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Functional Outcome of Surgical Treatment of Combined Posterior wall and Posterior Column Acetabular Fracture (2005-2015)

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Abstract

Background: *One of the major advances in the field of orthopaedic traumatology is the treatment of acetabular fractures. Until recently all acetabular fractures were treated primarily by closed methods. Acetabular fractures are complex fractures, and achieving optimum result requires experience. Fractures of acetabulum are very difficult to treat because of the difficulty in understanding the fracture pattern, difficult surgical approach and difficulty in achieving anatomical reduction.*

Objective: *the main objective of this study is to assess Outcome of Surgical fixation of combined posterior wall and posterior column acetabulum Fractures in Sudan.*

Material and Method: *The sample of this study was 38 patients who sustained combined posterior wall and posterior column acetabular fracture who underwent internal fixation through posterior approach* ***(****Kocher Langenbeck approach****)*** *by reconstruction plate from different hospitals in Khartoum state Sudan. The data of this study collected through form of data collection during a period* ***(****2005-2015****)****. This form contains two parts which are clinical data pre-operative and clinical data post-operation. We use modified MAJEED SCORE to evaluate the functional outcome.*

Result: *The functional outcome after one year from surgery was excellent in 71% of our patients, good in 21% of our patients and poor in 8% of patients.*

Conclusion: *With the availability of imaging, expert surgeon, good perioperative and postoperative care, we believe that the surgical fixation of combined posterior wall and posterior column acetabular fractures would yield better results.*

Key words: *Posterior wall and posterior column acetabular fracture, Operative fixation, Open reduction.*

Introduction

Background

One of the major advances in the field of orthopedic traumatology is the treatment of acetabular fractures. Until recently all acetabular fractures were treated primarily by closed methods. Acetabular fractures are complex fractures, and achieving optimum result requires experience. Fractures of acetabulum are very difficult to treat because of the difficulty in understanding the fracture pattern, difficult surgical approach and difficulty in achieving anatomical reduction.

Acetabular fractures are often caused by high energy trauma and associated injuries are frequent.**(**1**)** Treatment should follow accepted ADVANCED TRAUMA LIFE SUPPORT **(**ATLS**)** protocol, with orthopaedic management of acetabular fracture appropriately integrated into the treatment plan.**(**1**)** Fractures of the acetabulum make up about 2% of all fractures but are associated with significant morbidity and mortality due to high energy transfer, other injuries, local visceral damage and neurovascular and joint trauma.**(**2**)** The incidence of acetabular fractures is 3 per 100000 /year.**(**3**)** The mean age of occurrence of these fractures is 36 years with the male: female ratio being 6:1.5.

Conservative treatment of acetabular fractures has been criticized because of the inability to restore joint congruity, thereby causing increased incidence of osteoarthritis.**(**4,5**)** In the earlier days, as the anatomy of the pelvis and acetabulum was poorly understood, the acetabular fractures were managed conservatively and hence the outcome was poor as the anatomical reduction could not be attained. As the medical science has advanced the newer diagnostic tools like the CT scan have helped us to analyse the three dimensional disturbance in the normal anatomy and plan the surgical management accordingly. Hence, the outcome of surgically managed acetabular fractures has been found to be better.

Operative treatment is the treatment of choice in the management of acetabular fractures as precise anatomical reduction with adequate internal fixation can be attained.**(**4**)** In 1960, Judet first suggested that open reduction and internal fixation be done in all cases of displaced acetabular fractures to achieve accurate reduction.

The accuracy of reduction of an acetabular fracture is directly proportional to the number of surgeries performed by the surgeon. In short, experience of the surgeon has a vast role in attaining anatomical reduction of the fracture. **(**1, 4**)**

The morbidity in acetabular fractures is significantly high. Hemorrhage is the most immediate and perilous complication. The other causes of early morbidity are open and closed degloving injuries, superadded infection and thrombotic phenomenon. **(**6**)**

The late morbidity in pelvi- acetabular trauma is usually due to chronic pain, postural and gait disturbances or persistent neurological deficits in the lower extremities, and genitourinary or rectal dysfunctions.**(**6**)** In acetabular arthritis, avascular necrosis and heterotropic ossification are commonly seen.**(**7**)**

In the past decade, the emergence of pelvic and acetabular trauma surgery as a specialty has led to increased experience and expertise with these fractures resulting in decreased technical difficulties and wider acceptance of standard techniques. A thorough understanding of normal pelvic anatomy, plain radiograph and CT is necessary to understand the fracture patterns. An understanding of the Letournel classification aids the surgeon in understanding the individual fracture pattern, in planning the surgical approach, and in understanding surgical reduction techniques for a given fracture.

Posterior wall acetabular fracture is the most common type of acetabular fracture **(**up to 50% of acetabular fractures will contain a posterior wall fragment**).(**8**)** 90% of dislocations of the hip are posterior, most often secondary to motor vehicle accidents and knee-to-dashboard trauma with a posterior directed force.**(**9**)**in this study we will concentrate on functional outcome of the posterior wall and posterior column injuries of the acetabulum after surgical fixation as it is the most common and most important acetabulum fracture and no available data about this important injure in our country.

Classification of acetabular fractures.

Letournel Classification
Judet and Letournel o most common referenced classification system o classified as 5 elementary and 5 associated fracture patterns

Elementary	characteristic
Posterior wall	• Most common • "gull sign" on obturator oblique view
Posterior column	• check for injury to superior gluteal NV bundle
Anterior wall	• Very rare
Anterior column	• More common in elderly patients with fall from standing **(**most common in elderly is "anterior column + medial wall"**)**
Transverse	• Axial CT shows anterior to posterior fx line • Only elementary fx to involve both columns
Associated Both Column	• Characterized by dissociation of the articular surface from the inonimate bone; will see "spur sign" on obturator oblique
Transverse + Post. Wall	• Most common associated fx
T Shaped	• May need combined approach
Anterior column or wall + Post. Hemi transverse	• Common in elderly patients
Post. Column + Post. Wall	• Only associated fracture that does not involve both columns

Justification

Acetabular fracture is an important and serious fracture.

i. We need more study about this important and serious injury in Sudan to council our patients about the outcome and prognosis of this common and important injury.
ii. This study is expected to increase our knowledge in this field that help us to choose the better option in treating our patients.

Outcome Scoring systems

There are many scoring systems used to asses the functional outcomes of hip joint the most used system is Merle d´Aubigné and Postel the original version published in 1954: Contain **(**Pain, mobility, ability to walk**)**.

Meena et al use this score to asses one hundred and eighteen patients, treated surgically for their displaced acetabular fracture after two years follow-up, they found that the mean score was 15.7+/-2.2 **(**range from 8-18**)**, the outcomes was excellent in 27 **(**22.9%**)**, good in 52 **(**44.2%**)**, fair in 20 **(**16.9%**)** and 10 patients with poor outcome. **(**10**)**

Harris Hip score is another score which was developed for assessment of the results of hip surgery, and is designed to evaluate various hip disabilities in adult population. The original version published in 1969. It Contain **(**pain, function, absence of deformity, and range of motion**)**.

Shaukat et al use this score in their study on the functional outcome of surgery in thirty cases with acetabular fracture in six months and found that 21 patients have good score, 4 patients with excellent score while 5 patients with poor result. **(**11**)**

Other scores like, the Hip Disability and Osteoarthritis Outcome Score, the Oxford Hip Score, the Lequesne Index of Severity for Osteoarthritis of the Hip and the American Academy of Orthopedic Surgeons Hip and Knee.

Almost all of the hip scores made to assess the Degenerative hip joint and some of them used in assessment of post-operative pelvis and acetabulum fractures.

The special scoring system that used to measure the post-operative functional outcome was Majeed Score which published in 1989. Majeed Score asses **(**Pain, work, sitting, sexual intercourse & walking 'gait, aid & distance'**)** post-operatively.

Another score that first presented by Kebaish **(**12**)** based on range of motion at the hip joint, status of ambulation and adequate muscle strength and published in more recent research that done by Naseem Munshi et al who study 75 and compare the functional score with the quality of reduction. **(**13**)**

Objectives

General objectives

I. To assess functional Outcome of Surgical Fixation of combined posterior wall and posterior column acetabulum Fractures in Sudan

Specific objectives

Assess the functional outcome of surgical fixation of combined posterior wall and posterior Column acetabular fracture according to:

I. Age.
II. Gender
III. Time of intervention
IV. Mode of trauma.
V. Presences or absences of other non-skeletal injuries pre-operative.
VI. Presences or absences of post-operative complications.

Methodology

Type of study:

Cross-sectional hospital based study.

Sampling:

Sample size; A total of 38 patients collected through total coverage.

Sample plan:

The sample of this study involve all documents of patients who sustained combined posterior wall and posterior column acetabular fractures who underwent internal fixation through the posterior approach **(**Kocher Langenbeck approach**)** by reconstruction plate from different hospitals in Khartoum state, Sudan.

Data was collected through questionnaires during a period between 2005- 2015. The questionnaire contained two parts which are; clinical data pre-operative and clinical data post-operation assessment.

We used modified MAJEED SCORE to evaluate the functional outcome. The modified scoring system contained four indicators which were, pain, sitting, walking and return to work. The pain had three grades **(**no pain, pain with activity and pain at rest**)**.

Regarding sitting we can categorize it into **(**sitting without modification, sitting with modification and unable to sit**)**. We also subdivide the ability of our patient to walk into **(**walking without pain or deformity, walking with pain or deformity and unable to walk**)**.

We classified the patients according to their ability to return to work into three categories **(**return to pervious work without any modification, return to work with modification and cannot return to their wok**)**.

All this above information allowed us to categorize the surgical outcomes of patients into excellent, good or poor outcomes.

Sample analysis:

The data of this study was processed by SPSS 20th edition. Test of significance was chi square test.

Inclusion criteria:

i. All patients in age group **(**20-60**)**
ii. All patients presented with posterior wall and posterior column acetabulum fracture and treated by ORIF.

Exclusion criteria:

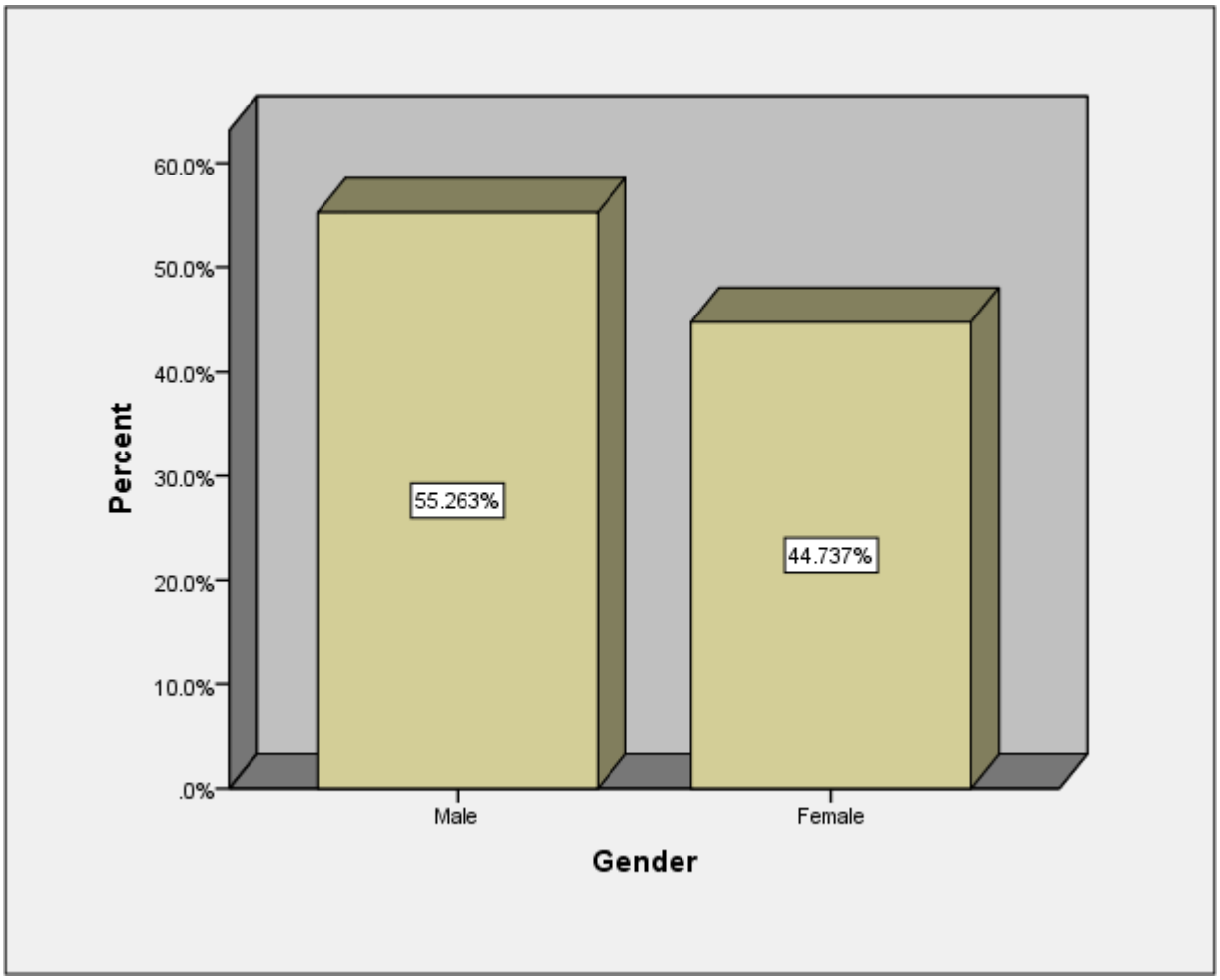
i. Patients with acetabulum fracture who are treated conservatively.
ii. Patients with preexisting bone pathology that may affect the outcome.
iii. Patients with other disease **(**CVA, Parkinson, ataxia,..etc**)** that may affect the outcome.

Ethical Consideration:

Obtain ethical clearance from SMSB and the ethical committee at research unit-EDC, and ethical approval from hospital administration for this study. We waive the requirement of informed consent because this research will not affect the clinical care of patients who already leave the hospital & by coding the records with numbers.

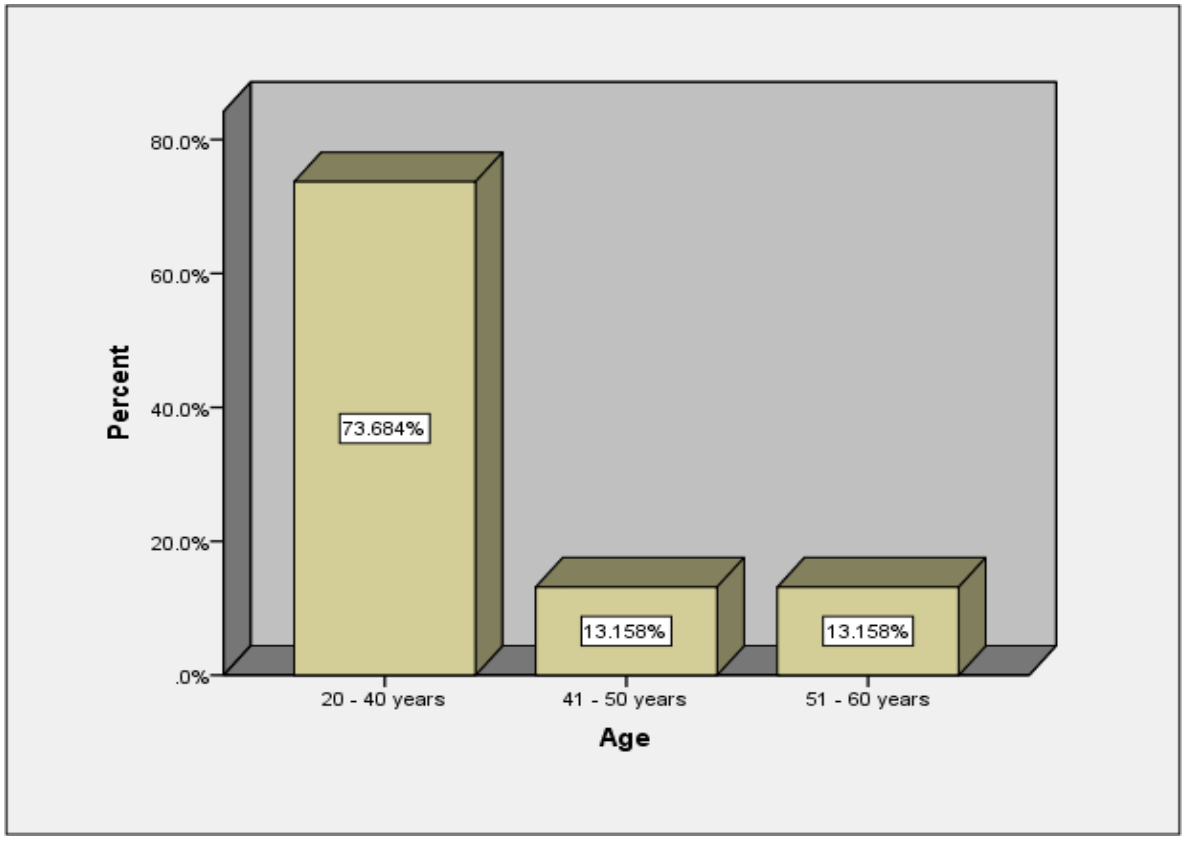
Results

There were 50 patients with combined posterior wall and posterior column acetabular fracture treated surgically by recon plate through posterior approach all done in bahri and shawamikh hospitals. After considering the inclusion and exclusion criteria only 38 patients fulfilled the requirements. Of these patients, there were 55.3% males and 44.7% females as demonstrated in grapgh **(**6-1**)**.



Graph (1-6): show the gender distribution of the patients.

Patients were classified according to their age in to three age groups. The first group was from 20- 40 years **(**73.6%**)**, the second group was 41- 50 years and **(**13.2%**)** and the last group was 50-60 years which constituted 13.58% as well as seen in graph **(**6-2**)**.



Graph (6-2): show the age groups of our patients.

Regarding the mode of trauma the main cause of this injury was RTA which was reported in 97.4%, fall from height was reported in less than 3% of our patients as shown in the diagram **(**6-1**)**.

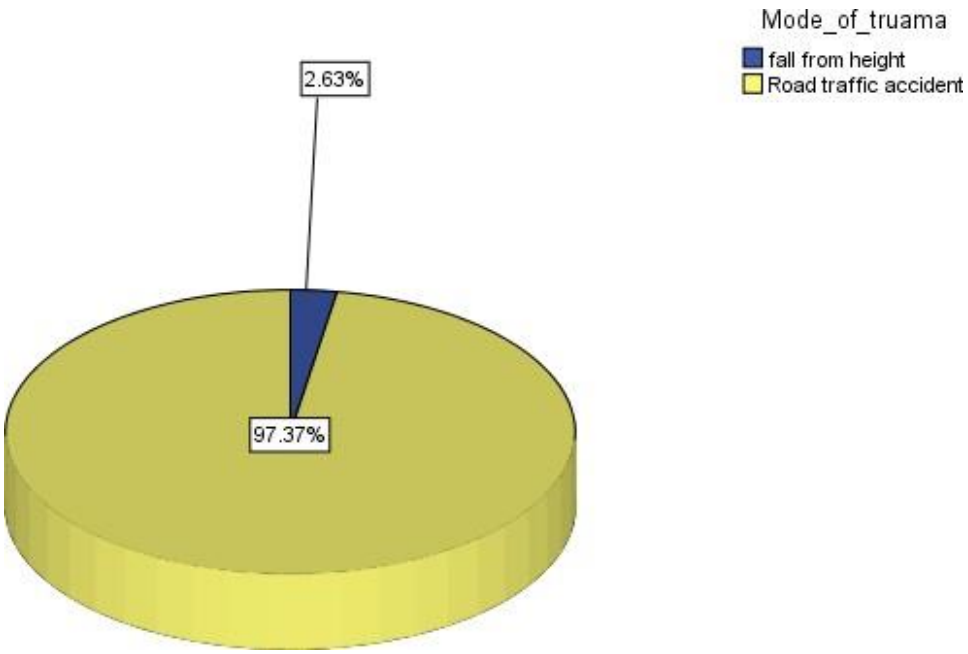
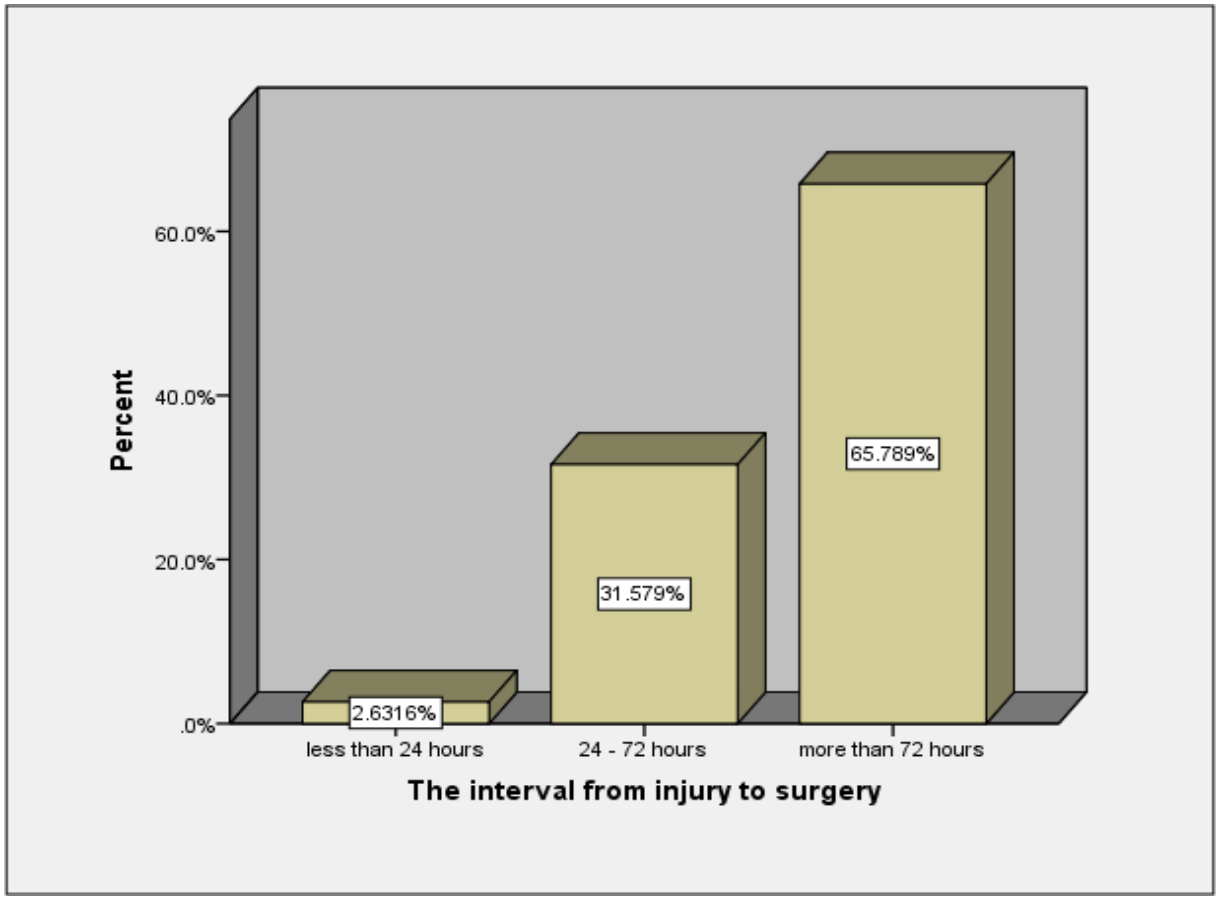


Diagram (6-1): show the causes of the injury.

Regarding the interval between the time of injury to the time of surgery the patients were categorized into three groups as well. In the first group the interval from injury to surgery was less than 24 hours and this was reported in 2.6% of our patients, in the second group the time from trauma to the surgery was more than 24 hours and less than 72 hours and this time was reported in 31.6% the last group was those who wait more than 72 hours without surgical intervention and this group was the main group it provide 65.8% of our patients as we can see in Graph **(**6-3**)**.



Graph (6-3): show the distribution of patients according to the interval from injury to surgery.

60% of our patients had associated skeletal injuries which included hip dislocation, femur fracture, tibia fracture, upper limb fracture and pelvic fracture as we can see in Diagram **(**6-2**)**.

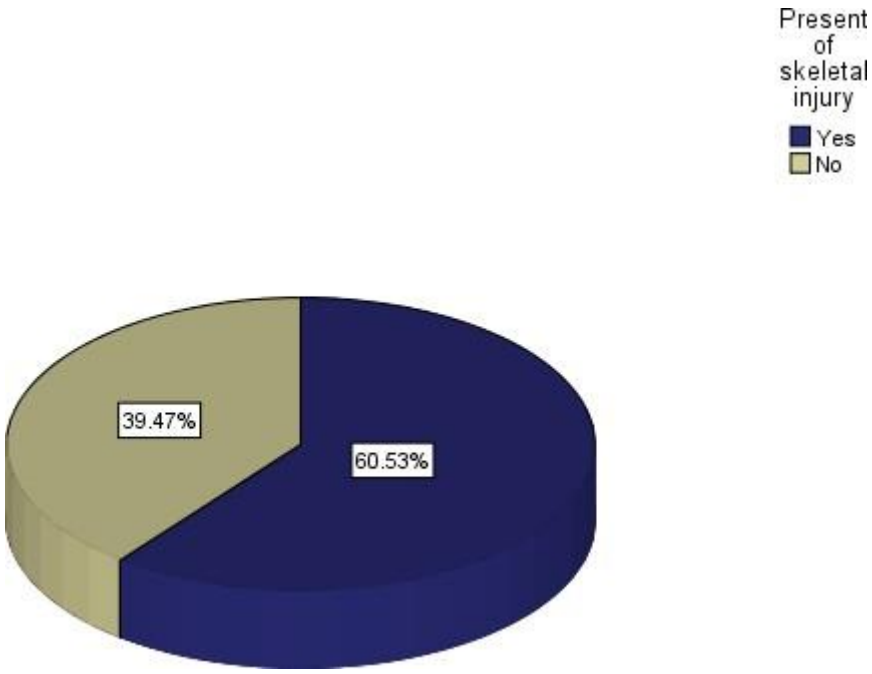


Diagram (6-2): show the percentage of associated skeletal injury.

Non skeletal injuries **(**head, chest, abdomen and others**)** were reported in 15.7% of the patients. Chest injury was presents in 2.6% patients, head injury was reported in 5.6% patients, and other non-skeletal injuries were reported in 7.8% of our patients as shown in Diagram **(**6-3**)** and Graph **(**6-4**)**.

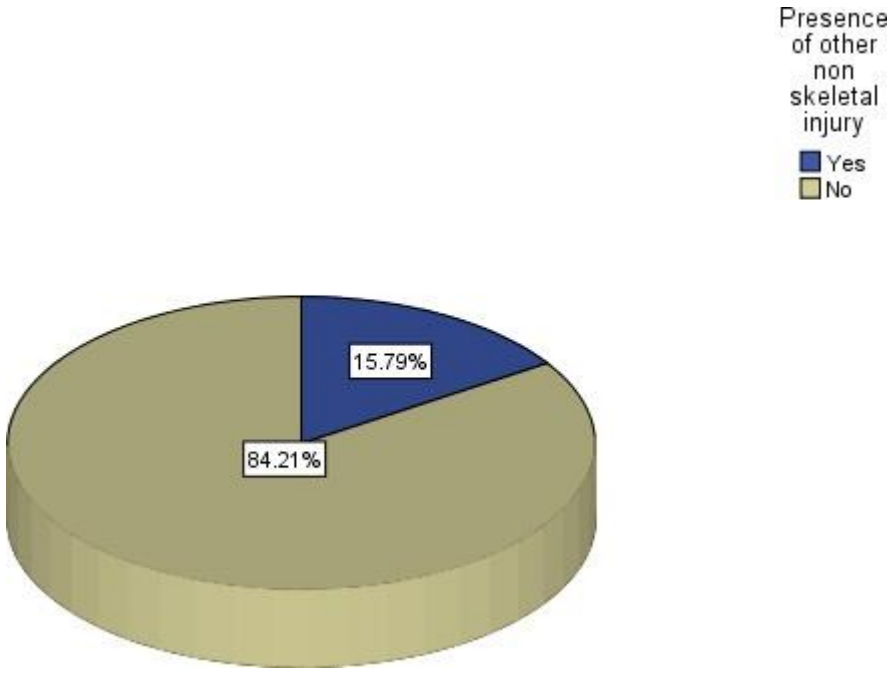
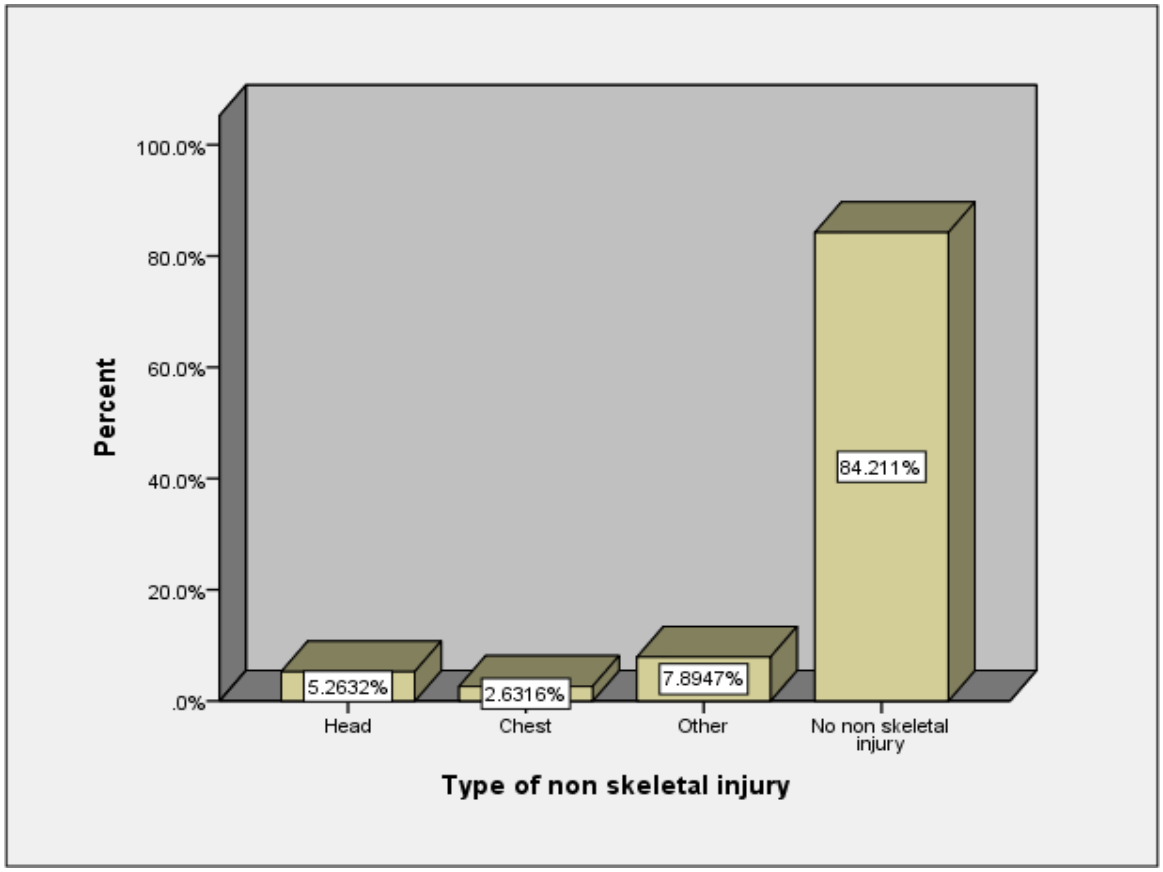


Diagram (6-3): show the percentage of associated non-skeletal injuries.



Graph (6-4): show the types of associated non-skeletal injuries.

Post-operative complications were observed in 32% of our patients which included AVN in 21% of the patients, nerve injuries reported in 5% patient, infection in 3% of the patients and other complications such as osteoarthritis in 3% of our patients as seen in Diagram **(**6-4**)** and **(**6-5**)**.

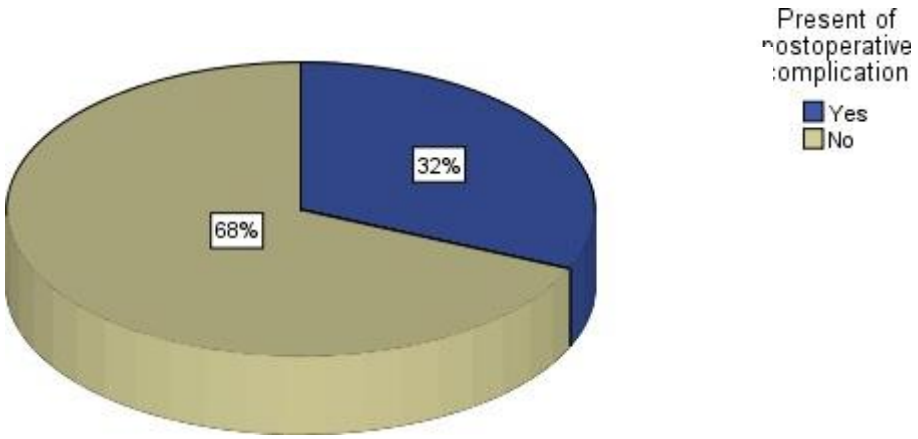


Diagram (6-4): show the percentage of post-operative complications.

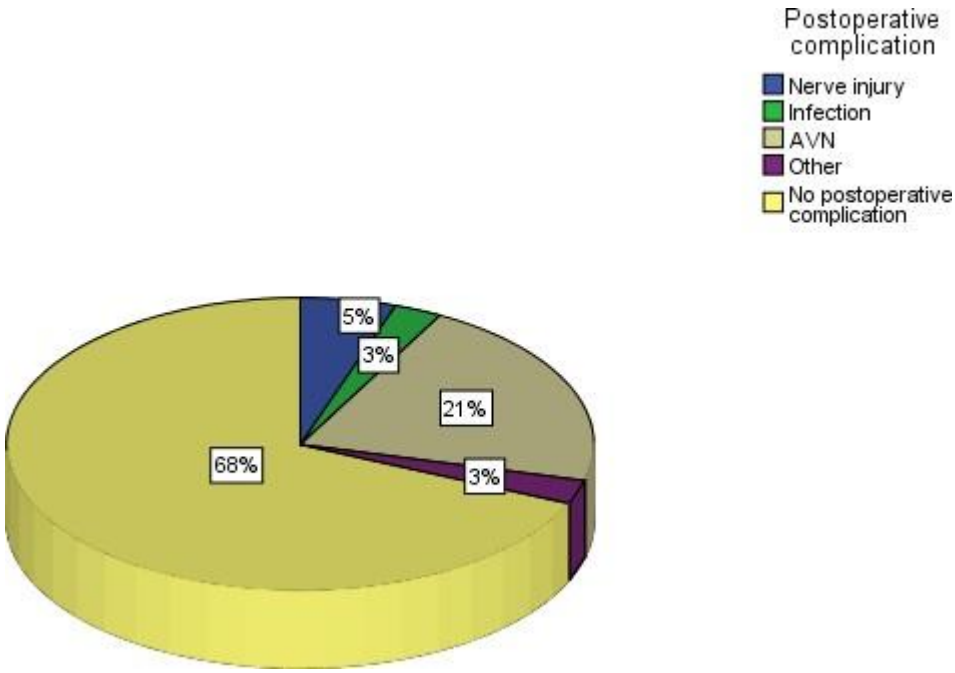
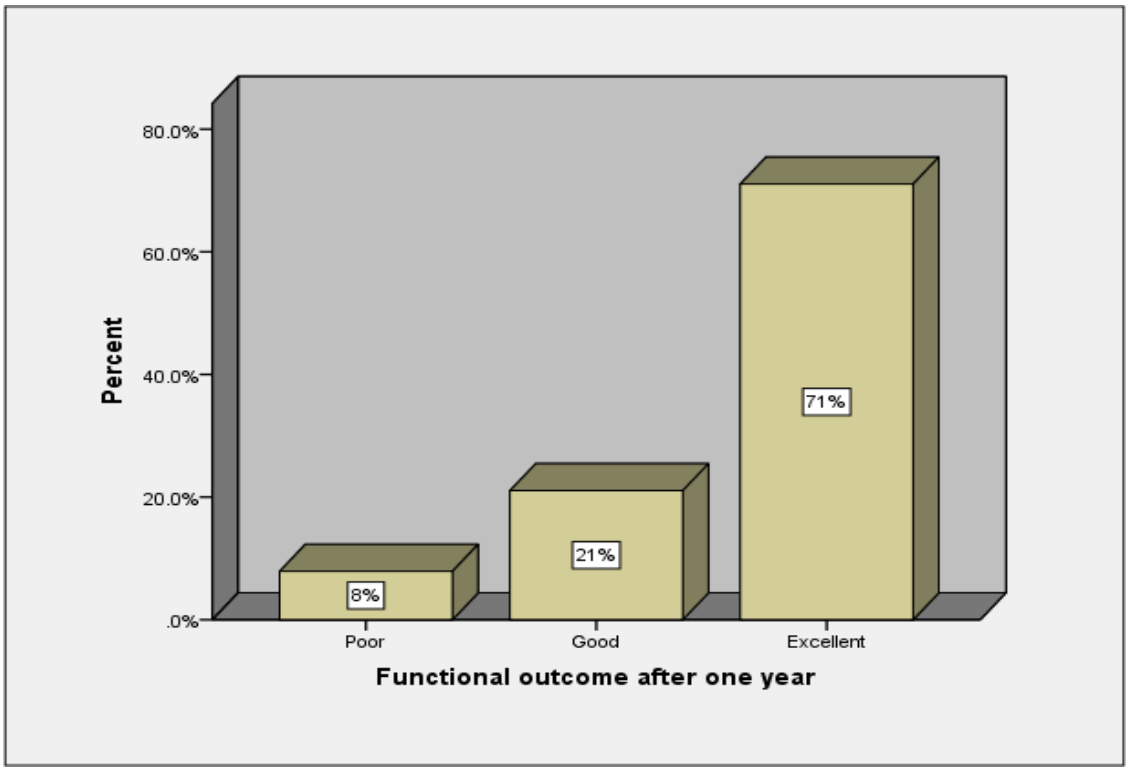


Diagram (6-5): show the types of post-operative complications.

Follow up was done for one year and we used modified MAJEED score to assess the functional outcome after one year from surgery. Excellent outcome was seen in 71% of our patients, good outcome was seen in 21% of our patients and poor outcome was reported in 8% of the patients as shown in Graph **(**6-6**)**.



Graph (6-6): show the functional outcome after one year.

In regards to our hypotheses, there was strong relation between the functional outcome and the age of patients as seen in table **(**6-1**)**, **(**6-2**)** and Graph **(**6-7**)** with a P value of .031.

Age * Functional outcome after one year Crosstabulation

Count

		Functional outcome after one year			Total
		Poor	Good	Excellent	
Age	20 - 40 years	0	6	22	28
	41 - 50 years	1	1	3	5
	51 - 60 years	2	1	2	5
Total		3	8	27	38

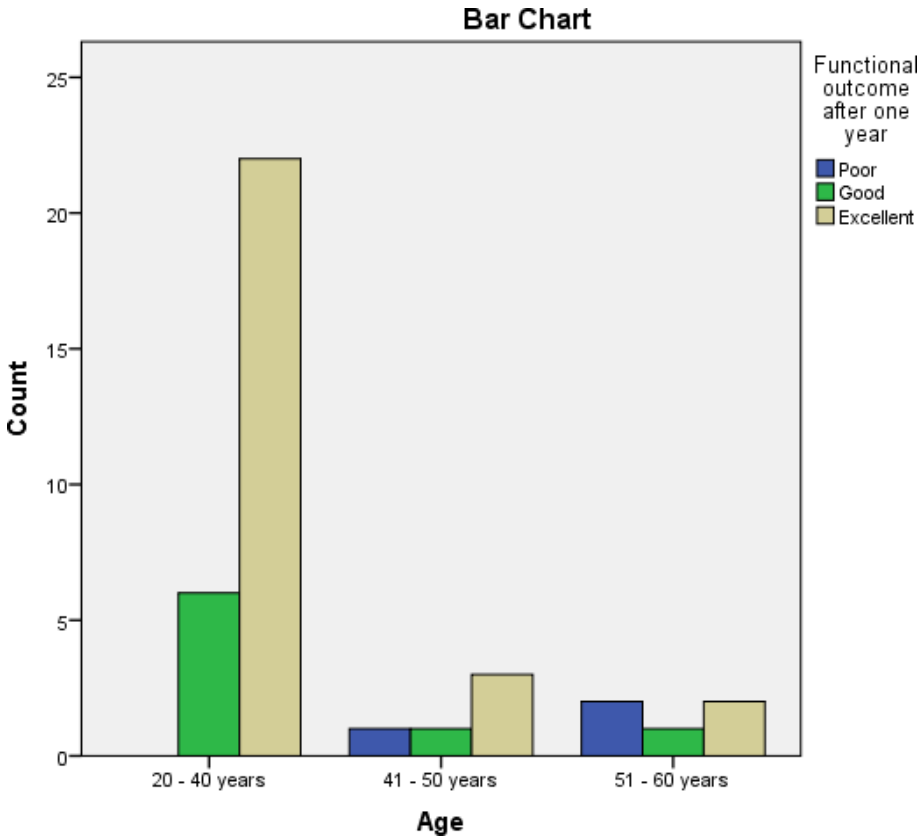
Table (6-1): show the relation between age and functional outcome

Chi-Square Tests

	Value	Df	Asymp. Sig. **(**2-sided**)**
Pearson Chi-Square	10.661[a]	4	.031
Likelihood Ratio	9.470	4	.050
Linear-by-Linear Association	7.298	1	.007
N of Valid Cases	38		

*7 cells **(**77.8%**)** have expected count less than 5. The minimum expected count is .39.*

Table (6-2): show the relation between age and functional outcome



Graph(6-7): show the relation between the age and the outcome.

There was also a strong relation between the outcome and the presence of non- skeletal injuries as shown in table **(**6-3**)**, **(**6-4**)** and Graph **(**6-8**)** with a P value of .041

Type of non skeletal injury * Functional outcome after one year Crosstabulation

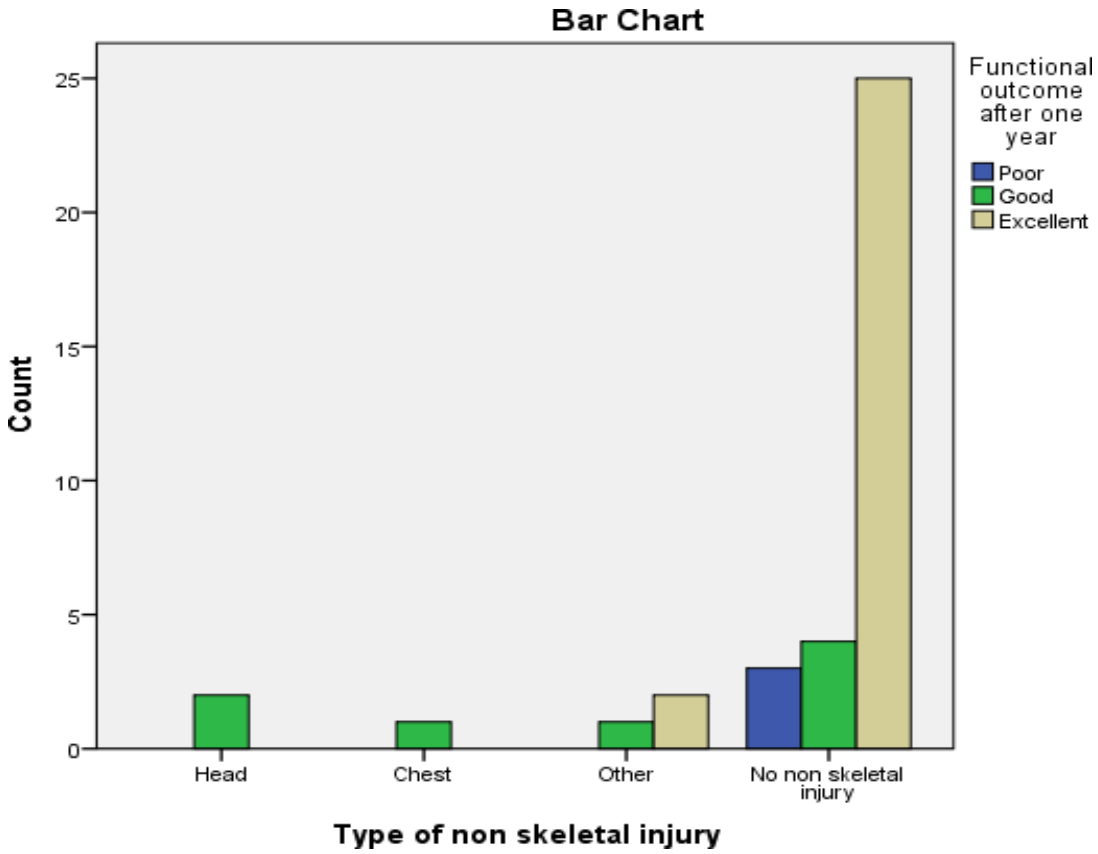
		Functional outcome after one year			Total
		Poor	Good	Excellent	
Type of non skeletal injury	Head	0	2	0	2
	Chest	0	1	0	1
	Other	0	1	2	3
	No non skeletal injury	3	4	25	32
Total		3	8	27	38

Table (6-3): show the relation between the associated non-skeletal injuries and the functional outcome after one year.

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.136[a]	6	.041
Likelihood Ratio	11.618	6	.071
Linear-by-Linear Association	3.149	1	.076
N of Valid Cases	38		

Table (6-4): show the relation between the associated non-skeletal injuries and the functional outcome after one year



Graph (6-8): show the relation between the associated non-skeletal injuries and the functional outcome after one year.

The functional outcome also was affected by the presence of post-operative complications as we can see in table **(**6-5**)**, **(**6-6**)** and Graph **(**6-9**)** with a P value of .000.

Postoperative complication * Functional outcome after one year Crosstabulation

Count

		Functional outcome after one year			Total
		Poor	Good	Excellent	
Postoperative complication	Nerve injury	1	1	0	2
	Infection	0	0	1	1
	AVN	2	6	0	8
	Other	0	0	1	1
	No postoperative complication	0	1	25	26
Total		3	8	27	38

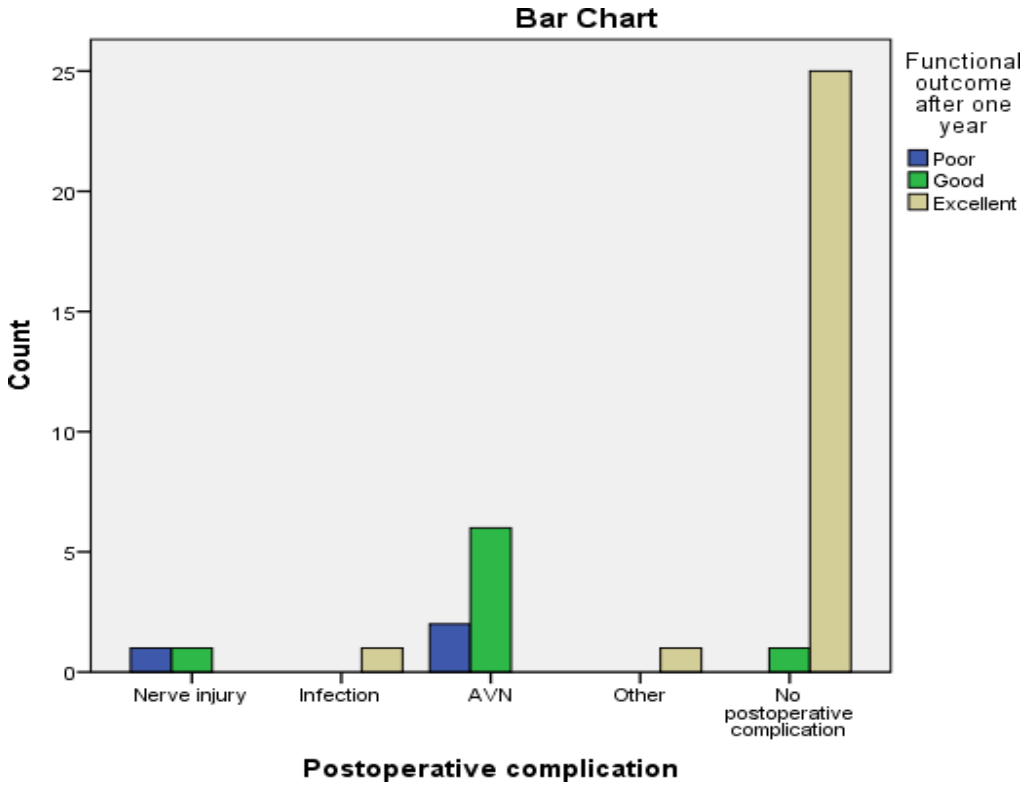
Table (6-5): show the relation between the functional outcome and the post-operative complications

Chi-Square Tests

	Value	Df	Asymp. Sig.**(**2-sided**)**
Pearson Chi-Square	35.246[a]	8	.000
Likelihood Ratio	38.371	8	.000
Linear-by-Linear Association	24.375	1	.000
N of Valid Cases	38		

*a. 12 cells **(**80.0%**)** have expected count less than 5. The minimum expected count is .08.*

Table (6-6): show the relation between the functional outcome and the post-operative complications.



Graph (6-9): show the relation between the functional outcome and the post-operative complications.

There was no relation between the interval from trauma to surgery and the functional outcome with a P value of 0.674.

And no relation between the presence of other skeletal injuries and the functional outcome with a P value of 0.734.

The gender of the patient did not affect the functional outcome with a P value of 0.664 nor did the mode of trauma with a P value of .

There was no relation between the presence of associated skeletal injuries pre- operative and development of post-operative complications **(**P value 0.452**)** especially the presence of posterior hip dislocation and development of AVN after one year.

Discussion

Acetabular fractures are complex high energy injuries and have the potential for a poor outcome regardless of the treatment method. Surgical treatment of displaced acetabular fractures is beyond any doubt the treatment of choice, because it gives a better chance for the anatomical reconstruction of the joint.

The goals of surgical treatment are the correction of significant deformity, prevention of late deformity and instability and restoration of pain-free function.

There are many factors that affect the functional outcome of acetabular fractures fixation which are the type of fracture, surgical approaches, age of the patient and severity of the initial injury, time needed before surgical intervention, mode of trauma and presence of postoperative complications.

We studied 38 patients with combined posterior wall and posterior column acetabular fracture all of which were treated as ORIF with reconstruction plate through Kocher Langenbeck approach.

We tried to determine the effect of certain factors such as age, sex, mode of trauma, time from injury to intervention, severity of the initial trauma, associated skeletal and skeletal injuries and presence of postoperative complications on the functional outcome of this particular type of acetabular fracture.

We assessed the functional outcome in our patients after one year of follow up and we observed excellent outcome in 71% of our patients, good outcome was seen in 21% of our patients and poor outcome was reported in 8% patients. There was no literature regarding combined posterior wall and posterior column acetabular fractures. Most literature was generally on acetabular fracture and their postoperative functional outcome.

For example our results were similar to a study done by Lal SR,Rev Bras on 2017 on the functional outcome of acetabular fractures in general as he found the results were excellent in 60.86%, good in 21.73%, fair in 8.69%, and poor in 8.69%.**(**16**)**

This also similar to the study done by Sagar K. V1 el al in in which the functional outcome of surgical manement of acetabulum fracture by internal fixation found that full weight bearing was attained in

thirty five (63.6%) patients in 16 weeks and in twenty (36.4%) patients after 16 weeks. Forty five (81.8%) patients were free of complications.

According to Matta et al score 27(49.1%) had excellent, 15(27.3%) had good, nine (16.4%) had fair, and four (7.3%) had poor results (18).

Outcome after Surgical Management of Acetabular Fractures was a paper published after a 7-Year experience through which Seyed Amir Reza Mesbahi1, Ali Ghaemmaghami, Sara Ghaemmaghami, and Pouya Farhadi found the functional results to be excellent in 41 patients (51.9%), good in 12 (15.2%), fair in 13 (16.5%),and poor in 13 patients (16.5%).(20)

The main cause of this type of injury was found to be RTA reported in 97.4%, fall from height was reported in less than 3% of our patients so this gives us a clue that this type of injury is high energy injury in most cases. It was associated with other injuries in many patients of which 60% of the patients who had associated skeletal injuries and 15% has associated non skeletal injuries.

The mode of trauma was not found to affect the functional outcome with a P value of .811.

The presence of non-skeletal injuries (head, chest and abdominal injuries) has a direct influence on the functional outcome so we can say that the severity of the initial trauma may affect the functional outcome.

Hence, if the initial trauma was severe and lead to major injuries in the chest, head or abdomen the functional outcome will be worse than less severe trauma that doesn't affect the other body parts. This is the same result reported by Naseem Munshi and et al in there article Functional outcome of the surgical management of acute acetabular fractures as they found excellent results were attributed to the less severe initial trauma, anatomical reduction and stable internal fixation after operation and adequate postoperative care and rehabilitation program.(21)

The functional outcome also was affected by the presence of post-operative complications Post-operative complications seen in 32% of our patients included AVN in 21% of the cases, nerve injuries in 5% patient, infection was seen in 3% of the patients and other complications was reported in 3% of our patients. This result was related to many results that were reported in other studies for example Isaacson et al report 52% postoperative complication and it's related to the functional outcome.(22) Also 21.6% postoperative complications is reported by Negrin et al. [23]

The age of the patient was one of the most important factor that affected the functional outcome of our patients. Young patients has better functional outcome comparing with elderly patients.

We found there was strong relation between the functional outcome and the age of patients with a P vale of .031. This result was similar to many results as reported by Faizan Iqbal, Muhammad Kazim Raheem Najjad, Naveed Khan and Osama Bin Zia in there article Fucntional and Radiological Outcome of Surgical Management of Acetabular Fractures in Tertiary Care Hospital; where they stated that there was significant association of functional outcome with respect to age.

The same paper reported a strong relation between the functional outcome and the patients' sex and mechanism of injury which is unlike our study findings that stated no relation between them.

Conclusion

Study results indicated that age, severity of initial trauma, present of associated non skeletal injuries and present of postoperative complications effect on functional outcome.

Recommendation: Availability of imaging, expert surgeon, good perioperative and postoperative care, we believe that the surgical fixation of combined posterior wall and posterior column acetabular fractures would yield better results. So we need good training for doctors and nurses, good referral system, special center to deal with this injuries and improve team work to reach the best functional outcome.

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