Results

Thirty Trochanteric fractures in thirty high surgical risk patients were treated in this series by Trochanteric external fixator. For appropriate evaluation, ASA score was used for the estimation of the overall condition of the patients. The prompts that were followed: the time between trauma and operation, the type of anaesthesia, the average time of operation, the average radioscopic exposition during the operational period, the need for the blood transfusion during or after the operation, prophylactic use of antibiotics and thromboprophylaxis, the average duration of the hospitalization, time to union, post-operative complications. The ultimate functional and anatomical results were shown according to the Foster's rating system. The follow up time was up to 6 months.

The level of pain was recorded for each patient on the 3rd postoperative day when mobilization was attempted. On a four-grade verbal scale (none, mild, moderate, sever) ***Jadad et al. 1994***, 21 patients had mild pain and 9 had moderate pain on start of mobilization, none of our patient had severe pain postoperatively.

Table (20) Post operative pain

Post operative pain	*Number of patients*
None	**0**
Mild	**21**
Moderate	**9**
Sever	**0**
	Total= 30

The time of the start of walking differed for our patients according to the medical status and the pre-fracture ability to walk but the majority of them were able to start supervised walking during the first three weeks after operation on the 4 legs frame. All of the patients were allowed to sit in bed on the 1st postoperative day.

Fig. (77) The patient is bearing weight fully with the fixator

Fig. (78) The patient is sitting on bed with the fixator

Overall Results According to Foster's Criteria

- **Anatomical results:**

In all patients the pins were inserted in a satisfactory position in the A P and Lateral planes, according to the manufacturer s recommendations. Results were anatomically excellent *(Union in perfect position)* in 22 (73.3%) patients, good *(Union with less than 10° of varus, and minimal shortening)* in 2 (6.7%) patients, and fair *(Union with 20-25° of varus, and half an inch to one inch (1-2.5 cm) of shortening)* in 6 (20%) according to Foster's criteria. In total of 30 patients 24 (80%) were satisfactory and 6 (20%) were unsatisfactory.

Table (21) Anatomical results

Anatomical results	*Number of patients*
Excellent	**22**
Good	**2**
Fair	**6**
	Total= 30

- **Functional results:**

Trochanteric external fixator's frame is small, well tolerated and did not interfere with sitting, lying or walking in conventional clothes. No clinically significant limitation of hip or knee movements in all patients. Results were functionally excellent *(Walks as well as before operation, no limp or pain)* in 16 (53%) patients, good *(Walks well, used crutch to go out)* in 12 (40%) patients, and moderate *(Requires crutch. Considerable limp or pain)* in 2 (7%) patients, according to Foster's criteria. In total of 30 patients 28 (93.3%) were satisfactory and 2 (6.7%) were unsatisfactory.

Table (22) Functional results

Functional results	*Number of patients*
Excellent	**16**
Good	**12**
Fair	**2**
	Total= 30

Analysis of the Results

- **Average duration of the hospitalization:**

All of patients were discharged from hospital as soon as they could walk on their own with a crutch. The mean hospitalization time was 3 weeks (range 2–4 weeks).16 (53%) patients discharged at the 2nd week postoperative and 6 patients (20%) discharged at the 3rd week and 8 (27%) patients discharged at 4th week postoperative due to medical causes. Relatives of our patients were learned the daily care of the pins entry sites. We did not put any limitation on their daily activities after discharge.

Table (23) Duration of hospitalization

Duration of hospitilization	*Number of patients*
2wk	**16**
3wk	**6**
4wks	**8**
Average= 3 weeks	**Total= 30**

- **Time to union:**

Union occurred in all cases and there was no fracture healing failure. The mean time to union was 12 weeks (range 9-20 weeks). Union occurred within 9 weeks in 2 (7%) cases, 10 weeks in 10 (33%) cases, 13 weeks in 4 (13%) cases, 16 weeks in 4 (13%) cases, and 20 weeks in 2 (7%) cases. Fracture type and medical condition of the patient affect the time of fracture healing.

Table (24) Time of union

Time of union	*Number of patients*
9wk	**2**
10wk	**10**
12wks	**8**
13wk	**4**
16wk	**4**
20wks	**2**
Average= 12 weeks	**Total= 30**

- **Follow up time**:

Patients were followed up clinically and radiologically for six months. Monthly visit in outpatient clinic with follow-up x-ray was arranged. The mean time for Fixator removal was 12 weeks (range 9-20 weeks). Fixator was removed within 9 weeks in 2 (7%) cases, 10 weeks in 10 (33%) cases, 12 weeks in 8 (27%) cases, 13 weeks in 4 (13%) cases, 16 weeks in 4 (13%) cases, and 20 weeks in 2 (7%) cases. The fixator was removed when the union was achieved. No patient died while hospitalized or in the follow-up period. Patients were contacted by phone.

Table (25) Time of fixator removal

Time of fixator removal	*Number of patients*
9wk	**2**
10wk	**10**
12wks	**8**
13wk	**4**
16wk	**4**
20wks	**2**
Average= 12 weeks	**Total= 30**

To reveal the different factors affecting the safety and the efficacy of the external fixator as a biological mode of fixation for trochanteric fractures and reflecting its advantages, relationship between different factors and the results (anatomical and functional) were compared.

-*Results in relation to the sex*: among 30 patients (12 males and 18 females), 45.5% of excellent anatomical results were males and 54.5% were females, 0% of good anatomical results were males and 100% were females ,40% of fair anatomical results were males and 60% were females. 50% of excellent functional results were males and 50% were females, 28.6% of good functional results were males and 71.4% were females. No significant difference was revealed between male or female concerning the anatomical (chi-square test=2.27, P value=0.32) or the functional results (chi-square test=1.43, P value=0.23) by using chi-square test.

-*Results in relation to the age*: concerning the anatomical results, the median of the age obtaining excellent results was 79 years old, and for good results was 86 years old, and was 75 years old for the fair results. concerning the functional results, the median of the age obtaining excellent results was 77 years old, and for good results was 79 years old by using ANOVA test (P value=0.090).

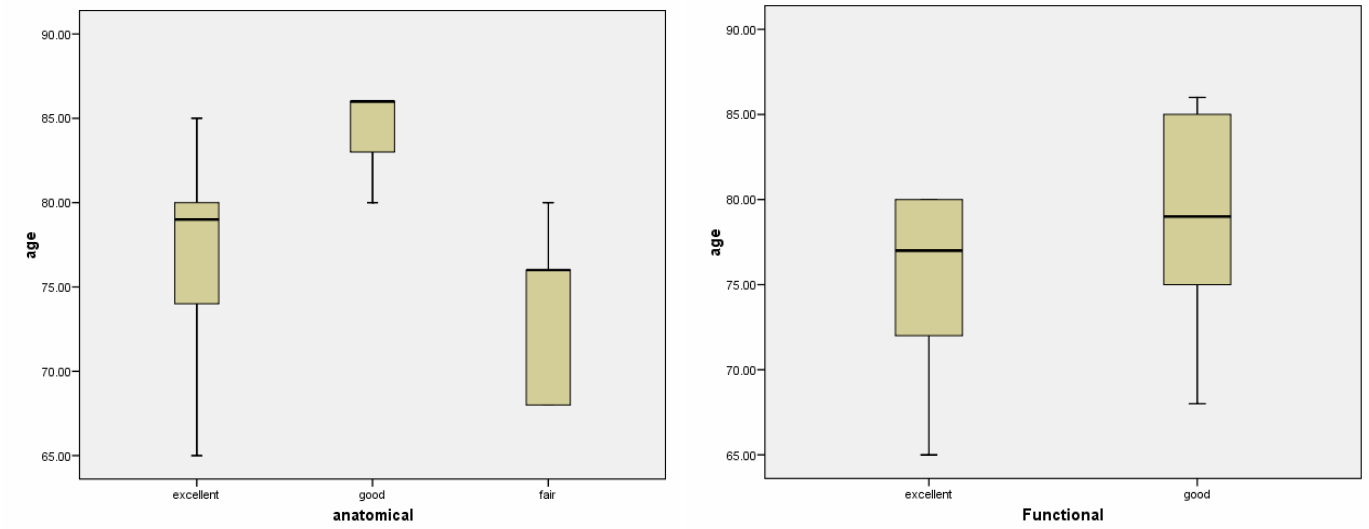

Fig. (79) A graph shows the correlation between the mean of the age and the anatomical and the functional results

-*Results in relation to the ASA grade*: among 30 patients (18 grade 3 and 12 grade 4), 63.6% of excellent anatomical results were grade 3 and 36.4% were grade 4, 33.3% of good anatomical results were grade 3 and 66.7% were grade 4 ,60% of fair anatomical results were grade 3 and 40% were grade 4. 100% of excellent functional results were grade 3 and 0% were grade 4, 14.3% of good functional results were grade 3 and 85.7% were grade 4. No significant difference was revealed between ASA grade 3 or 4 concerning the anatomical (chi-square test=1.01, P value=0.60) but concerning to the functional results, grade 3 obtained better results (chi-square test=22.86, P value=0.00) by using chi-square test.

-*Results in relation to the fracture type*: 18.2% of excellent anatomical results were of type I , 54.5% were of type II, 9.1% were of type III, 9.1% were of type IV and 9.1% were of type V. 66.7% of good anatomical results were of type III and 33.3% were of type IV. 60% of fair anatomical results were of type IV and 40% were of type VI. 25% of excellent functional results were of type I, 50% were of type II, 12.5% were of type IV and 12.5% were of type V. 28.5% of good functional results were of type II, 28.5% were of type III, 28.6% were of type IV and 14.3% were of type VI.. There is significant difference was revealed that types I, II and III obtained the best anatomical (chi-square test=29.49, P value=0.001) and functional results (chi-square test=13.93, P value=0.016) by using chi-square test.

-*Results in relation to the medical problems*: 90.9% of *hypertensive* patients obtained excellent anatomical results were 9.1% obtained fair anatomical results. 54.5% of hypertensive patients obtained excellent functional results were 45.5%

obtained good functional results. There was a significance that hypertension patients obtained satisfactory anatomical results (chi-square test=14.57, P value=0.001) although no significant difference was revealed concerning the functional results (chi-square test=0.49, P value=0.83) by using chi-square test.

66.7% of *Diabetic* patients obtained excellent anatomical, 5.6% obtained good anatomical results were 27.8% obtained fair anatomical results. 44.4% of diabetic patients obtained excellent functional results were 55.6% obtained good functional results. There was no evidence that diabetes affecting both anatomical results (chi-square test=4.50, P value=0.106) or functional results (chi-square test=1.43, P value=0.23) by using chi-square test.

100% of *CVA* patients obtained excellent anatomical results. 100% of CVA patients obtained good functional results. There was no evidence that CVA affecting both anatomical results (chi-square test=0.78, P value=0.68) or functional results (chi-square test=2.45, P value=0.12) by using chi-square test.

60% of *IHD* patients obtained excellent anatomical results were 40% obtained fair anatomical results. 40% of IHD patients obtained excellent functional results were 60% obtained good functional results. There was a significance that IHD patients obtained satisfactory anatomical results (chi-square test=6.76, P value=0.034) although no significant difference was revealed concerning the functional results (chi-square test=1.07, P value=0.30) by using chi-square test.

100% of *CRF* patients obtained excellent anatomical results. 100% of CRF patients obtained good functional results. There was no significance concerning the anatomical results (chi-square test=1.68, P value=0.43) although there was a significance that CRF patients obtained good functional results (chi-square test=5.28, P value=0.022) by using chi-square test.

50% of *LCF* patients obtained excellent anatomical results were 50% obtained good anatomical results. 12.5% of LCF patients obtained excellent functional results were 14.3% obtained good functional results. There was a significance that concerning the anatomical results (chi-square test=8.50, P value=0.014) although no significant difference was revealed concerning the functional results (chi-square test=0.021, P value=0.89) by using chi-square test.

100% of *anaemic* patients obtained excellent anatomical results. 12.5% of anaemic patients obtained excellent functional results. There was no significance concerning anatomical results (chi-square test=0.78, P value=0.68) or functional results (chi-square test=1.86, P value=0.171) by using chi-square test.

-*Results in relation to the body weight*: concerning the anatomical results, the median of body weight obtaining excellent results was 100 Kg, and for good results was 90 Kg, and was 80 Kg for the fair results. Concerning the functional results, the median of body weight obtaining excellent results was 105 Kg, and for good results was 85 Kg by using ANOVA test.

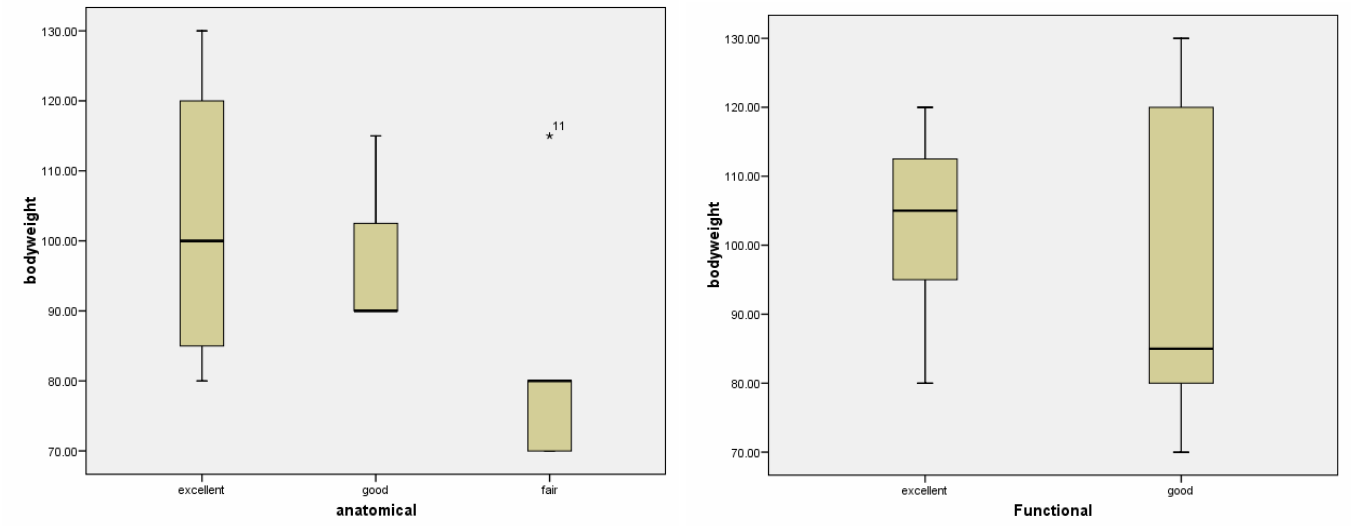

Fig. (80) A graph shows the correlation between the mean of the body weight and the anatomical and the functional results

There was no significance concerning the time between the trauma and the operation (P value=0.244) or the duration of hospitalization (P value=0.34) but time of union had a significant effect on anatomical and functional results (P value=0.034).

Effect of the complications on the results

The relationship between different complications and the results (anatomical and functional) were compared to reveal its effect on the final results.

60% of patients had *pin tract infection* obtained excellent anatomical results were 40% obtained fair anatomical results. 100% of these patients obtained good functional results. There was a significance that pin tract infection affects both anatomical (chi-square test=6.76, P value=0.034) and functional results (chi-square test=17.143, P value=0.00) by using chi-square test.

16.7% of patients with *shortening* obtained good anatomical, 83.3% obtained fair anatomical results. 33.3% of them obtained excellent functional results were 66.7% obtained good functional results. There was a significance concerning the anatomical results (chi-square test=25.833, P value=0.00) but no significance concerning the functional results (chi-square test=1.21, P value=0.27).

100% of patients with *varization* obtained fair anatomical results while100% obtained good functional results. There was a significance that varization affects the anatomical results (chi-square test=10.70, P value=0.005) but no significance was revealed concerning the functional results (chi-square test=2.45, P value=0.118) by using chi-square test.

100% of patients with *mechanical complications* obtained fair anatomical results while100% obtained good functional results. There was a significance that varization affects both anatomical (chi-square test=0.78, P value=0.005) and functional results (chi-square test=2.45, P value=0.004) by using chi-square test. 100% of patients with *Knee stiffness* obtained excellent anatomical results while 60% obtained excellent and 40% good functional results. There was no significance that knee stiffness affects both anatomical (chi-square test=2.18, P value=0.336) or functional results (chi-square test=0.107, P value=0.743).