RESULTS

I) Methods of Assessment of the results :

The criteria for assessment of the end results were clinical, radiological and functional criteria based on : pain, weight - bearing, quadriceps muscle function, knee movement, fracture unon, aligment, shotening and infection ***(Thoresen et al., 1985).***

The results was graded as excellent when the function was fully and pain - free and when the restriction of motion of the knee or malalignment did not exceed one - half of the good value.

The results was graded as Good within the following ranges : Varus or Valgus 10°, anterior or posterior angulation of the femur at the frcture site 10°, external rotation 15°, internal rotation 10°, length discrepancy 2cm, knee flexion 120°, deficit of knee extension 10° and pain not restricting activities.

The results was graded fair with the following criteria : Varus or valgus 15°, antecurvatum or recurvatum 15°, internal rotation 15°, external rotation 20°, shortening 3 cm, knee flexion 90°, deficit of knee extension 15°, significant pain, or two malalignment of the good category simultaneusly.

The results was graded as poor, when the restriction of motion or malalignment exceed the fair value or non - union of the fracture during the follow - up period did occure. Table (4.4.) ***(Thoresen et al., 1985).***

Item	Results			
	Excellent	Good	Fair	Poor
Malalignment of the femur (degree)				
- Varus or valgus	5	10	15	>15
- Antecurvatum or recurvatum	5	10	15	>15
- Internal rotation	5	10	15	>15
- External rotation	10	15	20	>20
Range of motion of knee (degree)				
- Flexion	>120	120	90	<90
- Extension deficit	5	10	15	>15
Shortening of femur (cm)	1	2	3	> 3
Pain or swelling	Non	Sporadic minor	Sigificant	Severe

Table (10). Classification system for the results of treatment (*Thoresen et al., 1985*).

NB : Non - union with or without loss of motion was considered as a poor result. Excellent and Good results were considered salisfactory results, while fair and poor results were considered as unsatisfactory results.

According to the previously mentioned criteria, thirty (30) patients with (31) femoral shaft fractures who attended the final follow - up (clinical and radiological) were analysed and their results were assessed at four months and one year postoperatively.

The overall results recorded in this series were : Twinty cases (64.52%) were Excellent, five cass (16.12%) were good, three cases (9.68%) were fair and three cases (9.68%) were poor. Also twinty - five case (80.65%) were considered satisfactory, while only six cases (19.35%) were considered as unsatisfactory.

1) Pain :

At four months (10) patients (35.48%) had no pain, (12) patients (38.71%) had mild pain not interferig with activity and (8) patients (25.81%) had moderate pain on moderate activity.

By one year, (26) patients (83.87%) were pain - free and only five cases (16.13%) had mild pain. Table (12), figure (42)show the distribution of patients according to pain around 4 and 12 months postoperatively.

2) Weight - Bearing :

At four months, (12) patients (38.71%) had full weight - bearing with no support, (7) patients (22.59%) occasionlly used one cruch only,

(6) patient (19.35%) used occasionlly one cruch while (6) patients (19.35%) used two cruches (Full weight bearing).

by one year, (23) patients (74.19%) had full weight bearing with no support, (3) patients (9.68%) used one cruch constantly, (3) patients (4.68%) occasionlly used one cruch and (2) patient (6.45%) used two cruches. Table (13), Figure (45) show the distribution of patients according to weight - bearing.

3) Quadriceps muscle wasting :

At four months, (13) patients (41.93%) had normal quadriceps function and no extension lag, (10) patients (32.25%) had mild quadriceps wasting of 1-2 cm (compared to toehr side) and no extension lag, while (6) patient (19.35%) had moderate quadriceps wasting of 2 - 3 cm and / or upto 10° extension lg, and only two patients (6.45%) had sereve quadriceps muscle wasting of more than (3) cm with extension lag upto (15) degree.

By one year, (23) patients (74.19%) had no wasting, (6) patients (19.35%) had mild wasting ~~and only two patients (6.45%) had mild wasting~~ / and only two patients (6.45%) had moderate wasting and up to (10) degrees extension lag. Table (14), Figure (44) show the distribution of patients according to quadriceps muscle wasting around (4) and (12) months postoperatively.

4) Knee movement :

At four months, (14) patients (45.17%) had full active flexion and extension range, (6) patient (19.35%) had (10) degrees loss of flexion and extension, and (8) patients (25.80%) had flexion range from (90° - 120°)

and / or decrease extension by (10) degrees and (3) patients (9.68%) had flexion range < 90°.

By one year, (22) patients (70,47%) had full active flexion and extension range, (4) patients (12.90%) had (10) degrees loss of extension, (3) patients (9.68%) had flexion range less than 90 degree. Table (15), Figure (47) show the distribution of patients according to knee movements around 4, 12 months postoperatively.

5) Fructure Union :

At four months, (10) patients (32.25%) had consolidation of fracture, (14) patients (45.16%) had good bridging callus, while (7) patients (22.58%) had very weak callus.

By one year, (21) patients (67.74%) had consolidation of the fracture, (7) patients (22.58%) had good bridging callus but fracture line persist and (3) patients (9.67%) had very weak callus formation and were considered as non united fractures and were recorded as poor results.

Table (16) and Figure (48) show the distribution of patients according to fracture union around (4) and (12) months postoperatively.

Duration of union :

Radiographic healing of fracture was defined as the presence of callus around most of the fracture's circumference, with a density similar to that of the adjacent cortical bone.

In the patients follow - up, (18) patients (61.24%) had comminuted fractures of various grades according to ***Winquist and Hansen***

classification (1984), where (4) patients (21.05%) with grade II comminution of fracture were united at (4) months postoperatively and (3) patients (15.79%) with grade III comminution were united at (6) months postoperatively while (4) patients with grade III fracture comminution and associated injuries were united after (12) months postoperatively. Also (6) patients (31.58%) with grade IV comminuted fracture united after 12 months while (2) patients (10.53%) with grade IV comminuted fracture with associated injuries united after (18) months postoperatively. Table (٧) shows the relation between grade of comminution of fracture femoral shaft, duration of union and associated injuries.

6) Shortening :

At four months, 24 patients (77.42%) had no shortening, while (7) patients (22.58%) had shortening of the affected limb with variable degrees. Two of them had 1 cm shortening, four patient had 2 cm shortening while one patient had 3 cm shortenin of the injuried limb. These values didnot change during the period of follow up.

7- Alignment :

A) Angulation (Varus or Valgus):

At four months, (26) fractures (83.87%) had no varus, valgus deformity at the fracture site while (5) patients (16.13%) had 5 - 10 degrees varus deformity. These values didnot change through the period of follow-up.

B) Rotation (Internal or external) :

At four months, (27) patients (87.09%) had no internal or external rotational at the fracture site, while (4) patient (12.9%) had

external rotation deformity from 5 - 20 degree. These values didnot change during the period of follow - up.

8) Infection:

During the period of follow-up, (27) patients (87.09%) showed no infection, while 4 cases (12.9%) showed variable degrees of infection at variable periods postoperatively, where one case showed superfecial controlled infection, two cases showed deep seated controlled infection and only one case showed deep seated uncontrolled infection and need surgical removal of the interlocking nail, Debridement and external fixation at 6 months postoperatively. Table (18) shows distribution of patients according to infection.

II- The overall results :

The results in twinty fractures (64.52%) were rated as excellent, In five fractures (16.12%) were Good, three fractures (9.68%) as fair and other three fractures as poor results, i.e. twinty - five fractures (80.65%) were considered satisfactory while six fractures (19.35%) were unsatisfactory. Table (19) shows distribution of the end results.

Of the twinty cases with Excellent results, there was no pain or malalignment, the knee movements was normal and shortening was not more than 1 cm.

Of the five cases with Good results, Three (9.68%) had loss of active extention by 10 degree and one case had flexion range from 90° - 120° degree, Two (6.45%) had varus deformity from 5° - 10° and one of them had external rotation about 15° degree. All had quadriceps muscle wasting

of 1-2 cm and two cases occasionlly use one cruch duet to associated musculs skeletal fractures.

Of three patients (9.68%) with fair results, they had shortening of about 3 cm, loss of active flexion by 10 degrees and varus angulation of 15 degree.

Of the three cases (9.68%) with poor results, two had flexion range < 90 degree, one case had external rotation of 25 degree, two cases had varus angulation of 15° - 20° and one case had deep seat infection reached to the bone with infected non union and quadriceps muscle wasting more than 3 cm.

III - Analysis of the results :

1- The effect of age on results :

Table (20):

AGE	No. of patient	Results			
		SAT		UNSAT	
15 - 24	2	2	(100.0)	--	0.00
25 - 34	12	9	(75.00)	3	25.00
35 - 44	8	5	(62.5)	3	(37.5)
45 - 54	3	3	100.0	--	0.00
55 - 64	4	4	100.0	--	0.00
65 - 74	1	1	100.0	--	0.00

Chi - Square = (0.218) P value > 0.05

Significance : Non significant

It was found that, the age of the patient has no effect on the results. The average age of the six patients with unsatisfactory results was (38.7) years.Table (20).

2- The effect of sex on the results :

It was found that 80.76 percent of the male patients had satisfactory results, while 75.0 percent of the female patients had satisfactory results. However, this difference was found statistically insignificant. Table (21).

Table (21):

	Number of patients	Results			
		SAT.		UNSAT	
		No.	%	No.	%
Male	26	21	80.76	5	19.23
Female	4	3	75.0	1	25.0

Chi - Square = 0.450 P. > 0.05

Significance : non significant.

3- The effect of level of fracture on results :

It was found that 90.0 percent of upper third fracture had soctis factory results, Middle third 71.4 percent and lower third fractures had 85.7 percent satisfactory results and there was no correlation between level of fracture and the results Table (22).

Table (٢٢):

level of fracture	Number of fracture	Results			
		SAT.		UNSAT	
		No.	%	No.	%
Upper third	10	9	90.0	1	10.0
Middle third	14	10	71.4	4	28.6
Lower third	7	6	85.7	1	14.3

Chi square = 0.0271 $P > 0.05$

Significance : non significant.

4- The effect of fracture line on the results :

The presence of comminution and segmental fractures affect the results. It was found that 73.7% and 80.0% of comminuted and segmental fracture had satisfactory results. However there were 5 patients of comminuted fracture had unsatisfactory results (80.3 % of the cases with unsatisfactory results). Statistically the difference was found highly significant. Table (٢٣).

Table (٢٣) :

Fracture line	Number of fracture	Results			
		SAT.		UNSAT	
		No.	%	No.	%
Comminuted	19	14	73.7	5	26.3
Segmental	5	4	80.0	1	20.0
Spiral	1	1	100.0	0	0.0
Butterfly	2	2	100.0	0	0.0
oblique	2	2	100.0	0	0.0
Transverse	2	2	100.0	0	0.0

Chi - square = 103.130, $P < 0.0001$

Significance : Highly significant.

5- The effect of grade of comminution and associated injuries :

The presence of associated injuries affect the results and also the grade of comminution affect the results.

There were three patients with comminuted fractures grade III, IV and with associated injuried had unsatisfactory results (50% of the cases with unsatisfactory results). It was found that the associated injuries were the cause of unsatisfactory results in two cases. Table (24).

Table (24)

Grade of comminution	Associated injuries	Number of fractures	Results			
			SAT.		UNSAT.	
			No.	%	No	%
II	--	4	4	100.0	0	0.0
III	--	3	3	100.0	0	0.0
III	+	4	3	75.0	1	25.0
IV	--	6	3	50.0	3	50.0
IV	+	2	0	0.0	2	100.0

Chi square = 307.692 P value < 0.0001

Significance : Highly significant.

6- The effect of type of fracture on the results :

It was found that 82.8 percent had satisfactory results in closed fractures, while 50 percent of open fractures had satisfactory, while 50 percent of open fractures had satisfactory results and this difference was found statistically significance Table. (25).

Table (٢٥) :

Type of fracture	Number of fractures	Results			
		SAT.		UNSAT	
		No.	%	No.	%
Closed	29	24	82.8	5	17.2
open	2	1	50.0	1	50.0

Chi square = 24.11, $P < 0.05$

Significance : significant.

7- The effect of Timing of IM. nailing on the results :

It was found that all the fractures, who were operated upon on the first 24 hours had satisfactory results, while fractures who were operated upon the second week after injury showed a lower incidence of satisfactory results (57.14%). However, the difference was found statistically non significant Table (٢٦).

Table (٢٦) :

Timing of IM. Nailing	Number of Fractures	Results			
		SAT.		UNSAT	
		No.	%	No.	%
First 24 h.	9	9	100.0	--	--
1-7 days	10	8	80.0	2	20.0
8 - 14 days	7	4	57.14	3	42.9
14 - 21 days	3	3	100.0	--	--
< 21 day	2	1	50.0	1	50.0

Chi square = 4.3036, $(P > 0.05)$

Significance : non significant.

8) The effect of surgical technique on the results :

It was found that there was no correlation between the technique (either closed or open) with the results. Where (82.6) percent with closed technique had satisfactory results while 75.0 percent of open technique (with small incision at the fracture site) had satisfactory results. However, the difference was statistically non significant Table (٢٧).

Table (٢٧):

Surgical technique	Number of Fractures	Results			
		SAT.		UNSAT	
		No.	%	No.	%
Closed	23	19	82.6	4	17.4
open	8	6	75.0	2	25.0

Chi - square = 1.729 (P. value > 0.05)

Significance = non significant.

9) The effect of type of I.M. nailing on the results :

It was found that there was no correlation between static or dynamic nailing on the results where (81.0) percent of satisfactory results had statically locked nail while (80.0) percent of satisfactory results had dynamically locked nail and the difference was statistically insignificant Table (٢٨).

Table (٢٨):

Type of IM nailing	Number of fractures	Results			
		SAT.		UNSAT	
		No.	%	No.	%
Static	2	17	81.0	4	19.0
Dynamic	10	8	80.0	2	20.0

Chi square = 0.032 (P value > 0.05)

Significance : Non significant.

10) The effect of Dynamization on results :

It was found that there was no correlation between dynamization of the statically locked nail and the results, where 77.8% of satisfactory results had recorded with the persistant statically locked nail while 83.3 percent of the satisfactory results had reported with dynamization of the static nailing. However statistically the difference was insignificant. Table (٢٩).

Table (٢٩):

Dynamization	Number of fractures	Results			
		SAT.		UNSAT	
		No.	%	No.	%
Statically	9	7	77.8	2	22.2
Dynamization	12	10	83.3	2	16.7

Chi square = (P value : > 0.05)

Significance : non significant.

11) The effect of weight bearing and the results :

It was found that there was correlation between early weight bearing and the end result of fracture union and the results. And also, the more the period of non weight bearing, the worse the end results. The difference was found statistically significant. Table (٣٠), However the post operative ambulation depends on other factors such as the type of fracture, the degree of comminution and presence of associated injuries.

Table (٣٠) :

Wt. bearing	Number of fractures	Results			
		SAT.		UNSAT	
		No.	%	No.	%
Full wt. bearing	23	20	87.0	3	13.0
Partial wt. bearing	6	4	66.7	2	33.3
Non wt. bearing	2	1	50.0	1	50.0

Chi - square = 31.504, $P < 0.0001$

Significance : highly significant.

IV) Complications : Table (31)

1- Fat embolism :

Fat embolism had recorded in only one patient (3.23%) who had comminuted femoral shaft fracture with association of other injuries. The case was diagnosed clinically and laboratory (Tachypnea, Tachycardia, fever, altered mental status and petechiae) 12 hours after injury. Laboratory and chest radiographic investigation to confirm the diagnosis was performed immediately.

Treatment : Emergent fixation of the femoral fractures (within 24 hours) helps limitation the incidence of fat embolism complications, early intubation and respiratory support with positive pressure ventilation and proper manegment of fluids.

2) Infection :

There were four infections (12.90%) . All, infections occured after surgury on closed fractures. Three cases with inection (9.68%) were located at the site of insertion of the distal locking screws and they were treated with medication only within 6 weeks postoperatively. The organism was staph. aureus, antibiotic was given according to culture sensetivity tests.

One case (3.23%) had deep infection involving the bone and persisted at the time of review, with a drainage sinus in association with non union. This case with poor result was maneged by removing the implant, debridement and external fixator device with Autogenous bone grafting and systemic antibiotic according to the culture and sensetivity tests.

3) Delayed and non - union :

There were three fractures (9.68%) with non union after six months postoperatively. One of them occurred in association with deep infection, one with pathological fracture of the midshaft femur with associated other lesions and the third one occurred after failure of fixation which was treated by exchange nailing, bone grafting and dynamization with gradual weight bearing.

4- Shortening :

Seven cases (22.58%) had shortening of 1 - 3 cm. Shortening had occurred in three fractures had dynamic interlocking nail, two cases with Associated ipsilateral fracture tibia and other with ipsilateral fracture neck femur. The other two fractures with shortening had sevene comminuted fracture and had intraoperative shortening after static interlocking nail.

5) Varus deformity :

There were five cases (16.13%) had varus angulation ongulation of 5 - 10 degrees. Varus deformity had occurred with comminuted upper third fracture treated with supine position on the fracture table in three patients and two patients with unstable lower third fracture and had earlly dynamization before appearance of good callus. This varus degree not enterfere with the patients activity and function.

6) External rotation deformity :

Four cases (12.90%) had external rotation deformity of 5 - 20°. The fixation of three of them was by dynamic interlocking nailing and the later ~~later~~ had fixation with statically interlocking nail while the patient position was Lateral pateral on the fracture table.

7) Implant Failure failue :

Two cases (6.45%) had implant failure in this series. The fracture level was distally on the lower third femoral shaft and the nail failure occurred neer the proximal of the two distal screw holes. The cause of failure were, small size delta nail (11 mm), earlly weight bearing at 6 weeks before formation of good callus. high Stress Concentration at the proximal hole of the distal Two holes where the distance between the locking screw and the lower third fracture less than 5 cm.

The two cases were manged by nail exchange with Nail with large size (13 mm) after good reaming of the endosteum.

8) Nerve injury :

Two cases (6.45%) had nerve injury postoperatively, one case with peroneal nerve palsy (sciatic) and the other with pudendal nerve palsy, due to streach on the sciatic nerve of the injuried limb on traction table. Both cases recover completelly within six months postoperatively Table (31) shows distribution of complication.

Complications	Number	Percentage
Fat embolism	1	3.23
Infection	4	12.90
Non/delayed union	3	9.68
Varus deformity 5°	5	16.13
External Rotation 5 - 20°	4	12.90
Shortening 1-3 cm	7	22.58
Implant failure	2	6.45
Nerve injuries	2	6.45

Table (31) Complications