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Floating knee injuries: Associated injuries and clinical outcome

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Abstract

Background: Floating knee injuries are frequently part of polytrauma. The outcome of this injury pattern when compared to only femur or tibia fracture is less satisfactory. The outcome is even worse when there is presence of other associated injuries. We hypothesized that not all associated injuries have similar bearing on the outcome thus tried to find out the impact of commonly associated injuries on the final outcome of these complex fractures.
Methods: Study was conducted including the patients of floating knee injury operated between September 2016 and January 2019. Total of 42 eligible patients were operated, 4 patients were excluded to due to lack of adequate follow-up. Data relating to demography, Fraser subtype, compounding, associated injuries and clinical outcome were collected. Statistical analysis was performed to see the association of associated injury, Fraser subtype and presence of compounding with clinical outcome.
Results: Mean age was 33.5 years (17-63 years) with a male preponderance. Mean follow up was 1.6 years. Twenty-seven patients (71.1%) had excellent/good outcome while outcome of 11 patients (28.9%) was acceptable/poor. Seventeen patients (44.7%) had compound fractures. Injuries which were significantly associated with Acceptable/Poor outcome were ligament injuries, popliteal artery injury, abdominal injury and patella fracture. Chest injury with a p value of 0.05 was also very close to being statistically significant.
Conclusion: The clinical outcome of these patients not only depend on proactive and optimum management of tibial and femoral fractures but also on the management of associated injuries.

Keywords: Floating knee, associated injury, outcome, impact, polytrauma

Introduction

With increase in modernization and automation, road traffic accidents are also on rise. These are often high energy injuries with complex fracture patterns. Floating knee is one such manifestation of these high velocity injuries. Term floating knee was introduced by Blake and Mcbryde in 1975 when they used this to describe ipsilateral fractures of femur and tibia which resulted in a floating fragment in between consisting of knee joint and “disconnecting” it from rest of the limb[1]. In a classification system proposed by him, he categorised these injuries in to Type I constituting true floating knee with diaphyseal fractures

and type II constituting floating knee variants with fracture line extending into hip, knee or ankle joints. Fraser in 1978 further subdivided type II injuries in to three sub types. Type II-a (8%) consisted of diaphyseal femur factures with proximal tibia intra-articular fractures, type II-b (12%) included tibial diaphyseal fractures with distal femur intra-articular fractures and type II-c (9%) having intraarticular fractures on either side i.e. distal femur and proximal tibia[2].

To break two of the strongest bones in the body, it requires very high amount of injury which also dissipates in to surrounding soft tissues. Because of their high violence mechanism, they are frequently part of polytrauma involving head injuries, torso injuries, vascular injuries and other musculoskeletal injuries. In a case series 69.2% of these fractures are compound on either or both sites and poly trauma (ISS > 18) was present in around 38% cases[3]. Presence of these associated injuries add to the difficulty in management of these fractures. Certain injuries like Head injury, chest injuries or vascular injuries take priority in management and definitive management of the associated fractures are thus delayed. Associated compounding or poor soft tissue condition also contribute to delayed definitive fixation of these fractures, where often the management is temporary stabilization with external fixator with delayed definitive fixation when the skin or soft tissue condition allows. Studies have suggested that the outcome of this injury pattern when compared to only femur or tibia fracture if less satisfactory. The outcome is even worse when the fractures are of type II or associated with other injuries. We hypothesized that not all associated injuries have similar bearing on the outcome thus tried to find out the impact of commonly associated injuries on the final outcome of these complex fractures. To best of our knowledge there is no other study in the literature determining the individual impact of associated injuries on the outcome of floating knee injuries.

Material and Methods

Retrospective study was conducted including the patients of floating knee injury operated between September 2016 and January 2019 at our level I trauma centre. Skeletally immature patients, peri-prosthetic fractures and pathological fractures were excluded from the study. Total of 42 eligible patients were operated in the said duration out which complete one-year follow-up data of 4 patients was not available and hence they were excluded. All the patients were admitted through emergency where they were managed according to the ATLS protocol. Associated head, chest, torso or vascular injuries were noted and managed accordingly. X Ray Chest, Pelvis with bilateral Hip and e-FAST was done in all the patients, also ISS was calculated as protocol. Patients who had closed fractures and were haemodynamically stable were managed with early definitive fixation. Compound fractures were given intravenous antibiotics in emergency department and wound was debrided at the earliest possible. Open fractures were fixed with temporary external fixator which was converted to definitive fixation after wound healing. Diaphyseal fractures were fixed with intramedullary nailing while periarticular fractures were fixed with pre-contoured locking plates. Figure 1 and Figure 2 showing x rays of the operated patients. Femur was fixed first in all the cases except those with compound tibia and closed femur, where tibia was first stabilized by external fixator. Knee Rom of was started immediately after definitive fixation. Partial weight bearing was allowed at six weeks, full weight bearing was allowed after radiological union (bridging callus in 3 out of 4 cortices). Patients were followed at6 weeks, 3 months, 6 months and one year. X rays were done at each follow-up for radiological assessment. Fractures were classified according to modified Fraser classification. Clinical signs of superficial or deep infection if any were noted. Clinical assessment was done to see for Knee ROM, shortening, mal alignment and clinical outcome was assessed as per Karlstrom and Olegrud criteria. Statistical analysis was performed to see the association of associated injury, Fraser subtype and presence of compounding with clinical outcome.

Statistical analysis

Data relating to demography, Fraser subtype, compounding, associated injuries and clinical outcome were collected, coded and recorded in MS Excel spreadsheet program. SPSS v23 (IBM Corp.) was used for data analysis. Descriptive statistics were elaborated in the form of means/standard deviations and medians/IQRs for continuous variables and frequencies and percentages for categorical variables. Data were presented in a graphical manner wherever appropriate for data visualization using histograms/box-and-whisker plots/column charts for continuous data and bar charts/pie charts for categorical data. Chi-squared test was used for group comparisons for categorical data. In case the expected frequency in the contingency tables was found to be <5 for >25% of the cells, Fisher's exact test was used instead. Odds ratios were calculated as appropriate. Statistical significance was kept at $p < 0.05$.

Results

Total of 38 patients were included in the study for analysis. Most of the patients were young, mean age was 33.5 years (17-63 years) with a male preponderance (89.4%). Most common mechanism of injury was road traffic accidents (88.4%), second most common being fall from height. Mean ISS score was 15.07 (9-45). Mean follow up was 1.6 years. Seventeen patients (44.7%) had compound fractures. Distribution of patients according to Fraser classification and Gustillo-Anderson classification is shown in table 1 and 2. Twenty-seven patients (71.1%) had excellent/good outcome while outcome of 11 patients (28.9%) was acceptable/poor. Outcome was better in patients with closed fractures than those with open with a p value of 0.05.Twenty patients had isolated floating knee injury while 18 patients had other associated injuries. (Figure 3). Distribution of associated injuries according to their impact on the clinical outcome is shown in table 2.

Master chart of the included patients is shown in table 4. Most common associated injury was "Other skeletal injuries" (n =13) with patella fracture being most common associated skeletal injury (n =4). Head injury was most common associated non skeletal injury (n =8) followed by Chest injury (n =7). Popliteal artery injury was present in 2 patients. Six patients had complaints of knee instability/locking in post-operative follow-up and were diagnosed as having associated ligament injury. ACL tear was most common associated ligament injury (n=4). Ligament injuries were more common in patients with patients with Fraser type 2 injuries.

Injuries which were significantly associated with Acceptable/Poor outcome were ligament injuries, popliteal artery injury, abdominal injury and patella fracture. Chest injury with a p value of 0.05 was also very close to being statistically significant. Other skeletal injuries except patella fracture did not show any negative impact on the outcome.

Mean length of hospital stay was 9.5 days (4-32 days). Mean duration from injury to first surgery was 1.2 days. Mean time of conversion of fixation from temporary to definitive was 16.4 days. Mean time for union was 5.5 months for femur and 6.7 months for tibia. Two patients required additional procedure in form of exchange nailing and bone grafting for tibia. Seven patients were diagnosed as surgical site infection 2 at femoral site while 5 at tibial site, six patients healed with serial debridement while 1 patient had to undergo implant removal debridement and antibiotic impregnated nail insertion. Four patients developed knee stiffness and all of them had associated patella fracture as well. Fat embolism was seen on only one patient who had associated pelvic fracture as well.

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Fig 1: A 26 year old patient presented to us with type 2a Fraser classification floating knee injury

1a) Preoperative X-ray of the patient.
1b) Immediate post-operative X-ray.
1c) X-ray showing bony union at 7 months of follow up.

Fig 2: A 17 year old patient presented with type 1 Fraser classification floating knee injury

1a) Preoperative X-ray of the patient.
1b) Immediate post-operative X-ray where tibia & femur fixed nail antegrade IMIL nail.
1c) X-ray showing bony union at $7^1/_2$ months follow up.

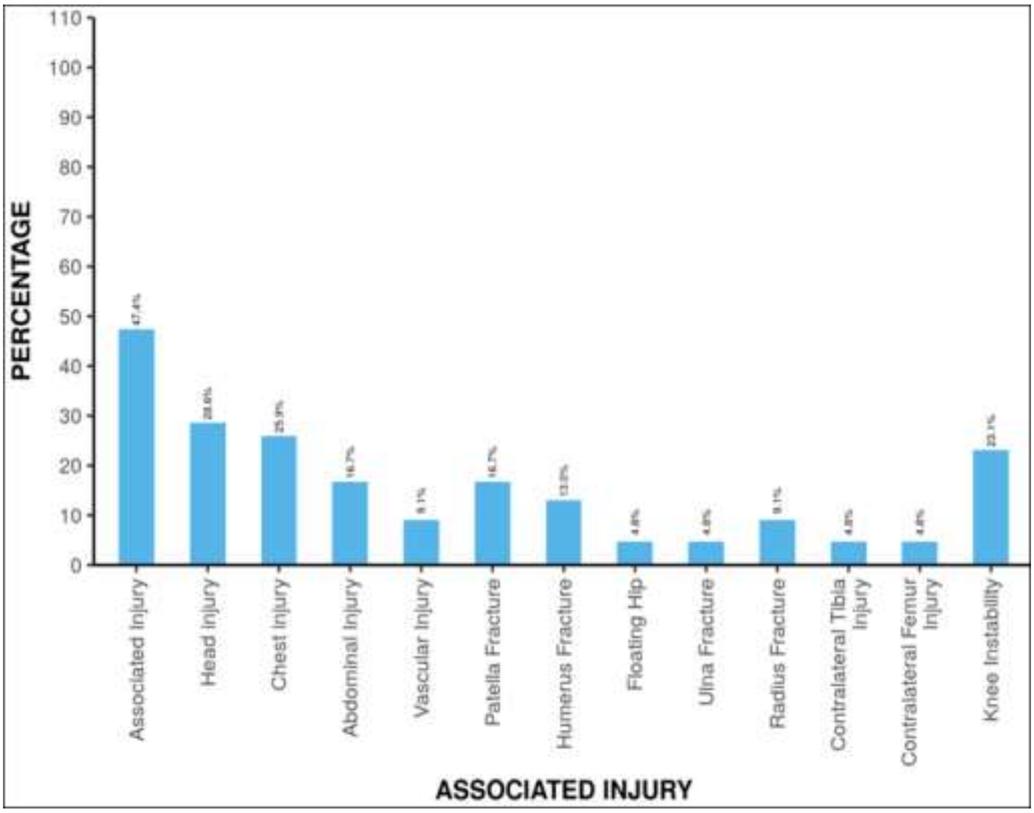

Fig 3: Percentage of individual injury associated with floating knee

Table 1: Result of Fraser Equivalent on the Outcome (n = 38)

Fraser classification	Outcome			Fisher's Exact Test	
	Acceptable/Poor	Excellent/Good	Total	X^2	P Value
Type 1	4 (16.0%)	21 (84.0%)	25 (100.0%)	4.857	0.098
Type 2A	1 (33.3%)	2 (66.7%)	3 (100.0%)		
Type 2B	2 (40.0%)	3 (60.0%)	5 (100.0%)		
Type 2C	3 (60.0%)	2 (40.0%)	5 (100.0%)		
Total	10 (26.3%)	28 (73.7%)	38 (100.0%)		

Fraser classification	Adjusted P Values
Type 1 vs. Type 2A	0.919
Type 1 vs. Type 2B	0.763
Type 1 vs. Type 2C	0.408

Table showing distribution of patients according to their Fraser classification and their clinical outcome. There was no significant difference between the various groups in terms of distribution of outcome (X^ = 4.857; p = 0.098) but we can see the trend of poor outcome with increase in severity of Fraser equivalent.

Table 2: Outcome in Closed and Open injuries

Type of Fracture	Outcome			Fisher's Exact Test	
	Acceptable/Poor	Excellent/Good	Total	X^2	P Value
Closed	2 (9.5%)	19 (90.5%)	21 (100.0%)	8.610	0.005
Open	9 (52.9%)	8 (47.1%)	17 (100.0%)		
Total	11 (28.9%)	27 (71.1%)	38 (100.0%)		

Table showing number of patient with closed and compound fractures. There was a significant difference between the both groups in terms of distribution of outcome (X^2 = 8.610; p = 0.005).

Table 3: Affect of individual associated injury on floating knee

Parameters	Outcome		p value
	Acceptable/Poor (n = 11)	Excellent/Good (n = 27)	
Associated Injury (Present)***	8 (44.4%)	10 (55.6%)	0.046[1]
Head injury (Present)	4 (50.0%)	4 (50.0%)	0.142[2]
Chest injury (Present)	4 (57.1%)	3 (42.9%)	0.050[2]
Abdominal Injury (Present)***	3 (75.0%)	1 (25.0%)	0.035[2]
Vascular Injury (Present)***	2 (100.0%)	0 (0.0%)	0.043[2]
Patella Fracture (Present)***	4 (100.0%)	0 (0.0%)	0.003[2]
Humerus Fracture (Present)	1 (33.3%)	2 (66.7%)	0.453[2]
Floating Hip (Present)	0 (0.0%)	1 (100.0%)	1.000[2]
Ulna Fracture (Present)	0 (0.0%)	1 (100.0%)	1.000[2]
Radius Fracture (Present)	0 (0.0%)	2 (100.0%)	1.000[2]
Contralateral Tibia Injury (Present)	1 (100.0%)	0 (0.0%)	0.190[2]
Contralateral Femur Injury (Present)	0 (0.0%)	1 (100.0%)	1.000[2]
Knee Instability (Present)***	6 (100.0%)	0 (0.0%)	<0.001[2]

***Significant at p<0.05, 1: Chi-Squared Test, 2: Fisher's Exact Test

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Table4: Distribution of different Fracture Patterns, their Management and Outcome

	Age (Years)	Gender	Fraser classification	GA Classification: Femur	GA Classification: Tibia	ISS scoring	Temporary fixation of Femur/Tibia	Definitive Fixation: Femur	Definitive Fixation: Tibia	Complications	Associated Injury	Outcome
1	29	Male	Type 1	2	3A	22	Ex-Fix	Dflcp	Tibia nail	Wound infection	Present (C)	Excellent/Good
2	21	Male	Type 1			9	Splinting	Afn	Tibia nail	-	Absent	Excellent/Good
3	45	Female	Type 1			9	Splinting	Pfn	Tibia nail	-	Absent	Excellent/Good
4	30	Male	Type 1			9	Splinting	Dfn	Tibia nail	-	Absent	Excellent/Good
5	22	Male	Type 1			9	Splinting	Afn	Tibia nail	Fat embolism	Absent	Excellent/Good
6	17	Male	Type 1		1	17	Ex-Fix	Afn	Tibia nail	-	Present (B,C)	Excellent/Good
7	19	Male	Type 1	2	2	13	Ex-Fix	Afn	Tibia nail	Wound Infection	Absent	Acceptable/poor
8	40	Male	Type 1		3A	14	Splinting	Afn	Tibia nail	Knee stiffness	Present (H,B,KI)	Acceptable/poor
9	24	Male	Type 1			9	Splinting	Afn	Tibia nail	-	Absent	Excellent/Good
10	32	Male	Type 1			9	Splinting	Dfn	Tibia nail	-	Absent	Excellent/Good
11	45	Female	Type 1			9	Splinting	Pfn	Tibia nail	-	Present (B)	Excellent/Good
12	38	Male	Type 1			9	Splinting	Pfn	Tibia nail	-	Absent	Excellent/Good
13	21	Male	Type 1	1	1	10	Splinting	Pfn	Tibia nail	-	Present (B)	Excellent/Good
14	43	Male	Type 1			9	Splinting	Afn	Tibia nail	-	Absent	Excellent/Good
15	45	Male	Type 1	1	2	17	Splinting	Afn	Tibia nail	Wound Infection	Present (H,A)	Acceptable/Poor
16	36	Male	Type 1			9	Splinting	Afn	Tibia nail	-	Absent	Acceptable/Poor
17	44	Male	Type 1			9	Splinting	Afn	Tibia nail	-	Absent	Excellent/Good
18	28	Male	Type 1	2	3B	22	Ex-fix	Pfn	Tibia nail	Wound infection	Present (C,B)	Acceptable/Poor
19	26	Male	Type 1			9	Splinting	Dfn	Tibia nail	-	Absent	Excellent/Good
20	33	Male	Type 1			9	Splinting	Pfn	Tibia nail	-	Absent	Excellent/Good
21	38	Female	Type 1	2	2	17	Ex-fix	Pfn	Tibia nail	-	Present (H,B)	Excellent/Good
22	36	Male	Type 1			9	Splinting	Dfn	Tibia nail	-	Absent	Excellent/Good
23	40	Male	Type 1			9	Splinting	Afn	Tibia nail	-	Absent	Excellent/Good
24	29	Male	Type 1			9	Splinting	Afn	Tibia nail	-	Absent	Excellent/Good
25	32	Male	Type 1			13	Splinting	Afn	Tibial nail	-	Present (H,B)	Excellent/Good
26	53	Male	Type 2A	2	3A	17	Ex-fix	Dfn	Lcp	Wound infection	Present (H,A)	Excellent/Good
27	26	Male	Type 2A			9	Splinting	Afn	Tibial nail	-	Absent	Excellent/Good
28	34	Male	Type 2A	1	3C	45	Splinting	Afn	Lcp	Knee stiffness	Present (H,V,B,KI)	Acceptable/Poor
29	24	Male	Type 2B		3A	24	Ex-fix	Dflcp	Lcp	-	Present (C,B,KI)	Acceptable/Poor
30	23	Male	Type 2B			9	Splinting	Dflcp	Tibial nail	-	Absent	Excellent/Good
31	35	Male	Type 2B	2	3A	20	Ex-fix	Dflcp	Lcp	-	Present (B)	Excellent/Good
32	29	Male	Type 2B		2	20	Splinting	Dflcp	Tibial nail	-	Present (B)	Excellent/Good
33	23	Female	Type 2B	3A		24	Ex-fix	Dflcp	Tibial nail	Knee stiffness, Wound infection	Present (C,A,B,KI)	Acceptable/Poor
34	35	Male	Type 2C			9	Splinting	Dflcp	Dual plating	-	Absent	Acceptable/Poor
35	49	Male	Type 2C	2	3A	29	Ex-fix	Dflcp	Dual plating	-	Present (C,H)	Excellent/Good
36	38	Male	Type 2C	2	3C	45	Splinting	Dflcp	Dual plating	Wound infection	Present (H,A,V,KI)	Acceptable/Poor
37	63	Male	Type 2C	3A	2	24	Ex-fix	Dflcp	Dual plating	Knee stiffness	Present (C,B,KI)	Acceptable/Poor
38	28	Male	Type 2C			9	Splinting	Dflcp	Dual plating	-	Absent	Excellent/Good

A-Abdominal Injury; B- Bony Injury; C- Chest Injury; H- Head Injury; V- Vascular injury; KI- Knee Instability

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Discussion

Floating knee injuries are being confronted by orthopaedic surgeons more commonly with increasing number of road traffic accidents. These are high velocity injuries with extensive soft tissue damage and other serious associated injuries. Optimum management of these injuries consists surgical fixation of both tibia and femur followed by early rehabilitation and range of motion exercises. Dwyer *etal.* in their study comparing outcome of various treatment methods reported that clinical outcome was better in operative patient groups[4].Hegagy*et al.* in their series of 15 patients reported excellent/good outcome in 80% patients[5]. Only 2 patients in their series had compound fractures (both on tibial side) and there was no mention of presence or absence of associated injuries. Ostrum*et al.* in their series of 20 patients treated with intra medullary nailing of both tibia and femur showed that 88% of these patients had excellent/good clinical outcome but complication rates were high specially at tibial site[6]. The outcome of these injuries has been described inferior to isolated fractures of femur or tibia. Several studies in past have reported below par outcomes with high complication rates.

Feng-Cheng Kao *etal.* retrospectively analysed 419 patients with floating knee injuries to review their post-operative complications and reported a complication rate of 24.8%[7]. They reported that complications were significantly higher in patients with compound fractures, Fraser type IIb or IIc fractures and distal tibia fractures. In our study we found that only 71.1%(27 out of 38) patients had excellent/good outcome. In spite of advances in implants surgical approaches and surgical techniques, the clinical outcome of these injuries is less rewarding. A lot of factors have been attributed to inferior outcomes in previous studies.

William T. Kent *et al.* in their series of26 patients concluded that treatment of floating knee injuries with aretrograde femoral nail result in a greater likelihood of developing heterotropic ossification and a greater severity of HO around the knee than if treated with a Antegrade femoral nail[8].However,this increased severity of HO is unlikely to affect range of motion. Hwan TakHee*etal.* in their case series of 84 patients reported that 59 patients (70.2%) had excellent/good outcome[9]. They suggested that along with open fractures, smoking and increasing age were predictors of delayed/non-union and delayed weight bearing and hence increase the chances of poor outcome.

In their series of 224 patients followed over 10 yearsRollo *etal.* showed that most common associated injuries were Spine fracture (42%), rib fractures and patella fractures (41%)[10]. Cerebral concussion was reported in 19.6% while abdominal injuries and haemo-pneumothorax was present in 23.1 and 26.7% patients respectively. None of the patient in their study had vascular injury. Associated knee soft tissue injuries were described with medial meniscus being most common. In our study also, most common associated skeletal injury was patella fracture but the frequency was less (10.5%). Interestingly non the patients in our series had spine fractures in spite of spine fracture being very common presenting injury at our institute. Rib fracture were included in chest injuries and were not taken as a separate entity. There was a remarkable difference in amount of ligament injuries. On our study 15.7% patients had associated soft tissue injuries around knee ACL injury accounting for 66.6% of the total. This difference could be attributed to the fact that Rollo *et al.* performed MRI screening at 8 months in all the patients while we performed MRI in only those who complained of instability or locking at follow visits. The total number of soft tissue injuries might be even more but only clinically relevant were included. Rollo *et al.* very elaborately described associated injuries but they did no mention anything about their impact on the final clinical outcome.

Yokoyama *et al.* analysed 63 patients to define the contributing factors influencing the outcome of floating knee injuries[11]. They reported that Gustilo Anderson grade 3 femoral fractures were significantly associated with poor clinical outcomes while grade 1 or 2 compounding, soft tissue injuries around tibia, neurovascular injuries, treatment methods and timing of surgery were found to be insignificant. V.P.Bansal *et al.* in their series of 39 patients reported that floating knee injury was commonly associated with other severe injuries with head injury being most common[12].

Kulkarni MS *et al.* showed that out of 89 patients in their series, 48 patients (53.9%) had other associated injuries[13]. Bony injuries were the most common associated injuries followed by head injuries. They also reported vascular in 7 patients out which 4 patients underwent above knee amputation. They found that compound fractures, temporary ex-fix application, extensor apparatus injuries and intra-articular fractures were significantly associated for poor outcomes. In their study they did not mention about associated soft tissue or ligament injuries, also the impact of other associated systemic injuries on the final outcome was not demonstrated.

Rethnam*et al*. in their series of 29 patients showed that vascular injury and knee ligament injuries were associated with poor outcome but this was no supported with any statistical analysis to demonstrate the statistical significance of this association[14]. They also concluded that some of the associated injuries caused a delay in surgical management and post-operative rehabilitation of these patients.

Rethnam*et al*. suggested that Antegrade femoral and tibial nailing(two incisions) makes treatment of knee ligament easier althougha single incision technique(antegrade tibial and retrograde femoral nailing through a single incision atthe knee)is a good technique in terms of speed and ease but the repair or reconstruction of a torn anterior or posterior cruciate ligament after a single incision technique can be a difficult proposition[15].

There is consensus in literature regarding complicated nature of these injuries leading to suboptimal outcome. Literature clearly suggests that these injuries are often a part of polytrauma and there are high rates of skeletal or non-skeletal associated injuries. Studies described earlier have shown that certain fracture patterns, nature of compounding and associated extensor mechanism injury mostly in the form of patella fracture are harbingers of unsatisfactory outcome but none of the study states the impact of other systemic injuries or associated soft tissue injuries on the management and in-turn on the final clinical outcome. Results of current study shows that patients with isolated floating knee injuries fared significantly better in terms of clinical outcome than their counterparts with other associated injuries. Injuries which imparted significant negative impact on the outcome were head injury, chest injury, abdominal injury, popliteal artery injury, patella fracture and post-operative knee instability. These associated systemic injuries affect the initial management, timing of surgery, delay in definitive fixation and also rehabilitation, all of which affects the final clinical outcome. It is also true that these are the patients which have suffered greater violence at the time of injury and are associated with greater degree of compounding and fracture comminution which can be a confounding factor leading to their inferior outcome, which is one of the limitations of this study. Smaller sample size is another limitation which is due to relatively rare nature of these injuries. Another limitation is that ligament injuries might be under reported as MRI was performed in only those patients presenting with complaints suggestive of the same, but the aim was to assess the impact of these injuries on the clinical outcome thus only clinically relevant patients were screened.

Conclusion

In the light of available data, it can be safely concluded that floating knee injuries are not simple skeletal injuries but often a part of polytrauma with other significant associated systemic injuries. The clinical outcome of these patients not only depend on proactive and optimum management of tibial and femoral fractures but also on the management of associated injuries. Presence of head injury, chest injury, abdominal injury, popliteal artery injury, patella fracture and post-operative knee instability was found to be significantly associated with poor outcome. It can be concluded that to achieve optimal clinical outcome in these patients a multi-disciplinary approach is required.

References

1. Blake R, McBryde A Jr. The floating knee: ipsilateral fractures of the tibia and femur. South Med J. 1975;68(1):13-6.
2. Fraser RD, Hunter GA, Waddell JP. Ipsilateral fracture of the femur and tibia. J Bone Joint Surg.

[Br]. 1978;60B:510-515.
3. Piétu G, Jacquot F, Féron JM. et les membres du GETRAUM.,Le genouflottant: étuderétrospective de 172 cas. [The floating knee: a retrospective analysis of 172 cases]. Revue de ChirurgieOrthopédique. 2007;93(6):627-34.
4. Dwyer AJ, Paul R, Mam MK, Kumar A, Gosselin RA. Floating knee injuries: long-term results of four treatment methods. Int. Orthop,29, 314-318.
5. Hegazy AM.Surgical management of ipsilateral fracture of the femur and tibia in adults (the floating knee): postoperative clinical, radiological and functional outcomes. Clinics in orthopedic surgery. 2011;3(2):133-9.
6. Ostrum RF. Treatment of floating knee injuries through a single percutaneous approach. Clinical Orthopaedics and Related Research®. 2000;375:43-50.
7. Kao FC, Tu YK, Hsu KY, Su JY, Yen CY, Chou MC. Floating knee injuries: a high complication rate. Orthopedics,2010, 33(1).
8. Kent WT, Shelton TJ, Eastman J. Heterotopic ossification around the knee after tibial nailing and ipsilateral antegrade and retrograde femoral nailing in the treatment of floating knee injuries.Int. Orthop. 2018 Jun;42(6):1379-1385. Doi: 10.1007/s00264-018-3845-7.
9. Hee HT, Wong HP, Low YP, Myers L. Predictors of outcome of floating knee injuries in adults: 89 patients followed for 2-12 years. Acta Orthopaedica Scandinavica. 2001;72(4):385-394.
10. Rollo G, Falzarano G, Ronga M, Bisaccia M, Grubor P, Erasmo R*et al*.,Challenges in the management of floating Skneeinjuries: Results of treatment and outcomes of 224 consecutive cases in 10 years. Injury. 2019;50(4):S30-S38.
11. Yokoyama K, Nakamura T, Shindo M, Tsukamoto T, Saita Y, Aoki S, Itoman M. Contributing factors influencing the functional outcome of floating knee injuries. American journal of orthopedics (Belle Mead, NJ). 2000;29(9):721-729.
12. Bansal VP, Singhal V, Mam MK, Gill SS. The floating knee. 40 cases of ipsilateral fractures of the femur and the tibia.Int. Orthop. 1984;8(3):183-7. Doi: 10.1007/BF00269914
13. Kulkarni MS, Aroor MN, Vijayan S,Shetty S, Tripathy SK, Rao SK. Variables affecting functional outcome in floating knee injuries. Injury. 2018;49(8):1594-601.
14. Rethnam U, Yesupalan RS, Nair R. Impact of associated injuries in the floating knee: a retrospective study. BMC musculoskeletal disorders. 2009;10(1):7.
15. Rethnam U. Single incision nailing of the floating knee-do we ignore the knee ligaments? Int. Orthop. 2006 Aug;30(4):311. Doi: 10.1007/s00264-006-0107-x.