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Is Physiotherapy the ultimate solution for better Functional Outcome of Operatively Treated Floating Knee Injuries? : A clinical study

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Abstract
Background: This study evaluated the role of physiotherapy in functional outcome of operatively treated floating knee injuries.
Methods: Twenty patients (19 men, 1 women; mean age, 30 years; range 25 to 60 years) were enrolled in this study. The fractures types were classified according to the classification by Blake and McBrydes as follows: type I (18), type IIa (2),type IIb (0).Femur fractures were treated using femur interlock nails either antegrade or retrograde or locking compression plate and tibia fractures were treated with either locking compression plate ortibial interlocking nails. Early physiotherapy was initiated. Follow up study was done at 4 weeks, 8 weeks, 6 months and 1 year**.**
Results: According to Karlstrom and Olerued Criteria the overall functional outcome was: Excellent in 8, Good in 4, fair in 4 and Poor outcome in 4.
Conclusions: physiotherapy forms an important part of management for better functional outcome of floating knee injuries.

Keywords: Ipsilateral Fracture, Floating knee, physiotherapy

Introduction

Ipsilateral femoral and tibial injuries, also known as floating knee injuries are becoming common injuries in developing countries. A very high energy trauma is required for these injuries to take place. These injuries are associated with high morbidity and may result in permanent disabilities. There are no specific guidelines for the management, as per the available literature. Letts *et al.* in 1986reported the incidence of floating knee injurie as 2.6 % of all fractures [1]. These Veith showed that these injuries are associated with head injuries, chest injuries and abdominal injuries [2]. The involved limb is also associated with soft tissue trauma which s can be variable from minor abrasions to grade III open injuries. Injuries to the neurovascular structures can be deceptive as well as life threatening. This confuses most surgeons in the choice of management. Some other complications attributable to floating knee injuries include infection, excessive blood loss, fat embolism, malunion, delayed or nonunion, knee stiffness, prolonged hospitalization, and inability to bear weight [2, 3].

The established principles of treatment are

1. Early debridement of the woundif present.
2. Accurate reduction of intraarticular fractures.
3. Stabilization of fractures.
4. Concurrent management of associated neurovascular injury.
5. wound closure and soft tissue coverage
6. Early mobilization of the knee joint and introduction of the functional activities of the lower limb as a whole.

Better results and fewer complications are observed when both fractures are diaphyseal than when one or both are intra-articular [4]. Most of earlier papers have given attention to shaft fractures only not giving much weightage to knee. As Early mobilization of knee joint is the key to successful treatment, we conducted this study to relate physiotherapy with the functional outcome

Materials and Methods

This prospective study was conducted in our tertiary care centre with 30 patients of floating knee between Sept 2015- Sept 2017. The patients were classified according to Blake and Mcbryde's [5]. (table 1) Classification for floating knee injuries.

Inclusion criteria

1. Patients with age >25 and <60
2. Recent history of trauma (within 1 week)
3. Closed fractures

Exclusion criteria

1. Blake and Mcbrydes Type IIB
2. Pathological fractures
3. Associated any other fractures.

When the patient presented, All fractures were splinted in Thomas splint or plaster of Paris slab accordingly. Patients were included into the study once a diagnosis of floating knee injury was made on xrays.

The femur fracture was fixed prior to the tibia fracture. Intramedullary nailing of both fractures was the commonest method. Postoperative Thromboprophylaxis was given. Physiotherapy was started as soon as the pain subsided (generally 1 week). Non weight bearing walking using crutches was permitted after 2 weeks, followed by partial weight bearing. Full weight bearing was allowed only after clinical and radiological union had been confirmed. Follow up was done at 1month, 2 months, 6 months and 1 year. functional outcome was measured using the Karlstrom's and olerued [6]. (table 2) criteria after 1 year.

Table 1: Blake and Mcbrydes Classification

Type	Definition	No of patients
I	True floating knee- the knee joint is isolated completely and not involved with either shaft fractured	18
IIA	Involves knee joint with either shaft fractured	2
IIB	Involves either hip or ankle joint with either shaft fractured	0

Karlstrom and Olerud Criteria for Functional Assessment

Table 2: Karlstrom and Olerued Criteria

Criterion	Excellent	Good	Acceptable	Poor
Subjective Symptoms from Thigh or leg	0	Intermittent slight symptoms	More severe symptoms impairing function	Considerable functional impairment; pain at rest
Subjective Symptoms from Knee or ankle Joint	0	Same as above	Same as above	Same as above
Walking ability	Unimpaired	Same as above	Walking distance Restricted	Uses cane, crutch or other support
Work and sports	Same as before accident	Given up some sport; work same as before accident	Change to less strenuous work	Permanent disability
Angulation, Rotational Deformity or Both	0	<10º	10-20º	>20º
Shortening	0	<1cm	1-3cm	>3cm
Restricted joint Mobility (hip, Knee, or ankle)	0	<10º at ankle; <20º at hip, knee, or both	10-20º at ankle; 20-40º at hip, knee or both	>20º at ankle; >40º at hip, knee, or both

Table 3: Patient's Variable

S. No.	age	sex	compliant to physiotherapy (early physiotherapy < 1 week)	functional outcome
1	35	M	No	Fair
2	20	M	yes	Excellent
3	40	M	No	Fair
4	32	M	No	Poor
5	27	M	Yes	excellent
6	30	M	Yes	Fair
7	50	M	No	good
8	20	M	No	Fair
9	22	M	yes	Good
10	25	M	No	Poor
11	60	M	No	Excellent
12	29	M	yes	Excellent
13	20	M	yes	excellent
14	57	M	No	Good
15	32	M	No	Poor
16	32	M	yes	Excellent
17	20	M	No	Excellent
18	40	M	No	Good
19	28	M	No	Poor
20	20	F	yes	Excellent

Results

The study included 20 patients, ranged from 25 years to 60 years with 19 males (95%) and 1 female (5%). There were 14 patients (70%) with right side involvement. All patients had road traffic accident as the cause of injury (100%).no open fractures were included in our study there were 18 cases of blake and Mcbrydes type i(90%). Antegrade femur interlock was done in 19 femur (95%) and retrograde nailing was done in 1 femur(5%). In 18 patients, tibial nailing was done (90%) and in 2 patients proximal tibial locking compression plate done. 8 patients started physiotherapy within 1 week and 12 patients were either noncompliant or delayed physiotherapy. the physiotherapy protocol included flexion and extension exercises for knee, patellar mobilisation, active exercises for ankle and orientation of limb positioning. Gait training and proprioceptive weight bearing formed an important part of rehabilitation. All this was mainly

for hip abductors and quadriceps strenghthening. Those patients who were consistent with the physiotherapy achieved early dynamic control of the affected lower limbs and better functional outcomes. The functional outcome was excellent in 8 patients (60%), good in 4 patients (20%), acceptable in 4 patients (20%) and poor in 4 patients (20%).

Among the 8 excellent outcome patients, 6 patients started early physiotherapy. Among the 4 poor outcome patients, all delayed in physiotherapy or were noncompliant. The knee mobilization started at mean of 3 weeks(range 1 week to 6 weeks). Weight bearing began with the mean of 7 weeks(range 4 weeks to 14weeks). The overall average knee range of motion was 5 to 100^0. Excellent outcome group of patients had an average knee range of motion about $0 – 170^0$. Good outcome group of patients had $0 – 160^0$. Acceptable outcome group of patients had $0 - 140^0$ and poor outcome group of patients had $15 – 60^0$.

Table 4: Physiotherapy and Functional Outcome

Physiotherapy	patients	Mean range of motion knee (^{0})	Results	Cases
Early (< 1 week)	8	0-160	Excellent	6
			Good	2
			Acceptable	0
			Poor	0
Delayed (or non-compliant)	12	15- 100	Excellent	2
			Good	2
			Acceptable	4
			Poor	4

We measured only shortening and malunion as a complication as they formed an important component in functional outcome. Shortening was recorded in 4 (20%) patients, 2 patients had shortening of more than 3 cm and the 2 (20%) had shortening from 1 to 3 cm. Malunion was seen in 3 case in tibia and 1 femurs

Discussion

The occurrence of floating knee injuries have increased due to the increase in more number of road traffic accidents. Fraser *et al* in a study of 222 cases of floating knee, had all cases due to road traffic accidents [7]. In our study also, the all injury was due to road traffic accidents (100%).Skeletally immature paediatric patients were not included in the study. Hee *et al* [8]. In their study described almost the same age group. in this study 20 patients were included, males predominated in our study (95% male, 5% female). The age distribution was from 25 years to 60 years. Fraser *et al.* in 1978, studied 222 cases with ipsilateral fractures of the femur and tibia, found that poor function outcome was seen in intraarticular fractures citing that stiffness of knee and ankle should be decreased emphasising early physiotherapy and mobilisation[7]. Similar results were shown by Bansal *et al* [9]. These studies show that the functional outcome was poor in the presence of articular fractures. Such fractures hamper knee movement and cause poor results. Our all patients were extraarticular. Katada *et al.* in 1984 described that both femoral and tibial fractures, must be fixed rigidly [10].in our study, all fractures were fixed rigidly. Behr *et al* [11]. In 1987 described flexible intramedullary nails. Rethnam *et al* in 2006 described Single incision nailing for both tibia and femur [12].

When electing surgical treatment, there is a consensus that the best option is fixation by intramedullary nails in both fractures [13]. it is believed that better functionl outcome can be aachieved with this stabilisation because it allows knee and ankle movement, early rehabilitation and accelerated bone healing as suggested by Dwyer *et al.* 2005 and described that the preferred method of fixation in both femoral and tibial diaphyseal fracture was intramedullary nailing [14].

Malunion was seen in 3 case in tibia and 1 femurs. Scheidts *et al.* [15] conducted similar study for malunion.

Knee mobilization period ranged from 1 week to 17 week. iniatially partial weight bearing was allowed and then Full weight bearing was done after complete bony union.The knee range of motion was an important criteria for the functional outcome. In our study,the maximum range of motion of knee was $0\text{-}170^0$. The minimum range was $20 – 80^0$.those who had good range of motion were compliant to physiotherapy form the beginning, so had better functional outcomes.

Comparison with other studies (table5)

Table 5: Other Studies on Floating Knee

Name of Study	Total Number patients	Excellent	Good	Acceptable	Poor
Fraser *et al.* 1978	63	3	15	30	15
Schiedts *et al.* 1994	18	4	7	-	7
Hee *et al.* 2001	89	6	53	25	4
Ulfin Rethnam *et al.* 2007	29	15	9	2	3
This study	20	8	4	4	4

Conclusion

Most troublesome complications in floating knee injuries are knee stiffness and malunion. But if early physiotherapy is started and patient is compliant with physiotherapy, the overall functional outcome is better. so, a good rehabilitation programme for floating knee injuries are as important as the surgery itself or we can say, more important for a better functional outcome, concluding That postoperative physiotherapy forms an integral part of treatment. this study needs consolidated support of other more studies.

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