OBSERVATION AND RESULT

In the Rajindra hospital and Govt. Medical College, Patiala the present study was undertaken for assessing the functional outcomes of monorail fixator as a primary mode of fixation in compound tibia fracture type 2 and type 3A,3B as classified by Gustilo-Anderson. The 30 cases of compound tibia fracture were selected and followed up between November 2018 to October 2020 under the department of Orthopaedics. Both the males and females patients who had presented with compound tibia fracture at emergency department were selected between this period. The present study of surgical treatment of compound tibia fracture with monorail system revealed the following.

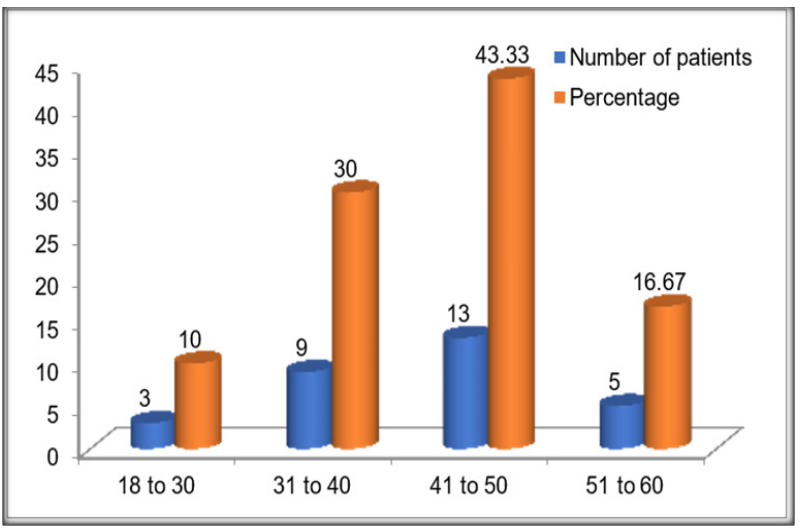
1. Age incident
2. Sex incident
3. Mode of injury
4. Type of fracture / classification
5. Side of fracture
6. Associated injury (AI)
7. comorbidity
8. Duration of surgery
9. Secondary procedure done
10. Time of full weight bearing post-operative
11. Time of fracture union
12. Complication
13. Modified Johner and Wruh's criteria parameters

α. Nonunion
β. Post-operative neurovascular injury
χ. Pain
δ. Infection
ε. Knee and ankle range of motion
ϕ. Gait
γ. Result

Following results were obtained:
Age Incidence

Table 1: Age-wise distribution of patients

Age group (years)	Number of patients	Percentage
18 to 30	3	10
31 to 40	9	30
41 to 50	13	43.33
51 to 60	5	16.67
Total	30	100
Mean ± SD	42 ± 10.09	



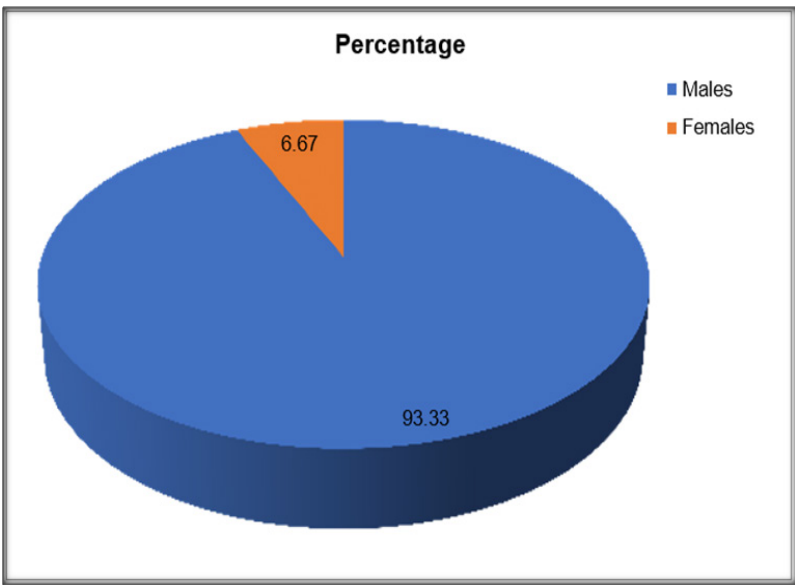
Graph 1: Age-wise distribution of patients

In our study we include patients aged between 18 and 60 years and the maximum numbers of patients (43.33 percent) belonged to the age group of 41 to 50 years while 16.67 percent of the patients belonged to the age group of 51 to 60 years. 30 percent of the patients belonged to the age group of 30 to 40 years. The youngest being at age 21 and the oldest being 58 year of age. Mean age of the patients was 42 years.

Sex Incidence

Table 2: Sex-wise distribution of patients

Sex	Number of patients	Percentage
Males	28	93.33
Females	2	6.67
Total	30	100



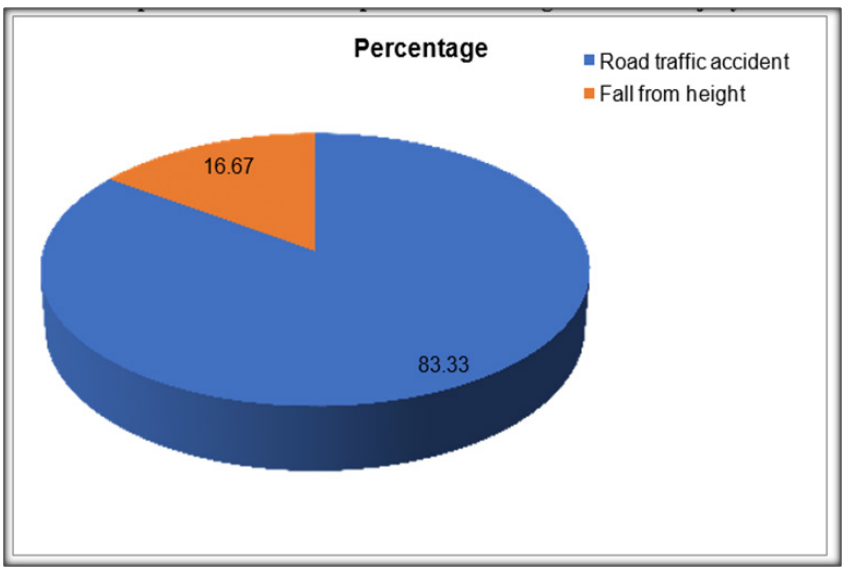
Graph 2: Sex-wise distribution of patients

In our study, there was male dominance. The 93.33 percent of the patients were males while the remaining 6.67 percent were females.

Mode of Injury

Table 3: Distribution of patients according to mode of injury

Mode of injury	Number of patients	Percentage
Road traffic accident	25	83.33
Fall from height	5	16.67
Total	30	100



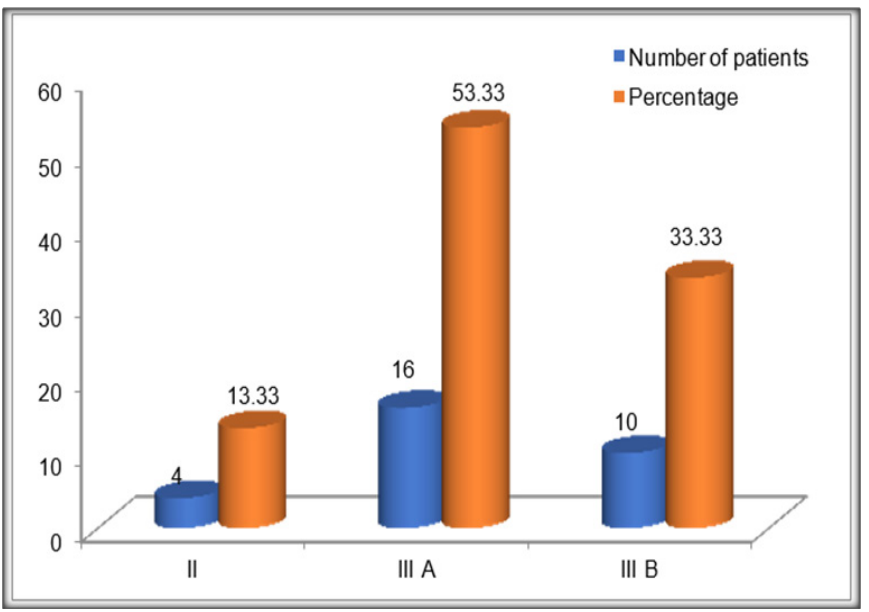
Graph 3: Distribution of patients according to mode of injury

In our study, most common cause was road traffic accident in 83.33 percent of the patients while it was fall from height in 16.67 percent of the patients.

Types of Fracture Classification

Table 4: Distribution of patients according to type of fracture (Gustilo-Anderson classification)

Type of fractures (Gustilo-Anderson classification)	Number of patients	Percentage
II	4	13.33
III A	16	53.33
III B	10	33.33
Total	30	100



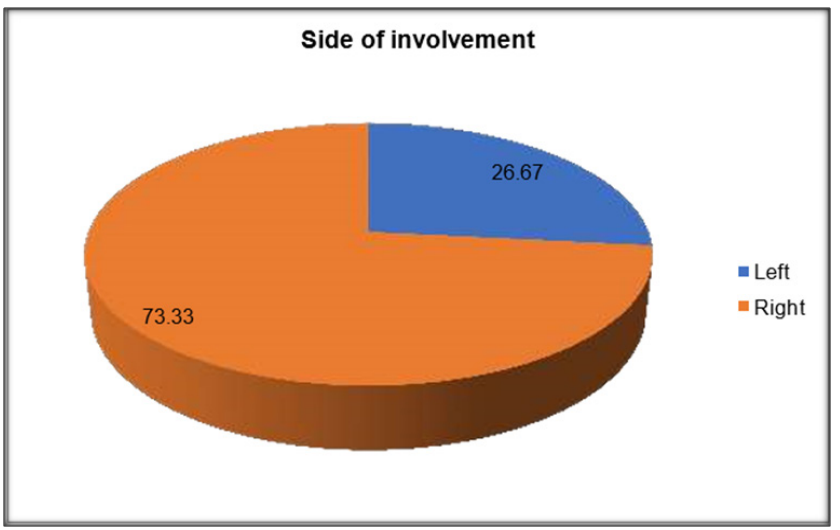
Graph 4: Distribution of patients according to type of fracture (Gustilo-Anderson classification)

According to Gustilo-Anderson classification we included in our study from type II to type III B, in our study 53.33 percent of the patients were belonging to type III A while 33.33 percent of the patients were of type III B. 13.33 percent of the patients were of type II.

Side of Injury

Table 5: Distribution of patients according to side of involvement

Side of involvement	Number of patients	Percentage
Left	8	26.67
Right	22	73.33
Total	30	100



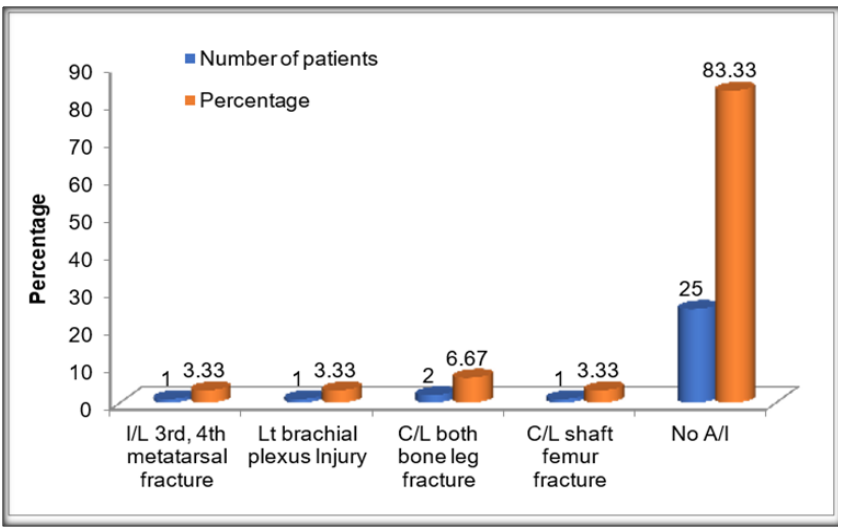
Graph 5: Distribution of patients according to side of involvement

In our study Right side involvement occurred in 73.33 percent of the patients while left side involvement occurred in 26.67 percent of the patients.

Associated Injury

Table 6: Associated Injury

Associated Injury	Number of patients	Percentage
I/L 3rd, 4th metatarsal fracture	1	3.33
Lt brachial plexus Injury	1	3.33
C/L both bone leg fracture	2	6.67
C/L shaft femur fracture	1	3.33
No A/I	25	83.33
Total	30	100



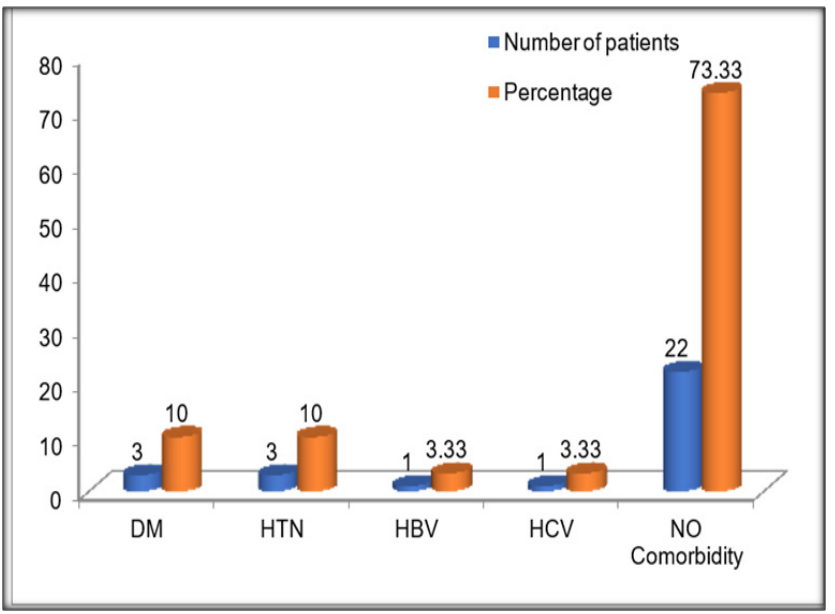
Graph 6: Associated Injury

In our study 6.67 percent of patients had C/L both bone leg injury, 3.33 percent patient come with Lt side brachial plexus injury while one patient (3.33 percent) presented with C/L shaft femur fracture. 83.33 percent patient had no associated injury.

Comorbidity

Table 7: Comorbidity

Comorbidity	Number of patients	Percentage
DM	3	10
HTN	3	10
HBV	1	3.33
HCV	1	3.33
NO Comorbidity	22	73.33
Total	30	100



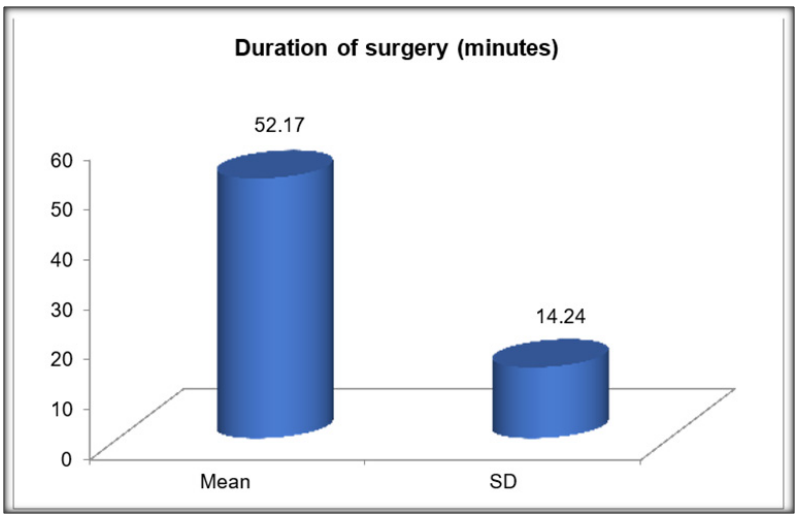
Graph 7: Comorbidity

In our study 10 percent of patients had Diabetes and Hypertension each while 3.33 percent patients presented with hepatitis B and hepatitis C infection each.

Duration of Surgery

Table 8: Duration of surgery

Parameter	Mean	SD
Duration of surgery (minutes)	52.17	14.24



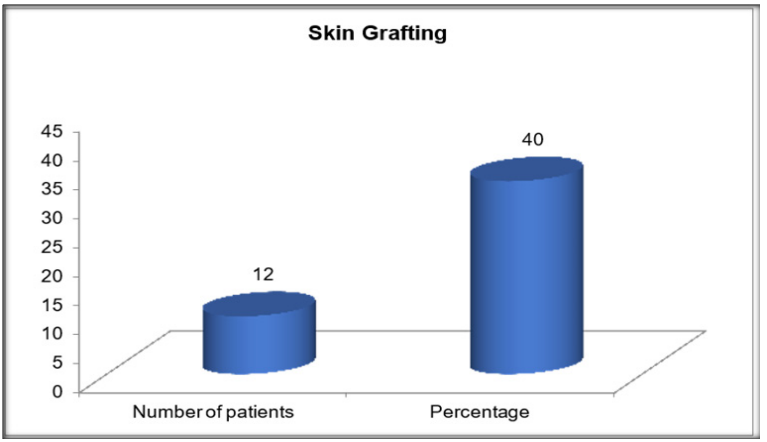
Graph 8: Duration of surgery

The Mean duration of surgery was 52.17 minutes.

Secondary Procedure

Table 9: Secondary procedure done

Secondary procedure done	Number of patients	Percentage
Skin Grafting	12	40
Total	30	100



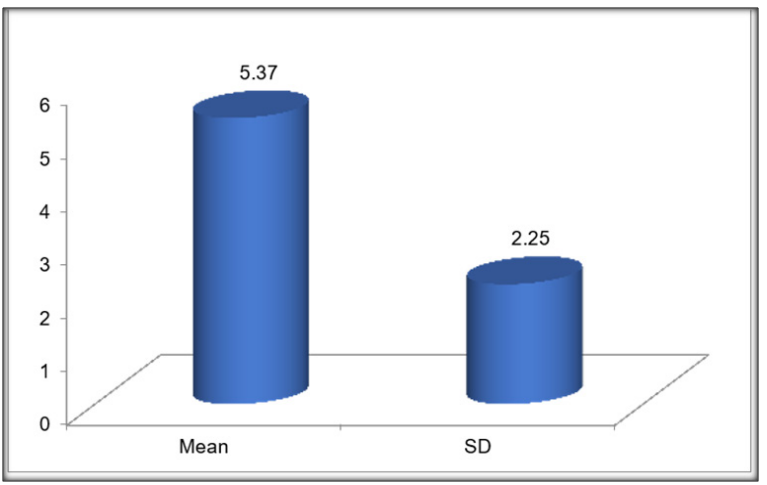
Graph 9: Secondary procedure done

In our study, Secondary procedures (Skin Grafting) were done in 40 percent of the patients.

Time of Full Weight Bearing Post-Operative

Table 10: Time of full weight bearing post-operative

Parameter	Mean	SD
Time of full weight bearing (days)	5.37	2.25



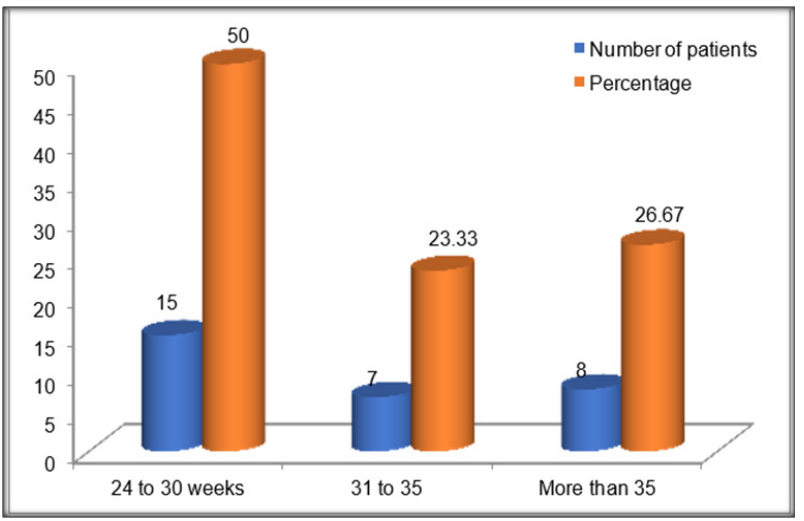
Graph 10: Time of full weight bearing post-operative

The mean time of full weight bearing post-operative was 5.37 days.

Time of Fracture Union

Table 11: Time of fracture union

Time of fracture union (weeks)	Number of patients	Percentage
24 to 30 weeks	15	50
31 to 35	7	23.33
More than 35	8	26.67
Mean ± SD	31.8 ± 5.8	8



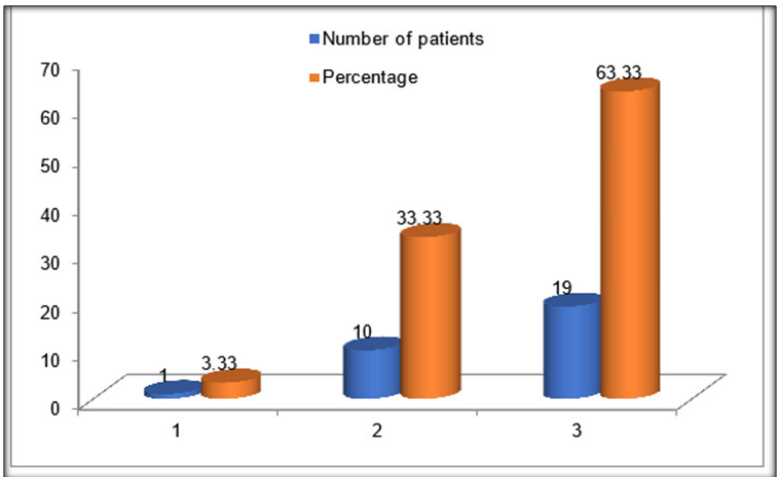
Graph 11: Time of fracture union

In our study, the 50 percent of the patients, time of fracture union was 24 weeks to 30 weeks, while in 23.33 percent of the patients; time to fracture union was 31 to 35 weeks. Mean time of fracture union was 31.8 weeks.

Rust Score

Table 12: RUST score (Radiographic Union Scale in Tibia)

RUST score	Number of patients	Percentage
1	1	3.33
2	10	33.33
3	19	63.33



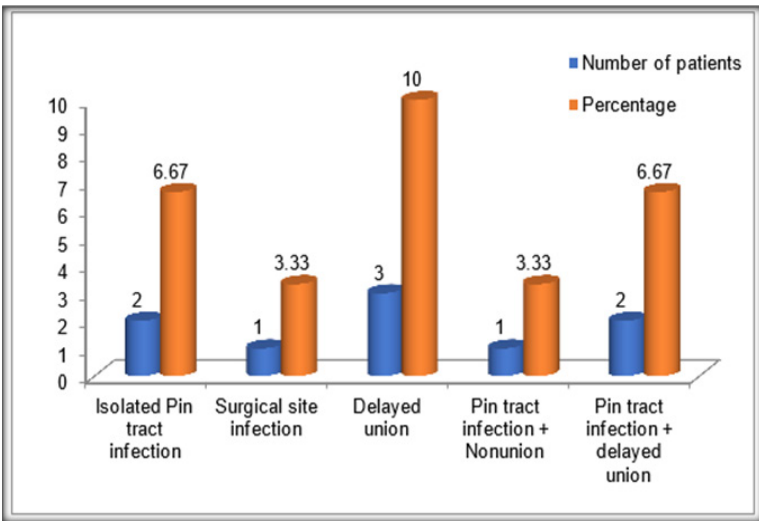
Graph 12: RUST score

In our study 33.33 percent of patients presented with RUST score 2 and 3.33 percent patient presented with RUST Score 1 while remaining 63.33 percent with RUST score 3.

Complication

Table 13: Complications

Complications	Number of patients	Percentage
Isolated Pin tract infection	2	6.67
Surgical site infection	1	3.33
Delayed union	3	10
Pin tract infection + Nonunion	1	3.33
Pin tract infection + delayed union	2	6.67



Graph 13: Complications

In our study Overall complications were seen in 9 patients. Two patient showed pin tract infection, one patient showed surgical site infection, one patient showed presence of pin tract infection along with nonunion. Two patients showed delayed union associated with pin tract infection the remaining 3 patients shows Delayed union only.

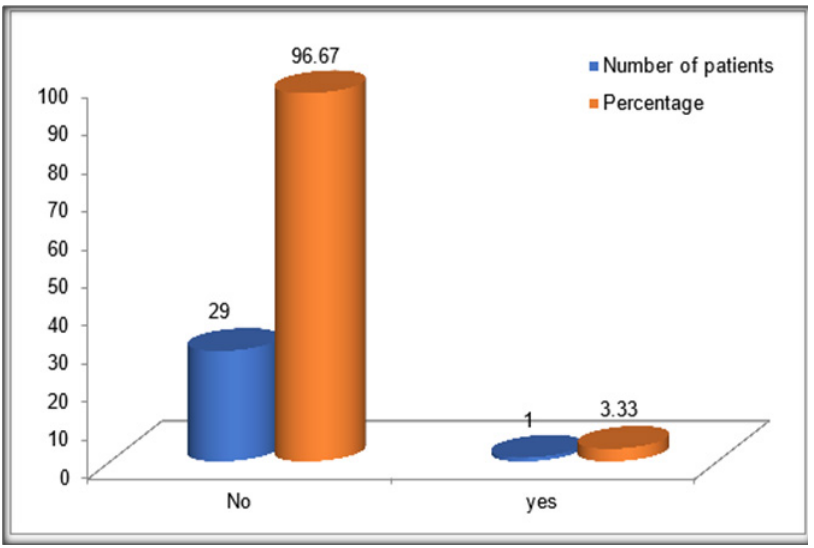
Modified Johner and Wruh's Criteria Parameters

A. Nonunion

Table 14: Nonunion

Nonunion	Number of patients	Percentage
No	29	96.67
yes	1	3.33

Total	30	100



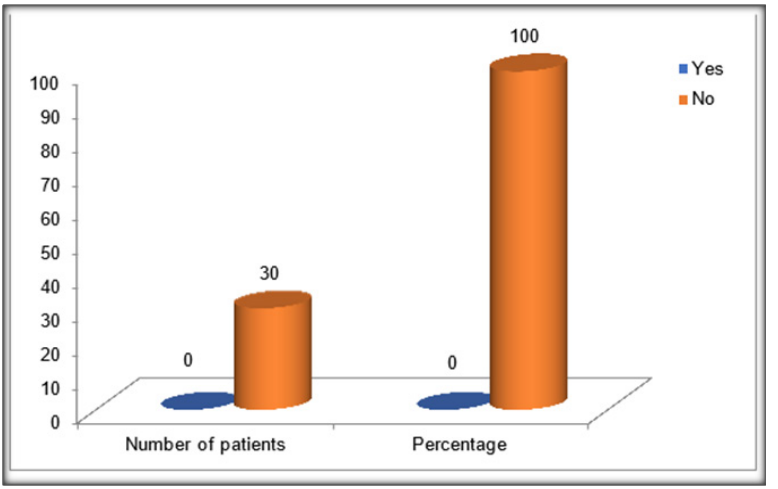
Graph 14: Nonunion

Among 30 cases, majority (96.67%) of the cases united within, whereas 3.33% cases landed into non- union.

B. Postoperatively Neurovascular Injury

Table 15: NVI - Postop

NVI - Postop	Number of patients	Percentage
Yes	0	0
No	30	100
Total	30	100



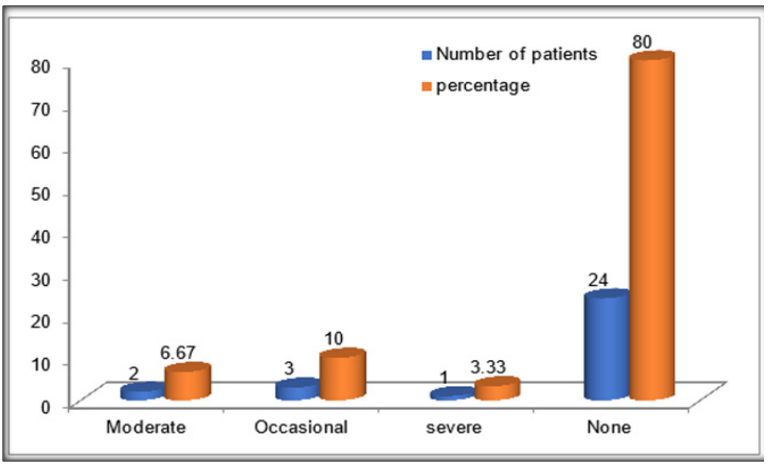
Graph 15: NVI - Postop

In our study neurovascular status after the placement of rail fixator was studied. Among 30 cases no neurovascular injuries seen post operatively.

C. Pain

Table 16: Pain

Pain	Number of patients	Percentage
Moderate	2	6.67
Occasional	3	10
severe	1	3.33
None	24	80
Total	30	100



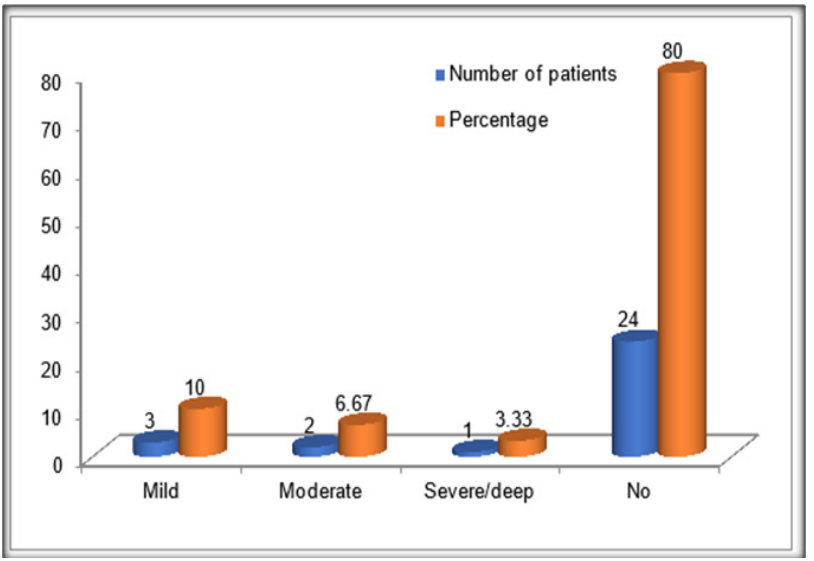
Graph 16: Pain

Among 30 cases, 6.67% cases were having moderate pain and 10% cases were having occasional pain where as 80% cases were fully recovered with no residual pain. One patient (3.33%) having severe type of pain. The functional assessment of pain was noted on the final follow up at time of fixator removal.

D. Infection

Table 17: Infection

Infection	Number of patients	Percentage
Mild	3	10
Moderate	2	6.67
Severe/deep	1	3.33
No	24	80
Total	30	100



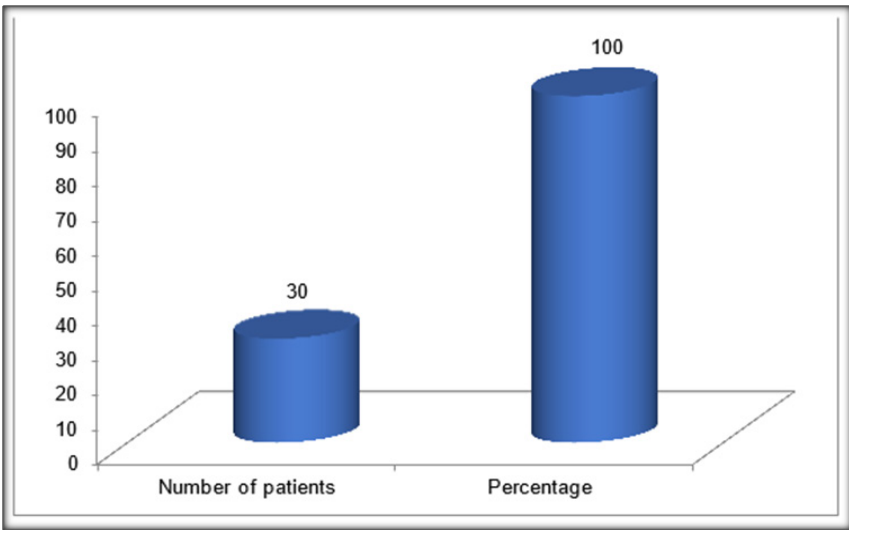
Graph 17: Infection

In our study among 30 patient's 10 percent of patients were presented with mild pin tract infection while 6.67 percent of patients came back with moderate infection on follow up. 3.33 percent of patients was presented with severe deep bone infection.

E. Knee and Ankle Range of Motion

Table 18: Knee range of motion

Knee range of motion	Number of patients	Percentage
Full range	30	100
Total	30	100



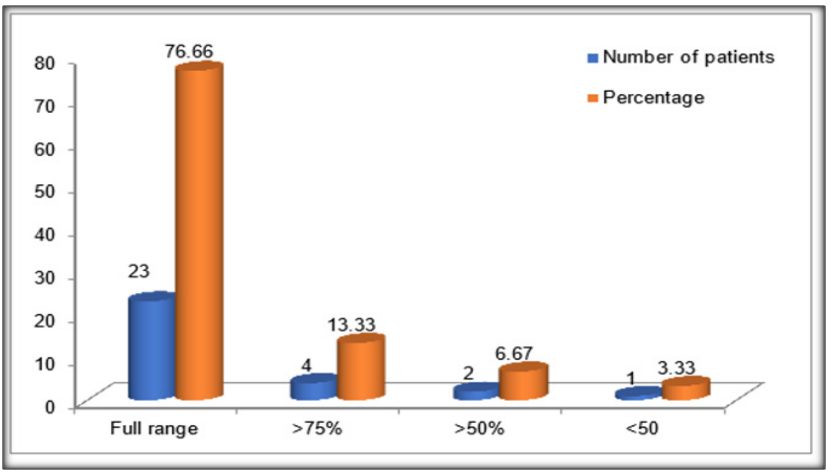
Graph 18: Knee range of motion

Full range of motion was present in 100 percent of the patients.

F. Ankle Range of Motion

Table 19: Ankle range of motion

Ankle range of motion	Number of patients	Percentage
Full range	23	76.66
>75%	4	13.33
>50%	2	6.67
<50	1	3.33
Total	30	100



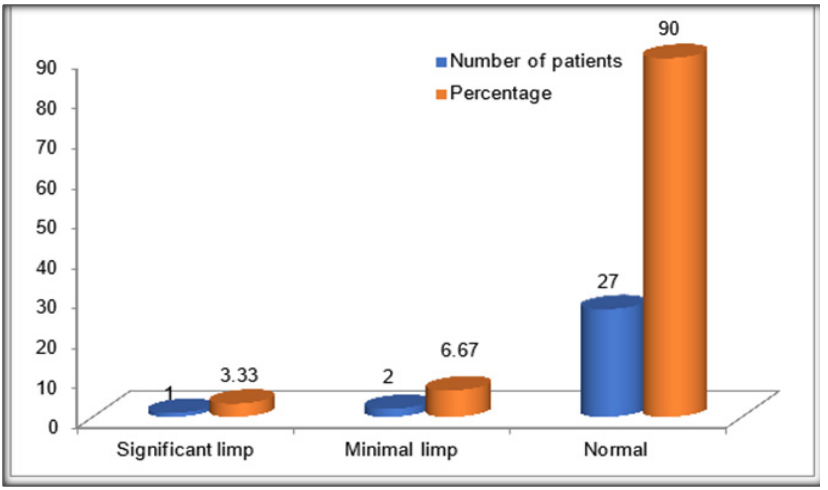
Graph 19: Ankle range of motion

Full range of motion at ankle joint was present in 76.66 percent of the patients while more than 75% present in 10 percentages of patients. 6.67 percent of the patients shows >50% range of motion at ankle and 3.33 percent patients shows <50%.

G. Gait

Table 20: Gait

Gait	Number of patients	Percentage
Significant limp	1	3.33
Minimal limp	2	6.67
Normal	27	90
Total	30	100



Graph 20: Gait

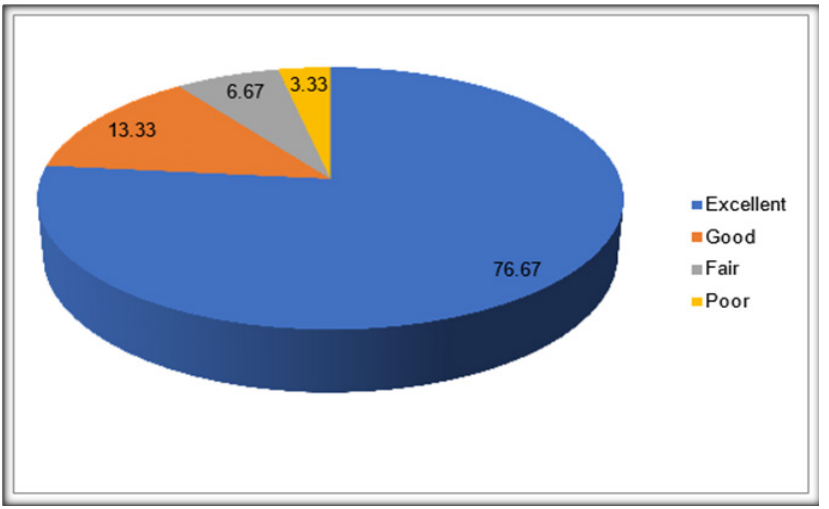
In our study among 30 cases, 3.33% cases were having significant limping gait and 6.67% cases were having minimal limping gait where as 90% cases were fully normal gait. The functional assessment of pain was noted on the final follow up at time of fixator removal.

H. RESULT

Table 21: Outcome according to Modified Johner and Wruh's criteria

Outcome according to Modified Johner and Wruh's criteria	Number of patients	Percentage
Excellent	23	76.67
Good	4	13.33
Fair	2	6.67

Poor	1	3.33
Total	30	100



Graph 21: Outcome according to Modified Johner and Wruh's criteria

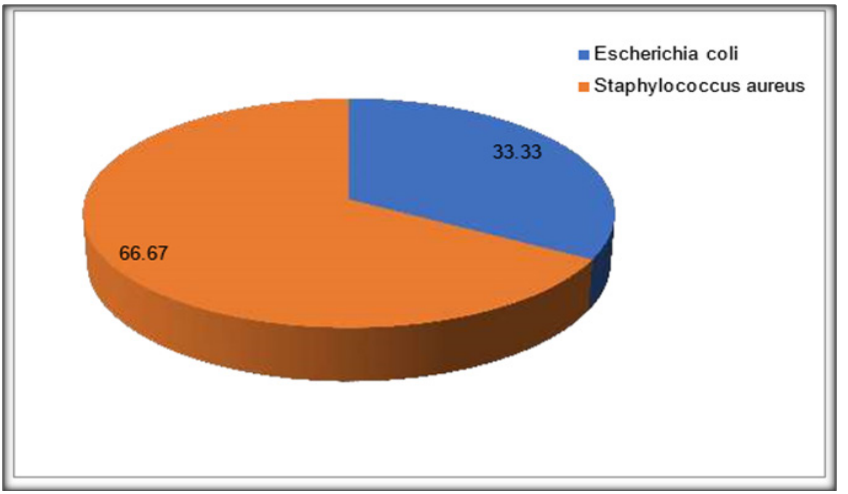
According to Modified Johner and Wruh's criteria, excellent results were seen in 76.67 percent of the patients while good results were seen in 13.33 percent of the patients. 6.67 percent of the patients showed fair results while 3.33 percent of patients show poor results.

Microbiological Profile

Table 22: Microbiological profile

Microbiological profile	Number of patients	Percentage
Escherichia coli	2	33.33
Staphylococcus aureus	4	66.67

Total	6	100



Graph 22: Microbiological profile

Microbiological culture and sensitivity testing was sent in 6 patients in whom complications were seen. Among these 6 patients, Escherichia coli were seen in 2 patient (33.33 percent) while staphylococcus aureus was seen in 4 patients (66.67 percent).

Antibiotic Sensitive Pattern

Table 23: Antibiotic sensitive pattern

Microbiological profile	Escherichia coli (n=2)		Staphylococcus aureus (n=4)	
	Sensitive	Resistant	Sensitive	Resistant
Amikacin	+		++	
Gentamicin	+			-
Ciprofloxacin		-		--
Ceftriaxone	+		++	
Cotrimoxazole	+			

Clindamycin			+	
Erythromycin				--
Vancomycin			++	
Ampicillin		-	++	

Antibiotic sensitivity of E. coli was seen for Amikacin, Gentamicin, Ceftriaxone, and Cotrimoxazole. Antibiotic resistance of E. coli was seen for Ciprofloxacin, Ampicillin. Antibiotic sensitivity of Staphylococcus aureus was seen for Amikacin, Clindamycin, Vancomycin, Ampicillin and Ceftriaxone while resistance was seen for Erythromycin, Gentamicin and ciprofloxacin.

CASE-1

Preoperetive xray

Intra-operative picture

Postoperetive xray

Postoperetive full weight bearing (FWB) picture

Follow up range of motion at knee and ankle

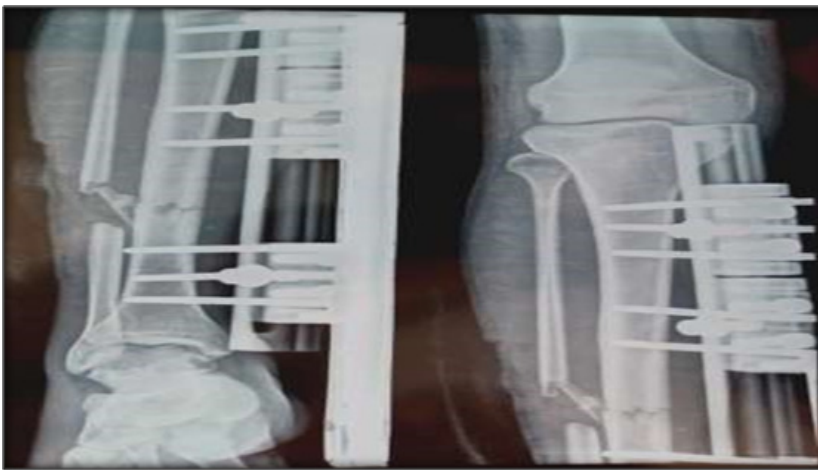
Follow up xray

Case 2

Preoperative x-ray

Intraoperative picture

Postoperative x-ray



Postoperative FWB

Range of motion at knee and ankle on follow up

Patellar tendon bearing cast (PTB cast)

Follow-up x-ray

Case-3

Preoperative X-ray

Dr.

Postoperative X-ray

Postoperative FWB picture

Range of motion at knee and ankle on follow up

Follow-up Xray