

PATTERNS OF NON-UNION OF FEMORAL SHAFT FRACTURE IN BASRAH TEACHING HOSPITAL. A RETROSPECTIVE REVIEW**Mofeed Yaseen Alwaaly ***

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Abstract

Long bone fractures are witnessed almost every day in the orthopedic practice. Femoral shaft fractures (FSF) generally are due to high energy trauma in working age group patients. Variety of fracture patterns are encountered with different treatment choices are available, however, non-union of FSF is not infrequently encountered challenge. This study reviews cases of FSF that ends up with non-union in Basrah Teaching Hospital in an attempt to explore some factors associated or probably led to non-union.

This is a retrospective case series study were conducted in Basrah Teaching Hospital from January 2012 to June 2014 including 124 patient with FSF. Thirty three patients were identified during the study period (18 months), demographic criteria and injury patterns, initial treatment, early complications, subsequent interventions and fate of the patients are described.

Among 33 patients with nonunion FSF, 23 were males and 10 females, aged from 15 to 60 years (mean = 35), 10 (31%) were active smokers during the period of treatment. High energy trauma is the chief source of FSF in this analysis ,27(82%), middle third fracture is the commonest site 20(60%), although 17(52%) was initially closed fracture , 16(48%) open fracture and 14/33 (42%) comminuted fracture.

All patients with closed fractures as well as 4 patients with compound fractures had been treated by open reduction with internal fixation, and other patients treated by external fixation. The most commonly documented complication was the development of surgical site infection in 13 (39%) patients. After the elapse of 9 - 12 months from the time of initial trauma, the patients ends up with a diagnosis of non-union, 9(27%) patients developed atrophic non-union, 13(39%) patients developed hypertrophic non-union and 11 (33%) patient developed infected non-union. Thirty patients underwent revision surgery, with addition of bone graft in most of the instances, and three patients no revision surgery, several types of bone grafts had been utilized during the revision surgery in 28 patients (out of 30) , within the study period (18 months), 25(75%) patients achieved successful union or showing signs of progressive union , 3 (10%) patients had united fractures with chronic osteomyelitis , while 5(15%) patients still with non-united fractures .

In conclusion; the nonunion of FSF is still a great challenge to the orthopaedic surgeon and unlimited obstacle to the patient life and development, therefore from 124 who sustained fracture femur thirty three developed nonunion and after numerous sessions of medical and surgical interventions only five patients still non united fracture, thus to overcome this problem both the surgeon and the patient should cooperate to avoid this tragedy story.

Keywords: nonunion, FSF (Femoral Shaft Fracture), high energy trauma

Introduction

Though there is no widely accepted definition for non-union , broadly it refers to the cessation of bone healing process in the expected time frame for certain fracture , a commonly cited definition is based to the guidance document released by the American Food and Drug Administration at 1998 that defines non-union as “established when a minimum of 9 months has elapsed since injury and the fracture shows no visible progressive signs of healing for 3 months”¹. For the femoral shaft, non-union is usually defined as a failure to achieve clinical union at 6–12 months following fixation or if there is no healing progress during the last 3

months or an implant failure is obvious^{2,3,4}.

Systemic and local factors interplay to contribute for the normal bone healing process, systemic diseases and condition as well as local factors that contribute for the development of non-union were discussed thoroughly across the literature , however, this study was prepared to explore which conditions are commonly involved when dealing with a patient with non-union of femoral shaft (and perhaps other long bone) fractures in the daily practice of orthopaedic surgeons serving in Basrah Teaching Hospital.

Patients and methods

A retrospective case series study were conducted in Basrah Teaching Hospital. Review of the hospital records of the orthopaedic unit from January 2017 to June 2018 was used to identify patients with FSF non-union.

Inclusion criteria:

1. Age from 15 years to 60 years.
2. Treated in Al-Basrah teaching hospital
3. Nonunion FSF at any stage of intervention or follow-up.

Exclusion criteria:

1. Pathological fractures.
2. Patients sustaining life threatening chest, abdominal or pelvic injuries.
3. Fractures with major head injury.
4. Fractures with neurovascular injury or Gustilo-Anderson type IIIC compound fracture
5. Missing patient contact information.

Thirty three patients were included, phone calls

had been arranged with the patients for consent to be enrolled in the study and to fulfill any missing fields in the hospital records. Also, interviews with the treating surgeons revealed further details about each case. The information obtained were used to provide statistical data about Demographic criteria of the patients, mechanism of injury, fracture identity, management, complication and the final outcomes.

Results

Thirty three patients were identified during the study period (18 months), demographic criteria and injury patterns, initial treatment, early complications, subsequent interventions and fate of the patients are described below:

1- Age and Gender distribution : among 33 patients, 23 were males and 10 females, aging from 15 to 60 years (mean = 35).

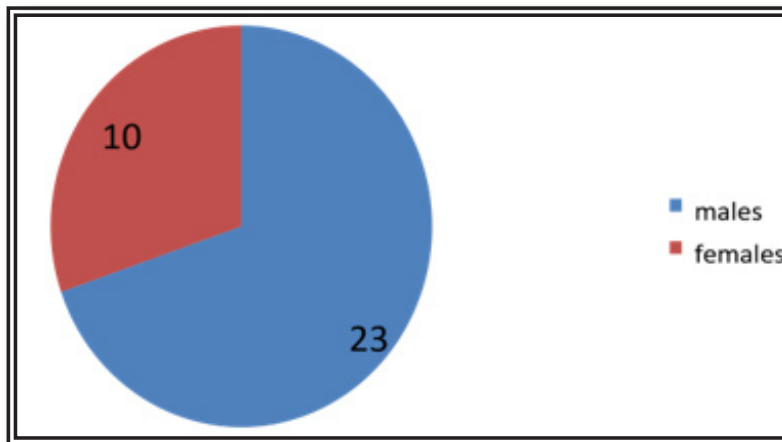


Figure (1) Smoking Distribution

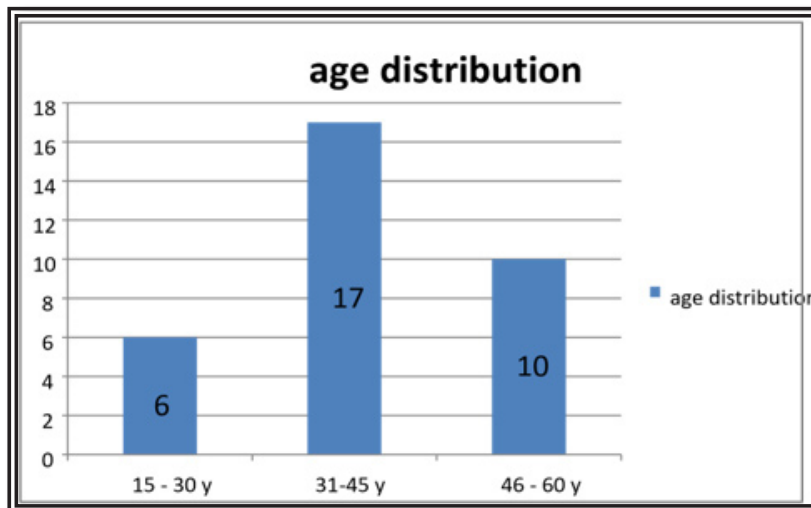


Figure (2) Age Distribution

2- Smoking status: among 33 patients, 10 (31%) were active smokers during the period of treatment.

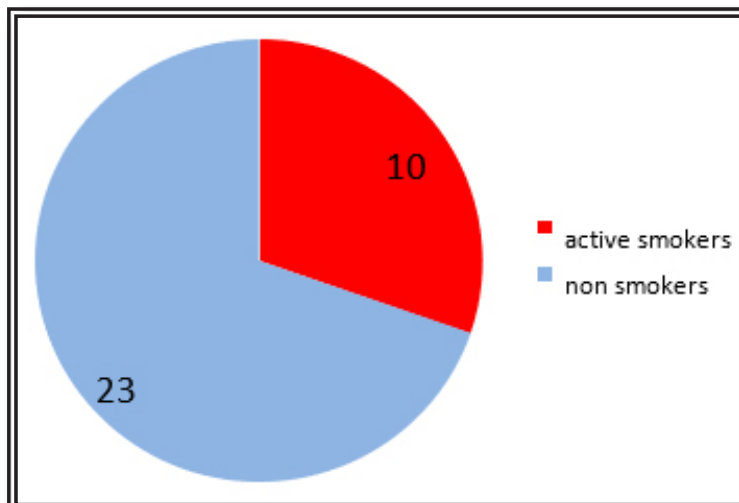


Figure (3) Smoking Distribution

3- Mechanism of injury and fracture identity (Table 1):

Table (1) mechanism, site, and shape of fracture femur

Mechanism of injury*	High energy trauma 27 (82%)		Low energy trauma 6 (18%)	
Site of fracture	Proximal third fractures		Middle third fractures	Lower third fractures
	5 (16%)		20 (60%)	8 (24%)
Open versus closed	Open fractures 16 (48%)		Closed fractures 17(52%)	
Shape of fracture	transverse	Spiral	Butterfly	Comminuted
	7(21%)	11(33%)	1(3%)	14(42%)

* The type of trauma in this study was classified into high energy, which include (RTA ,missile injury , falling from height more than three meters) and low energy trauma which include (falling on the ground, sport injury, falling from height less than three meters).

4-Initial operative treatment: all patients with closed fractures as well as 4 patients with compound fractures had been treated by open reduction with internal fixation (Table 2):

Table (2) timing of surgery, method of fixation, and bone graft

Timing of surgery^	early		late
	9		24
Method of fixation	Internal fixation		External fixation
	Plate and screws	Kruntcher nail	
	15	5	13
Bone Graft utilization	With graft		Without graft
	24		9

^ For descriptive purposes of this study, timing of operative treatment is labeled as early (within three days) or late (more than 4 days).

4- Development of complications and intermediate surgeries : the most commonly documented complication was the development of surgical site infection in 13(39%) patients. This was treated by multiple debridement sessions of necrotic tissue with parenteral antibiotics , this led to control of infection in 2 patients only.

5- Type of non-union: after the elapse of 9 - 12 months from the time of initial trauma, the patients ends up with a diagnosis of non-union, 9(27%) patients developed atrophic non-union, 13(39%) patients developed hypertrophic non-union and 11(33%) patient developed infected non-union.

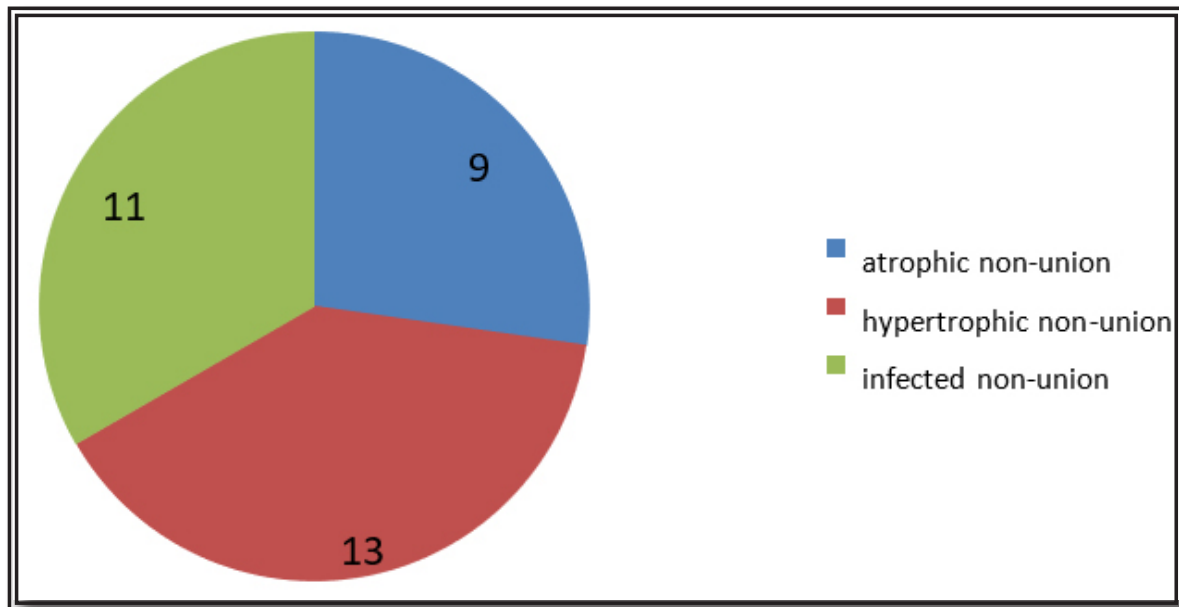


Figure (4) Type of Nonunion

Table (3) illustrates the type of non-union against the initial method of fixation

	Atrophic nonunion	Hypertrophic nonunion	infected nonunion
Plate and Screws	4	9	2
Kuntcher nail	2	1	2
External Fixation	3	3	7

7-Treatment for non-union : thirty patients underwent revision surgery, with addition of bone graft in most of the instances.

Table (4) treatment of nonunion

Revision of internal fixation		Revision of external fixation	
Plate to nail +bone graft	3	Debridement + bone graft	6
Nail to plate+ bone graft	3	Change to plate and screws + bone graft	6
Nail to plate without bone graft	1		
Exchange nailing	1		
Revision of plate and screw + bone graft	10	No revision	6
No revision	2		

8- Bone graft utilization for definitive treatment : several types of bone grafts had been utilized during the revision surgery in 28 patients (out of 30).

Table (5) Type of Bone Graft

Type of graft	Number of cases
Iliac crest autologous bone graft	2
Upper tibia autologous bone graft	21
Combination of iliac crest and upper tibia	2
Free fibular graft	1
Iliac crest autologous bone graft with hydroxyapatite	2

9- outcomes: within the study period (18 months), 25(75%) patients achieved successful union or showing signs of progressive union, 3 (10%) pa-

tients had united fractures with chronic osteomyelitis, while 5(15%) patients still with nonunited fractures.

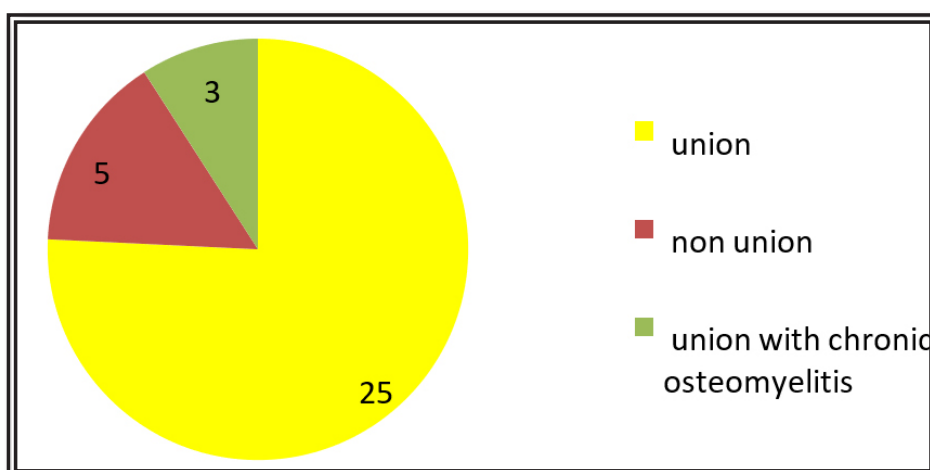


Figure (5) Outcome of Nonunion

Discussion:

Orthopedic surgeon must get prepared to face nonunion, probably this is best done by understanding the circumstances that may end up with the patient to have fracture nonunion.

Age gender distribution: In this study 33 patients , 23 (70%)male and 10 female (30%) presented with FSF nonunion, ranged 15-60 year, their mean age 35 year, commonest age group (31-45) (17/33) this is the most active age group who participate in daily activities and life challenges in our locality, on the contrary to the study by Sebastian Lotzien ⁵ (were the mean age was 65.4 years range from (34-91 years).

Smoking and nonunion: Twenty three patients out of thirty three was actively smoker (69.6%), this is badly reflects itself on bone healing which is goes with Jacques Hernigou ⁶, who strongly supported this series with Thirty-eight diaphyseal nonunions,

smoking (tobacco use) was significantly associated with nonunion Tobacco is confirmed as a deleterious factor for diaphyseal bone healing.

Mechanism of injury and fracture identity: High energy trauma is the prominent cause of fracture femur nonunion 27(82%) in this study although middle third femur fracture 20/33(60) is dominant site, so as closed fracture 17/33(52%), and as anticipated comminuted fracture in14/33(42%), while Saeed Koaban ⁷. There were a total of 69 patients reviewed caused by; a fall in 37 patients (53.6%), a road traffic accident in 16 (23.2%), motorcycle and motorbike accidents in 8 (11.6%), and heavy exercise in 8 (11.6%).

Initial operative treatment: In this study the primary fractured femur in (20/33) treated by internal fixation in form of plating and screws (15/33) or Kruntcher nail (5/33) or by external fixation

(13/33) end up with nonunion in spite of using bone graft in (24/33) which is not well-matched with study like giannoudis p. v. et al ⁸. There was no relationship between the rate of union and the type of implant, mode of locking, reaming, distraction or smoking.

Type of non-union: After the elapse of 9 - 12 months from the time of initial trauma, the patients ends up with a diagnosis of non-union, 9(27%) patients developed atrophic non-union, 13(39%) patients developed hypertrophic non-union and 11(33%) patient developed infected non-union. In study by Babhulkar ⁹, the minimum follow up was 24 months (average, 40 months, range 2-15 years), the nonunions were classified as aseptic (84) and septic (29) and additionally classified as hypertrophic (61) and atrophic (52) in order to determine the treatment.

Treatment for non-union: Thirty patients (30/33) underwent revision surgery, with addition of bone graft in most of the instances in different modalities of fixation, so as in Haidukewych ¹⁰, 23 subtrochanteric nonunions were treated with additional attempts to achieve union. Two patients were lost to follow up. The remaining 21 patients were fol-

lowed up for a mean of 12 months (range, 6–39 months).

Final outcome: Several types of bone grafts had been utilized during the revision surgery in 28 patients (out of 30), within the study period (18 months), 25(75%) patients achieved successful union or showing signs of progressive union, 3 (10%) patients had united fractures with chronic osteomyelitis, while 5(15%) patients still with nonunited fractures. As in T.F.RavenabA ¹¹ 150 patients (mean age 51.4) with atrophic and / or infected non-unions were included. A successful bony consolidation of the non-unions was observed in 120 (80%) cases with a median healing time of 12.1 months.

Conclusion:

The nonunion of FSF is still a great challenge to the orthopaedic surgeon and unlimited obstacle to the patient life and development, therefore from 124 who sustained fracture femur thirty three developed nonunion and after numerous sessions of medical and surgical interventions only five patients still non united fracture, thus to overcome this problem both the surgeon and the patient should cooperate to avoid this tragedy story.

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