Table 4).

The disappearance of fracture site tenderness upon palpation was assessed in thirty eight (38) of the operated patients. It coincided the time of initial radiologic callus activity, suggesting that fracture healing must have been appreciably established at this period. Most surgeons, however, would not encourage weight bearing as early as 9th week post operatively, especially in situation depicted by this study, where non locked devices and conventional methods of fixation were used. The callus at this stage probably lacks the requisite strength to withstand weight bearing stress in a setting of relative stability which may characterize the use of conventional methods.

Allowing weight bearing without unequivocal clinical and radiologic evidence of fracture healing may result in the failure of such conventional implants as were used in this study. This is more so in patients who fail to comply with instructions on weight bearing. The patients in this study were allowed weight bearing at 16 weeks (Figure 1), well after clinicoradiologic evidence of onset of union. It was noted that weight bearing at this time was non tender and devoid of untoward mechanical effects on the implants construct. Our patients were allowed full weight bearing at the mean time of 22weeks. This contrasts appreciably with the report by Salawu9, in which full weight bearing was allowed at 15weeks in Kuntscher nailed patients. We believe that a fracture should be regarded as healed when it remains asymptomatic and the implant construct remains stable following application of weight bearing stress. It, therefore, appears the fractures in this study may have healed at about 16-22weeks.

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TABLES AND FIGURES

Table 1a: Age Distribution

Age range (years)	Operative group	Control group
16-25	10 (16.13%)	1(12.5%)
26-35	28(45.16%)	3(37.5%)
36-45	12(19.35%)	3(37.5%)
46- 55	4(6.45%)	1(12.5%)
56-65	4(6.45%)	0
66-75	4(6.45%)	0
Total	**62(100%)**	**8(100%)**

Table 1b: Sex Distribution

	Operative group	Control group
Female	29(46.77%)	5(62.5%)
Male	33(53.23%)	33(53.23%)
Total	**62(100%)**	**8(100%)**

Table 2: Implants used at operation

Implants	**Number**	**Percentage(%)**
Kuntscher nail	27	43.6
Broad Dynamic Compression Plate(BDCP)	17	27.4
Condylar Plate	18	29.0
Total	**62**	**100.0**

Table 3. Time of disappearance of fracture site tenderness on palpation in 38 patients

Time (weeks)	**Kuntscher nail**	**BDCP**	**Condylar plate**	**Total**	**Control**
3-5	1	-	-	1	-
6-8	5	3	2	10	2
9-11	7	4	5	16	5
12-14	3	4	2	9	1
15-17	-	-	2	2	-
Total	**16**	**11**	**11**	**38**	**8**

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Table 4. Timing of earliest radiologic callus activity

Time (weeks)	Kuntscher nail	BDCP	Condylar Plate	Total	Control
3-5	-	-	-	-	3
6-8	10	5	7	22	4
9-11	3	2	3	8	1
12-14	4	4	-	8	-
15-17	1	-	1	1	-
Total	**18**	**11**	**11**	**40**	**8**

Figure I