



## ORIGINAL ARTICLE

# Results of Open Reduction and Internal Fixation of Recent Displaced Fracture Calcaneus in Zagazig University Hospitals

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### ABSTRACT

**ckground:** The calcaneus is the largest of the tarsal bones. It is irregularly cuboidal and designed to resist the daily stresses of weight bearing. The calcaneus have architecture much like an egg; hard on the outside and very soft in the center and is very liable to the crush injuries. Its anterior half supports the talus. The talus, in turn, carries the whole body load through the tibia. The calcaneus serves a double purpose: it provides an elastic, firm support for the weight of the body and also functions as a spring board for locomotion.

**Objective:** To evaluate clinical and radiological results of open reduction and internal fixations of calcaneal fractures.

**Patients and Methods:** Twenty four cases of recent fractures of the calcaneus were treated by open reduction and internal fixation using plates and screws via the extensile lateral approach. The patients were operated and followed up during the period between November 2016 and November 2018 in Zagazig university hospitals.

**Results:** These results show that internal fixation of displaced intra-articular calcaneus fractures using a single lateral approach is a relatively safe, reliable method of treatment.

**Conclusion:** Intra-articular fractures of the calcaneus should be treated as fractures of the major weight bearing joints with anatomical reduction, rigid fixation and early mobilization.

**Keywords:** Open reduction, internal fixation and fracture calcaneus



### INTRODUCTION

Open reduction and internal fixation (ORIF) have been used to provide appropriate bone morphology and correct the subtalar joint mechanics to allow better accommodation of uneven surface<sup>(1)</sup>. The complications of calcaneal fractures like: infection, pain, arthritis, peroneal tendonitis, calcaneocuboid arthritis, fibular abutment, tarsal tunnel syndrome, heel pad damage, stiff forefoot, and toes, weak gastrosoleus complex, a fixed flatfoot, and regional pain syndrome. The current aim of ORIF is an attempt to avoid these important and potentially disabling complications<sup>(2)</sup>.

Open reduction correctly insist that direct manipulation of the articular fragments is the only means of achieving reduction of the posterior facet which is essential first step in restoring function of the subtalar joint. Open reduction and internal fixation has been performed most commonly through a medial, lateral, or combined medial and lateral approach. Open reduction and internal fixation will improve the outcome of calcaneus

fractures<sup>(3)</sup>.

### AIM OF THE WORK

The aim of this work is to evaluate clinical and radiological results of open reduction and internal fixations of calcaneal fractures as a choice of fracture management.

### PATIENTS AND METHODS

Twenty four cases of recent fractures of the calcaneus were treated by open reduction and internal fixation using plates and screws via the extensile lateral approach. The patients were operated and followed up during the period between November 2016 and November 2018 in Zagazig university hospitals.

Written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

The youngest patient was sixteen years old and the oldest fifty seven years, with an average of

(32.29±7.83 years).

Out of twenty four cases in our series, sixteen cases (66%) were males and eight cases (34%) were females.

The head cause of injury in this series was fall from height in twenty three cases (96%) followed by direct trauma (in RTA) in one case (4%).

Twelve patients (50%) had right sided fractures, while eight patients (33.3%) had left sided fractures. Bilateral fracture calcaneus were seen in four patients (16.7%), the other side managed conservative. The distribution of patients according to the side of fracture is shown in.

All fractures were classified according to the scheme of Essex-Lopresti and Sanders's classification

Eighteen cases (75%) had no associated injuries, while six cases (25%) had associated orthopaedic injuries. The associated orthopaedic injuries included the following: Two cases have fracture spine at the level of L<sub>1</sub> vertebra, right knee ligament injury, fracture right inferior pubic ramus, fracture superior pubic ramus and fracture right medial malleolus.

#### **Pre-operative assessment:**

**1. Clinical assessment:** For every case, the pre-operative clinical data were documented. These included name-age-sex of the patient, the side affected and the mechanism of injury, history, general examination, the foot was examined, and the skin was inspected for probable ecchymosis and abrasions.

**Local examination:** All cases suffered from: pain in the heel, inability to bear weight on the heel.

**II – Radiological assessment:** For every patient, the following were done;

**(1) Pre-operative x-rays including:** Standard views: Antero-posterior, lateral and axial views of ankle. X-ray for chest, pelvis, cervical spine and any suspected associated injuries.

**(2) Pre-operative CT was done in all cases:** The Sagittal Views. The Coronal Views: The Transverse (Axial) Views. 3D views.

**Inclusion criteria;** All patients involved in our study had closed displaced intra-articular fracture of the calcaneus willing to means of open reduction and fixation with plates and screws.

**Exclusion criteria;** Extra-articular fractures, minimally displaced fractures, open fractures.

#### **Operative data**

**Approach:** All patients were operated by the extensile lateral approach, Patient was placed in the lateral decubitus position and mark the bony landmark (lateral malleolus and base 5<sup>th</sup> MTB).

Pre-operative administration of antibiotic just prior to tourniquet application and to be continued for 2 days after surgery.

**Positioning:** All patients were placed in the lateral decubitus position because it facilitates the lateral approach used in our series. Protective padding is placed beneath the contralateral limb to protect the peroneal nerve; a pillow is placed between the legs. C-arm monitor opposite operating surgeon.

**Incision:** The lateral extensile incision L-shaped

**Reduction:** Remove lateral wall piece with an osteotome, or take it laterally leaving its base attached to bone making bone window. Apply traction to the tuberosity fragment using Shanz pin inserted axially in the tuberosity fragment, by longitudinally traction to the pin using T handle, disimpaction of the fracture fragments and correction of overriding of the fragments, correction of Bohler angle and finally correction of varus or valgus.

Clean fracture site, irrigate. The fracture pattern was then identified. Mobilize intra-articular pieces. Reduce tuberosity first using Steinman pin blunt periosteal elevator under image intensifier. Reduce posterior facet: Put two lateral pieces together first with K-wires. Reduce lateral group onto medial bone: Temporarily fix with K-wires.

**Fixation:** Apply lateral calcaneal plate and fix by 4 mm cancellous screws and 3.5 mm cortical screws, the used plates included the small t plate used in 10 cases and calcaneal plates used in fourteen cases. Plates were used according to availability and suitability Plate position is verified on a lateral fluoroscopic view, and additional interfragment screws were used according to fracture pattern especially in cases with T plates.

We used temporary k/wires for fixation in all cases holding the posterior facet in reduction till we use the plate and screw. Being low profile plates impingement of the peroneal tendons was less likely to happen with the use of small T plate and calcaneal plates.

**Dressing:** Below knee posterior slap.

**Postoperative management:** Elevate. IV antibiotics for two days for usual clean cases. Remove drain when less than fifty cc over twenty four hours. A posterior slap was applied for a period of four to six weeks.

Functional assessment was done using the scoring system of Creighton-Nebraska Health Foundation assessment sheet for fractures of the calcaneus (table 1).

#### **Statistical analysis**

Functional assessment was done using the scoring system of Creighton-Nebraska Health Foundation assessment sheet for fractures of the calcaneus.

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then

imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean ± SD, the following tests were used to test differences for significance;. Difference and association of qualitative variable by Chi square test ( $X^2$ ). Differences between quantitative independent groups by t test or Mann Whitney. P value was set at <0.05 for significant results &<0.001 for high significant result. Data were collected and submitted to statistical analysis. The following statistical tests and parameters were used.

**RESULTS**

Our study was done on 24 cases. 16 cases (66%) were males and 8 cases (34%) were females from total 24 cases, their ages was ranging from 19 to 57 years, with an average of (32.54)years. In our study as regards to mechanism of Injury, the chief cause of injury was fall from height in 23 cases (96%) followed by direct trauma in 1 cases (4%) of cases (table 2).

Regarding to side of the fracture, 12 patients (50%) had right sided fractures, while 8 patients (33.3%) had left sided fractures. Bilateral fracture calcaneus were seen in 4 patients (16.6%). 18 cases (75%) had no associated injuries, while 6 cases (25%) had associated orthopaedic injuries (table 3).

Regarding to type joint depression were majority with 62.5% while tongue were 37.5 %, major sanders class were II-B and III-B with 41.7% and 33.3% respectively (table 4).

In the radiological assessment on the basis of the tuber-joint angle. Bohler’s angle was measured pre and post operatively and the percentage of correction is calculated in every case range from 60 to 100 % (table 5).

Functional assessment was done using the scoring system of Creighton-Nebraska Health Foundation assessment sheet for fractures of the calcaneus with excellent results in 12 cases (50%), good in 6 cases (25%), fair in 4 cases (16.6%) and poor in 2 cases (8.3%) (Table 6).

In our study clinical assessment regarding to basic characters tongue type of fracture more significant from joint depression type, sander type I more significant from type II from type III from type IV. Regarding to time of surgery unsatisfactory cases significantly higher regard time of surgery.

In this study regarding to complications, Superficial wound infection was reported in 2 cases(8.3%), valgus deformity of the heel in 2 cases (8.3%),reflex sympathetic dystrophy in 1 case (4.1%), subtalar stiffness in 2 cases(8.3%), and osteomyelitis in 1 case (4.1%) .No free-tissue transfers, local tissue flaps or skin grafts were needed

**Table 1:** Creighton-Nebraska Health Foundation Assessment Sheet for fractures of the calcaneum.

	Points
<b>Pain (30 points)</b>	
<i>At activity :</i>	
No pain when walking or ignore pain.	
Mild pain when walking : takes aspirin.	15
Moderate pain when walking : takes codeine.	10
Severe pain when walking : severe limitations.	5
<i>At rest:</i>	
No pain at rest or ignores pain.	0
Mild pain at rest.	15
Moderate pain at rest.	10
Severe pain at rest.	5
	0
<b>Activity (20 points):</b>	
Unlimited walking and standing.	20
Walks 5 to 10 blocks; stands for more than half an hour.	15
Walks 1 to 5 blocks; stands half an hour or less.	10
Walks less than 1 block (indoors only).	5
Cannot walk.	0
<b>Range of inversion / eversion (20 points):</b>	
25 <sup>0</sup> to 30 <sup>0</sup> = 80% to 100%.	20
20 <sup>0</sup> to 25 <sup>0</sup> = 60% to 80%.	15
15 <sup>0</sup> to 20 <sup>0</sup> = 40% to 60%.	10
10 <sup>0</sup> to 15 <sup>0</sup> = 20% to 40%.	5

	Points
0° to 10° = 0% to 20%.	0
<b>Return to work (20 points):</b>	
Full time, same job.	20
Full time with restrictions.	15
Full time, change job.	10
Part time with restriction.	5
Cannot work.	0
<b>Change in shoe size (5 points):</b>	
No change.	5
Change.	0
<b>Swelling (5 points):</b>	
None.	5
Mild.	3
Moderate.	2
Severe.	0

Score 90 to 100 points is an excellent result; 80 to 89 a good result; 65 to 79 a fair result; and 64 or less a poor result. Five degrees of eversion plus 25 degrees of inversion equals a range of motion of 30 degrees.

**Table 2:** Age and sex distribution among studied group

Age			
Mean± SD		32.29±7.83	
Median (Range)		31.0 (16-57)	
		N	%
Sex	Female	8	33.3
	Male	16	66.7
Total		24	100.0

Age was distributed as **32.29±7.83** with minimum 16 and maximum 57, and regarding sex male were majority with 66.7% and female 33.3%

**Table 3:** Injury characteristics distribution

		N	%
Mechanism injury	Direct trauma	1	4.2
	Fall height	23	95.8
Side	Left	8	33.3
	Right	12	50.0
	Bilateral Lt-operated	2	8.3
	Bilateral Rt-operated	2	8.3
Associated Injuries	No	18	75.0
	Fr. Spine L1	2	8.3
	inf p. ramus	1	4.2
	med.mall.	1	4.2
	RT knee ACL tear	1	4.2
	Sup p. ramus	1	4.2
	Total	24	100.0

**Table 4:** Type of fracture pattern

		N	%
Type	Joint depression	15	62.5
	Tongue	9	37.5
Sanders class	II_A	1	4.2
	II_B	10	41.7
	II_C	2	8.3
	III_A	1	4.2
	III_B	8	33.3
	IV	2	8.3

**Table 5:** Descriptive analysis of post operative Bohler’s angle of injured side in respect of preoperative normal angle of the patients

Case No.	Preoperative Bohler angle	Bohler angle of uninjured side	Postoperative Bohler angle	Postoperative % of correction to normal
1	9	35	30	85 %
2	9	26	24	100 %
3	4	28	20	71 %
4	12	30	25	90%
5	9	30	24	80 %
6	12	22	22	100 %
7	10	23	35	65 %
8	8	35	26	85 %
9	Rt8 Lt 10	---	Rt35 Lt35	---
10	5	35	21	60 %
11	Rt 30 Lt 15	.....	Rt30 Lt 27	.....
12	16	30	30	100 %
13	8	37	32	86 %
14	9	30	28	95%
15	Rt-12 Lt 20	---	Rt35 Lt35	---
16	9	30	24	85 %
17	10	25	22	88 %
18	7a	24	24	100%
19	12	32	30	93.75%
20	14	24	24	100%
21	Rt 10 Lt 35	---	Rt35 Lt35	---
22	10	20	20	100 %
23	15	40	40	100 %
24	12	38	38	100 %

**Table 6:** Clinical assessment according to the Creighton-Nebraska Health Foundation assessment sheet for fractures of the calcaneus.

Case No.	Pain (30 points)		Activity (20 points)	Range of inversion & eversion (20 points)	Return to work (20points )	Change in shoe size (5 points)	Swelling (5 points)	Results of clinical assessment (points)	
	Activity 15 points	Rest 15 points							
1	10	15	15	15	20	5	3	83	Good
2	15	15	20	20	20	5	5	100	Excellent
3	10	10	15	15	20	5	3	78	Fair
4	10	10	15	20	20	0	3	78	Fair
5	10	15	20	20	20	5	3	93	Excellent
6	10	5	5	5	5	0	0	30	poor
7	15	15	15	15	20	5	5	90	Excellent
8	10	15	10	15	20	5	3	83	Good
9	15	15	15	15	20	5	5	90	Excellent
10	10	15	15	20	20	5	3	88	Good
11	15	15	20	20	20	5	5	100	Excellent
12	10	15	15	15	20	0	3	78	Fair
13	5	5	5	5	5	0	0	25	Poor
14	10	15	15	20	20	5	5	90	Excellent
15	10	15	15	15	20	5	5	85	Good
16	10	15	15	20	20	5	5	90	Excellent
17	10	15	20	20	20	5	5	95	Excellent



Case No.	Pain (30 points)		Activity (20 points)	Range of inversion & eversion (20 points)	Return to work (20points )	Change in shoe size (5 points)	Swelling (5 points)	Results of clinical assessment (points)	
18	10	15	15	20	20	5	5	90	Excellent
19	10	15	15	15	20	5	3	83	Good
20	10	15	15	20	20	5	5	95	Excellent
21	10	15	10	15	15	0	3	68	Fair
22	10	15	15	20	20	5	5	90	Excellent
23	15	15	20	20	20	5	5	100	Excellent
24	10	15	15	15	20	5	5	85	Good

**Table 7:** Creighton-Nebraska Health Foundation Assessment Sheet for fractures of the calcaneus case 1

Pain (30 points)	
At activity :	
No pain when walking or ignore pain.	15
At rest:	
No pain at rest or ignores pain.	15
Activity (20 points):	
Walks 5 to 10 blocks; stands for more than half an hour.	15
Range of inversion / eversion (20 points):	
20° to 25° = 60% to 80%.	15
Return to work (20 points):	
Full time with restrictions.	15
Change in shoe size (5 points):	
change.	0
Swelling (5 points):	
None.	5

80 out of 100 points= good result.



**1 A-** Lateral view show tongue type with reduced Bohler angle to 15.



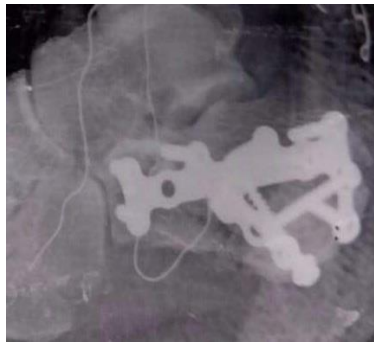
**1 B-** Axial view show varus of the tuberosity.



**1 C-** Transverse CT view show varus of the tuberosity, lateral wall bulge.



**1 D-** Coronal CT view show Sander type III BC.



**1 E-** Intra operative lateral view show Fixation with calcaneal plate.



**1 F-** intra operative axial view show Correction of the varus.



**1 G-** 1<sup>st</sup> post operative month lateral view; Show correction of Bohler angle to 24.



**1 H-** 1<sup>st</sup>post operative month axial view; show correction of the varus.



**1 I-** Lateral view; 12<sup>th</sup> post operative month.



**1 J-** Axial view; 12<sup>th</sup>post operative month

### DISCUSSION

Proponents of open reduction note the main advantages of anatomic reduction are; restoration of subtalar joint congruity, arch height, heel width and decreased lateral impingement. Most authors emphasize that this anatomic restoration, with a limited period of immobilization, leads to superior functional results.

It is well established that intra-articular fracture should be treated with an anatomic reduction and rigid fixation to permit painless early motion. We believe that the sub-talar joint should be treated that way.

Open reduction and internal fixation of calcaneal fracture is somewhat complex and requires considerable experience and critical assessment of the indications for surgery.

In a study done by Aktuglu and Aydogan<sup>(4)</sup>, was **Ali, H., et al**

conducted on 16 cases (57%) were males and 12 cases (43%) were females from total 28 cases, their ages was ranging from 13 to 60 years, with an average of 37years.

In another study done by Harvey (et al)<sup>(10)</sup>, was conducted on 145 cases (80%) were males and 36 cases (20%) were females from total 181 cases, their ages was ranging from 15 to 74 years, with an average of 37years.

In a study done by Sheng-Dan (et al) <sup>(11)</sup>, was conducted on 74 fractures 42 were males (56%) and 32 were females (44%) their age main 46 years and follow up from 12-26 months.

In study done by Linwei Chen (et al) <sup>(12)</sup>, was conducted 90 fractures of which 40 fractures were managed by ORIF 24 (60%) were males and 16 (40%) were females with main of age 32.1 and followed them up from 18-30 month (main 24).

In this study we performed 24 cases of recent fractures of the calcaneus were treated by open reduction and internal fixation using plates and screws, 16 cases (66%) were males and 8 cases (34%) were females, their ages ranged from 16 years to the oldest 57 years, with an average of (32.29±7.83 years). We noticed that better results are achieved with younger ages and fracture of calcaneus.

In Aktuglu and Aydogan study<sup>(1)</sup>, cause of injury was due to fall from height in 16 patients (57%) and a motor vehicle accidents was the cause of the fractures in 12 patients (43%).

In a study by Harvey (et al.)<sup>(10)</sup>, injury mechanisms were a fall or jump from a height in 144 patients (80%) and a motor vehicle accident in 29 patients (16%).

In Sheng-Dan (et al) study<sup>(11)</sup>, they referred for fall from height as the chief injury mechanism.

In this study regarding to mechanism of Injury, the chief cause of injury was fall from height in 23 cases (95.8%) followed by motor vehicle accidents in 1 cases (4.2%) of cases.

In Aktuglu and Aydogan study<sup>(1)</sup>, they classified their patients according to Sanders CT classification. Nineteen fractures (54.3%) were defined as type II, 10 fractures (28.5%) as type III and six fractures (17.2%) as type IV according.

In Sheng-Dan (et al) study<sup>(11)</sup>, they used Sander's classification according to which, there were 38 (51.3%) Type II fractures, 26 (35.1%) Type III fractures and ten (13.51%) Type IV fractures.

In Linwei Chen (et al)<sup>(12)</sup>, they used also Sander's classification which reproduced 61 (78.2) type II fractures and 17 (21.8) type III fractures.

In this study regarding to type of fractures, all fractures were classified according to the scheme of Essex-Lopresti, and Sanders Classification. There were 9 (37.5%) tongue type, 15 (62.5%) joint depression type, there were 13 (54.2 %) type II, 9 (37.5 %) type III and 2 (8.3 %) type IV fractures.

In study done by Harvey et al., 2001<sup>(10)</sup>, in 112 patients (62%) the calcaneus fracture was an isolated injury. 69 patients had associated injuries (38%).

In Aktuglu and Aydogan study<sup>(1)</sup>, there were 28 patients with 35 calcaneal fractures, 17 fractures (49%) were due to polytrauma and 18 fractures (51%) were due to isolated trauma.

In this study 18 cases (75%) had no associated injuries, while 6 cases (25%) had associated orthopedic injuries.

In Aktuglu and Aydogan study<sup>(1)</sup>, patients were treated in the first two-week period in isolated cases, but in polytrauma patients a mean delay of 7 days ranged from 4 days to 27 days was observed.

In this study the durations of delay until surgery ranged from 3 days to 20 days with an average of (10.25±3.34 days).

In Aktuglu and Aydogan, study 2002<sup>(1)</sup>, they had followed their patients for a period ranged from 18 to 83 months with an average of 38 months. Cases were seen three (17%) excellent, nine (52.9%) good and five (29.5%) fair results in polytrauma patients.

In Harvey (et al) study<sup>(10)</sup>, cases were seen Seven (38.8%) excellent, 10 (55.6%) good and one (5.6%) fair results.

In Sheng-Dan (et al) study<sup>(11)</sup> cases were seen 92% good and 8% excellent results.

In this study regarding to follow-up, the duration of follow-up were ranged between 6 months and 18 months, the result were: excellent in 12 cases (50%), good in 6 cases (25%), Fair in 4 cases (16.6%), and Poor in 2 cases (8.3%).

In Harvey et al. study<sup>(10)</sup>, this is a review of 183 patients with 218 fractures of the calcaneus treated by open reduction and internal fixation. 24 wounds (11%) required local wound care. One (0.4%) deep infection occurred in a neuropathic foot that required below-knee amputation. Six patients (2.8%) had postoperative sural nerve injury.

In Bezes et al.<sup>(15)</sup> reported an infection rate of 2.7% in 257 intra-articular fractures of the os calcis fixed with an Ao third tubular plate and screws. Ten percent had superficial necrosis of the skin. Six patients (2.7%) required secondary arthrodesis of the subtalar joint.

In 157 intra-articular fractures treated by Zwipp et al<sup>(16)</sup> the most common complication was wound edge necrosis in (8.3%). Infection occurred in 1.9% and four patients (3.3%) required subtalar arthrodesis.

In this study regarding to complications, any wound which did not heal primarily, required dressing changes, local wound care, further surgery, became infected with a discharge, or exhibited any signs of skin necrosis, was recorded as a wound complication. Superficial wound infection was reported in 2 cases (8.3%), valgus deformity of the heel in 2 cases (8.3%), reflex sympathetic dystrophy in 1 case (4.1%), subtalar stiffness in 2 cases (8.3%), and osteomyelitis in 1 case (4.1%). No free-tissue transfers, local tissue flaps or skin grafts were needed.

In a study done by Aktuglu and Aydogan<sup>(1)</sup>, after the operation, the patients were followed with the same protocol of elevation, ice and analgesia. A posterior splint was applied after the operation and rehabilitation was started after an average period of three weeks In Group 1 and Group 2, four weeks in Group 3 and five weeks in Group 4.

In Harvey et al. study<sup>(10)</sup>, permitted active range of



motion all patients after 3-5 days of foot and ankle splint. Passive range of motion of the toes to prevent foot intrinsic contracture was begun immediately. Sutures were removed approximately 21 days after surgery. Patients were fitted with support stockings to control foot and ankle edema for at least six months. Patients were not allowed to walk on the injured foot for 12 weeks, but active range-of-motion exercises of the ankle and subtalar joints continued during this period.

In this study regarding postoperative management, Elevation, posterior ankle slap for 4 to 6 weeks, IV antibiotics for 2 days, remove drain when less than 30 cc over 24 hours, follow up in 1<sup>st</sup> 3 days for dressing change and wound check. At 3 weeks (at least), remove sutures, check x-rays (lateral, axial views).

In Aktuglu and Aydogan study <sup>(1)</sup>, Weight bearing was allowed after an average period of nine weeks in Group 1, 10 weeks in Group 2 and Group 3 and 12 weeks in Group 4.

In Harvey et al. study <sup>(10)</sup>, Patients were not allowed to walk on the injured foot for 12 weeks.

In Sheng-Dan (et al) study <sup>(11)</sup> all the patients began weight bearing as early as 4 weeks after surgery.

In this study partial weight-bearing was started at 6 to 12 weeks if x-rays show healing, with full weight bearing at the 10<sup>th</sup> to 12<sup>th</sup> weeks. Patients with bilateral fractures were confined to bed-to-wheelchair ambulation during this period. Resumption of weight-bearing was then initiated to patient tolerance, with discontinuation of aids by 16 to 24 weeks. Individuals with unilateral fractures were instructed to bear weight on the forefoot initially, with gradual resumption of heel-to-toe ambulation.

### CONCLUSION

Intra-articular fractures of the calcaneus should be treated as fractures of the major weight bearing joints with anatomical reduction, rigid fixation and early mobilization.

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