FUNCTIONAL ANALYSIS OF FRACTURE PATELLA MANAGED WITH TENSION BAND WIRING

Abstract-

Background: Fracture patella accounts for around 1% of all the skeletal fractures. It is basically of 2 types : displaced fracture and un displaced fracture. It mainly occurs due to direct blow to the knee joint such as car accidents or sports injury or direct fall on the ground with bent knees. Management of these fractures varies from cylindrical cast application to surgical management for displaced fractures. This study focuses on the functional evaluation of fracture patella managed with tension band wiring. **Material and methods:** 17 patients with displaced transverse patella fracture managed with tension band wiring were included in the study. It was an interventional study performed in AVBRH hospital Wardha between 2017-2019. operated patients were followed up at 1 month 2 months and 3 months for functional assessment. On every follow up x ray were taken to assess the union and implant positioning. **Observations and results:** 41.47 were the mean age (in years) of patients participating in the study. In the study 17 patients participated out of which 13 were males (76.47%) and 4 were females (23.53%). Comminuted and oblique fractures were excluded from the study. Out of 17 patients at final follow up 70.58% patients had excellent results, 29.42 percent had good results and no patient had poor functional outcome. **Conclusion:** tension band wiring of fracture patella yields better functional outcome and in an inexpensive method of management of fracture patella. To avoid quadriceps muscle wasting early knee mobilization and knee range of motion exercises should be started.

Keywords: displaced Transverse patella fracture, tension band wiring, K-wire , SS wire

Introduction:

Fracture patella accounts for around 1% of all the skeletal fractures, it is more common in 2^{nd} to 5^{th} decade of life with a higher prevalence in males [1]. It is basically of 2 types which are displaced fracture and un displaced fracture. It mainly occurs due to direct blow to the knee joint such as in car accidents or sports injury or direct fall on the ground with bent knees. Management of these fractures varies from cylindrical cast application to surgical management for displaced fractures. these fractures are commonly encountered in orthopedic practice. Incidence of these fractures has increased rapidly due to increase in motor vehicle accidents. Fractures of patella can be managed conservatively with cylindrical cast immobilization for 6 weeks. Prolonged cast immobilization may lead to restricted knee range of motion as well as quadriceps muscle wasting. To overcome this surgical intervention and early physiotherapy exercises for quadriceps strengthening and knee range of motion exercises is beneficial.

Indications for surgical intervention for fracture patella are

(1) Extension lag activity

(2) Involvement of the articular surface

(3) Displacement of the fracture fragments of more than 2mm

(4) anatomical reduction and surgical restoration of knee joint function

Immediate knee ROM exercises should be started as early as possible to prevent periarticular and intra-articular fibrosis of the knee joint. Surgical managements of the fracture patella include Tension band wiring and Encirclage wiring. Surgical interventions aims to achieve satisfactory compression at the fracture site and to reduce the risks of delayed union, mal union, non-union and patello femoral arthritis[2].In this study we evaluated the functional outcome of surgically managed fracture patella with tension band wiring.

Material and methods:

We retrospectively collected the data of all the patients with fracture patella.17 patients with displaced transverse patella fracture who were managed with tension band wiring were included in the study.

It was an interventional study performed in AVBRH hospital Wardha between 2017-2019. Every operated patient was followed up at 1 month 2 months and 3 months for functional assessment. On every follow up x rays were taken to assess the union and implant positioning.

Inclusion criteria:

1. Isolated patella fractures without associated distal femur or tibial plateau fractures
2. Closed fractures
3. Displaced fractures
4. Fresh fractures<2weeks duration
5. Transverse fractures

Exclusion criteria:

A. Duration of injury more than 2 weeks
B. Compound fractures
C. Skeletally immature patients
D. Comminuted/Oblique patella fractures

All the patients were surgically managed with tension band wiring. Informed or written consents were taken from all the patients. Every patient was evaluated according to the GAUR's criteria of functional assessment which included Extension lag, quadriceps muscle wasting, quadriceps functional loss, knee pain, knee range of motion and overall restoration of knee function at the end of post OP day 1, after 1 month, after 2 months and final follow up at the end of 3 months.

Each criteria was categorized as excellent, good, fair and poor depending upon the loss of function and its severity.

Pre-operative assessment of the patient:

As soon as the patient comes to the emergency department with history of direct blow to the knee with diffuse swelling and tenderness around the knee, detailed history of the patient was taken and thorough examination of the affected knee was done. X-rays were done in AP view Lateral view and skyline view and diagnosis of transverse patella fracture was established.
Above knee slabs were given in the emergency basis for immobilization of the affected knee. Then patients were taken for elective surgeries as soon as they were medically cleared for surgery.

Preoperative preparation of patients:
Written Consent for surgery was taken from the patient and the relatives and possible outcomes of surgery were explained to them. Patient was kept NBM for 6 hours prior to the surgery and part preparation was done.
Injection tetanus toxoid was given prior to the surgery and xylocaine sensitivity testing was done. Patients were given Inj. Ceftriaxone+Sulbactum 1.5gm IV STAT 30min prior to the surgery. All the patients were operated under spinal anesthesia cover.

Operative procedure:

Patients were taken supine on the OT table and spinal anesthesia was given to all of them. Pneumatic tourniquets were applied over the thigh as high as possible. Under all aseptic precautions cleaning of the affected limb was done with chlorhexidine and betadine. Then 3 layered draping was done and the affected limb was painted.

Transverse incision of approximately 12cm was taken. Soft tissue dissection was done and the subcutaneous tissue and the skin was retracted proximally and distally to expose the fractured patella. This type on incision completely exposes the fracture site and helps in proper repair of ruptured extensor tendon.

After exposing the fracture site, the fractured ends were freshened and all the blood clots and small bone fragments were removed. Thorough wash was given and then the fractured fragments were reduced by holding them with bone holding forceps to ensure a smooth articular surface. After achieving proper reduction 2 parallel Kirschner wires of 2mm each were drilled from distal to proximal direction. These were placed 5mm deep to the anterior surface of patella and were sized to keep the wires freely protruding beyond the patella and quadriceps tendon attachment.

18 gauge SS wire was passed deep to the K-wires and the quadriceps tendon then anterior to the anterior aspect of patella, then through the patellar tendon attachment transversely on the inferior fractured fragment in a figure of 8 manner. This wire was tightened to reduce the fractured fragments to their anatomical position. Reduction of the fractured fragments was achieved and checked under C-arm guidance. The upper ends of K-wire were curved and cut. Thorough wash was given and closure was achieved.

Post-operative protocol:
Patients were kept immobilized with above knee slab. Static quadriceps and hamstring strengthening exercises were started from post operative day 1 itself. The patients were given injectable antibiotics for 3 days and pain killers. Check dressing of the suture site was done on post-operative day 2 and suture removal was done at day 12 after surgery. Active knee ROM exercises were started after 2 weeks and full weight bearing was started after 6 weeks of operation.

Follow up:
All the patients were followed up on OPD basis at 1 month, 2 months and final follow up was done at the end of 3 months. Based on the GAUR score (Table no. 7) each patient was evaluated and quadriceps wasting, quadriceps functional loss, extension lag, knee ROM and knee pain on movements was assessed.

Results and observations:

41.47 was the mean age (in years) of patients participating in the study. In the study 17 patients participated out of which 13 were males (76.47%) and 4 were females (23.53%) (Table no.1). Most of the patients were of 30-50 age group i.e. 9 out of 17 (52.94%). Out of 17 patients the most common cause of injury was road traffic accidents (58.3%) followed by fall from height (29.2%) and assault (12.5%).

s.no	sex	total	percentage
1	males	13	76.47
2	females	4	23.53
	TOTAL	17	100%

Table 1- Distribution of patella fractures-based on sex

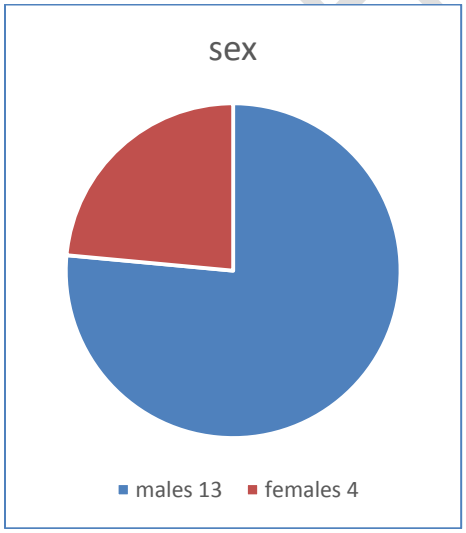

Fig 1. Distribution of patella fractures-based on sex

S.No	Side of fracture	Number of cases	Percentage
1.	Right	12	70.59
2.	Left	5	29.41
	TOTAL	17	

Table 2- Distribution of patella fractures based on side of fracture

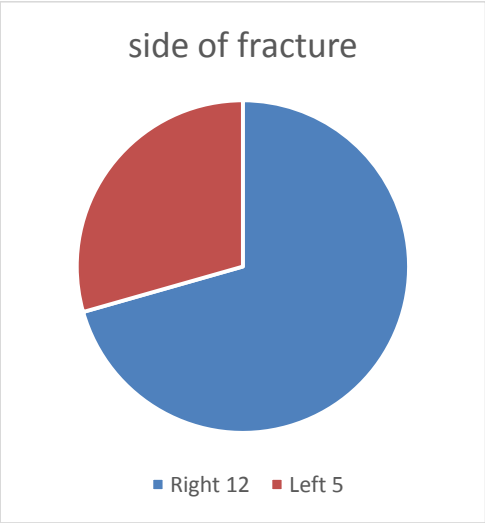

Fig 2. Distribution of patella fractures based on side of fracture

	Pre-operative	Quadriceps muscle wasting at different time interval post operatively					
		After 4 weeks		After 8 weeks		After 12 weeks	
		Number	Percent	Number	Percent	Number	Percent
Excellent (no wasting)	Nil	2	11.76	4	23.52	12	70.58
Good (<1cm)	Nil	10	58.82	13	76.48	5	29.42
fair(>1cm)	Nil	5	29.42	0	0	0	0

Table 3- quadriceps wasting at different time intervals

The study showed that percentage of patients with recovery from quadriceps wasting was significantly high to excellent scores at the end of 12 weeks.(Table no.3)

Table4- function loss of quadriceps muscle at different time interval

Percentage of patients with quadriceps muscle function loss recovered significantly at the end of 12 weeks (Table no.4)

Descriptive statistics	Pre-operative		Knee joint functional restoration at different time intervals post operatively					
			After 4 weeks		After 8 weeks		After 12 weeks	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Normal	0	0%	0	0%	0	0%	14	82.35
Poor	17	100%	0	0%	0	0%	3	17.65
Restricted	0	0%	17	100%	17	100%	0	0%
total	17	100%	17	100%	17	100%	17	100%

Table5- comparison of restoration of knee joint function at different time intervals

Post-operatively knee joint function improved significantly at the end of 12 weeks with 82% people having normal knee range of motion(Table no.5)

Descriptive statistics	Pre-operative		Knee joint extension-lag at different time intervals post operatively					
			After 4 weeks		After 8 weeks		After 12 weeks	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Excellent (0)	0	0%	0	0%	5	29.42	12	70.58
Fair (10 or <10)	0	0%	9	52.94	12	70.58	5	29.42
Poor (>10)	17	100%	8	47.06	0	0%	0	0%
total	17	100%	17	100%	17	100%	17	100%

Table6- comparison of Knee joint extension-lag at different time intervals post operatively

Table 7- Outcome as per GAUR criteria

Outcome at 12 weeks	Number	%
Excellent	12	70.58
Good	3	17.65
Fair	2	11.77
Total number	17	100%

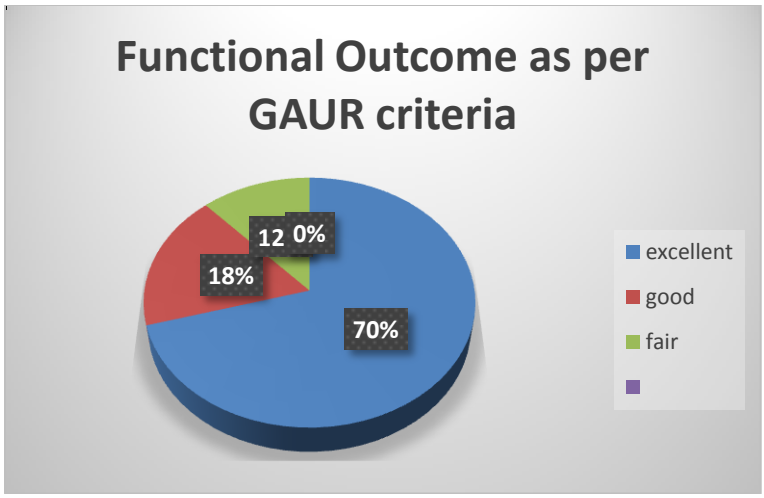

Fig 3- outcome as per gaur criteria

Discussion:

According to our study Patella fractures are significantly more common in older age group of age >35 years. Mean age of patients in our study was 42 years with range of 19 to 70 years. A similar study was conducted by Sudheendra P.R, Krishna prasad, also concluded that mean age of patella fractures was 42.4 and is more prevalent in 21 to 69 age group (3).

Male to female ratio in our study was 3:1 that is 76.47% of the cases were males and 23.53 were females. Most of the working class males sustain more road traffic accidents sustaining fractures. therefore males have a higher tendency of sustaining patellar fractures as compared to females. Anand.B. Jab Shetty also conducted a similar research where out of 20 patella fractures 2/3rd were males and 1/3rd were females.[4]

The most common cause of patella fractures in our study was road traffic accidents (58.3%) followed by fall from height (29.2%) and assault (12.5%). Similar type of study was conducted by A.B.Jab Shetty(4) which concluded that 60% of patella fractures were due to fall on knee and 40% only were due to road traffic accidents.
In our study we used tension band wiring as the preferred surgery of choice as it is more preferred worldwide as compared to encirclage wiring. This is also supported in a study conducted by Tien YU Yang, Tsan-Wen Huang et al and they concluded that tension band wiring is the most widely preferred surgery for patella fractures as compared to encirclage wiring[5].
One of the major assessment modality in our study was mean quadriceps wasting which showed a significant difference at different time intervals. This modality improved significantly over time post operatively. Durrani, MA Khan et al also concluded in their study that there was quadriceps muscle wasting immediately post OP but it improved significantly over time. [6]

The functional loss of quadriceps muscle also recovered significantly over a period of time. At the end of 8 weeks and 12 weeks of surgery there was no significant difference in mean quadriceps functional loss. This observation differed with the same study conducted by

Shrinivas et al which showed a significant difference in functional loss at different time intervals. [7].
Mean knee extension lag at different time intervals was also different. Over the time it decreased significantly. These results of our study were similar to the study conducted by Subhrat Mohapatra and Pulin Bihari. [8]
Over time the mean knee range of motion also increased and was almost full in most of the patients. Early knee ROM exercises were started in our patients which provided a better result in knee movements. A similar study was conducted by Krishna Prasad and Sudheendra P.R which showed similar results as compared to our study. They demonstrated only 1 patient with knee range of movements less than 90 degrees with poor outcome rest all the patients showed almost full range of movements over the period.

The functional assessment assessed by Gaurs criteria, 70 percent of the patients or 12 patients had excellent results with excellent knee function at final follow up of 12 weeks. Excellent results were significantly higher in our study as compared to 17% good results and 11% fair results. This was significantly higher in comparison to a similar study conducted by Rajesh V Chawda, Parag Tank et al which had 25% excellent results, 46.87 percent good results and 15 percent patients with poor results. [9]. Similar related study was reported by Sharma et. al. [10].

Conclusion:

Tension band wiring of fracture patella yields better functional outcome and in an inexpensive method of management of fracture patella. To avoid quadriceps muscle wasting early knee mobilization and knee range of motion exercises should be started. Patients managed with tension band wiring followed by early knee mobilization and quadriceps strengthening exercises have a better GAUR functional score and have a better long-term prognosis.

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