Initial Treatment of Knee Traumatic Dislocation

(A Cross-Sectional Study)

Abstract

Introduction: Knee dislocation has potential for complex injury to blood vessels nerves and ligaments. It requires prompt diagnosis and treatment. Radiological assessments aid in guiding appropriate orthopedic and surgical interventions. This study aims to assess the treatment outcomes of knee dislocations.

Materials & Methods: A cross-sectional study of patients admitted to an orthopedic center within 4 years with knee dislocation was conducted. Demographic data, initial treatments, correlated injuries, pain severity, and post-surgery outcomes were collected. The initial management which was with external fixation or bracing were conquered. Statistical analysis was performed using SPSS v25.

Results & Discussion: Sixty-two patients (11 female, 51 male) were enrolled. Motor vehicle accident, car accident, and falls were common causes. Co-occurring injuries included ligamentous, vascular, and nerve injuries, with the first one being predominant. The initial treatments were by either bracing or external fixation. No re-dislocation was reported in the external fixator group, while 5 occurred in the bracing group. Pain severity scores were lower in the external fixator group at 1 and 3 months post-surgery. Time to return to work and duration of rehabilitation were, non-significantly, shorter in brace treatment group.

Conclusion: Both brace and external fixator show promise as initial knee dislocation treatments, offering distinct benefits. Definitive conclusions warrant comprehensive clinical trials.

Keywords: Knee Dislocation, Treatment outcome, Knee, Joint Dislocations

Accepted: 30 days before printing

Mojtaba Baniasadi, MD[1], Mehdi Hadian, MD[1], Mohammad Rostami, MD[2], Alirza Assadi, MD[2], Shahryar Rahmani, MD[3]

1. Department of Orthopedic Surgery, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran
2. School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran
3. Department of Radiology, Tehran University of Medical Sciences, Imam Khomeini hospital, Tehran, Iran

Corresponding Author:
Mahdi Hadian, MD
Email:
m.hadian72@gmail.com

Introduction

Knee dislocation is a rare but significant condition that requires prompt diagnosis and treatment due to the potential for ligamentous, nervous, and vascular injuries.[1] It is imperative that such injuries are identified at the earliest possible opportunity and that radiological examinations are conducted to facilitate appropriate orthopedic and surgical consultations.[2]

High-energy trauma, such as that sustained in car accidents, falls, and sports-related incidents, can cause knee dislocation, which is often associated with multiple ligamentous injuries and may result in knee instability.[3] Vascular injuries, including intimal injuries, blood clot formation, and thrombosis, as well as partial or complete tearing of vessels, are also among the potential complications of knee dislocation. The unique anatomy of the knee vessels increases the risk of vascular injuries in such cases.[4]

Neurological injuries, such as peroneal nerve injury, are among the common complications of knee dislocation, occurring in 25%-40% of cases. This type of nerve injury typically has a poor prognosis, further explaining the importance of prompt diagnosis and treatment.[5] Despite the critical nature of knee dislocation, there remains some controversy over initial and definitive treatments. A number of studies have explored the efficacy of surgical and non-surgical treatments. Initial treatment may involve the use of braces and or external fixators.[6] External fixators are an appropriate treatment option for knee dislocations,[7] particularly in cases involving open dislocations, vascular repair, and an inability to stabilize reduced knee dislocations.

This method offers numerous benefits, including skin examination and monitoring of compartment pressure and neurovascular condition of the affected limb. Braces are another therapeutic option that come in different types.[8]

This study aims to examine the treatment outcome associated with initial treatment of knee dislocation, with brace and or external fixator. To the best of our knowledge, there is currently no literature on this topic available in medical resources.

Materials & Methods

This cross-sectional study included all patients admitted to Alzahra and Kashani hospitals between 2016 and 2021. These hospitals are orthopedic hub centers in Isfahan Province. The included patients were followed up for 6 months after admission.

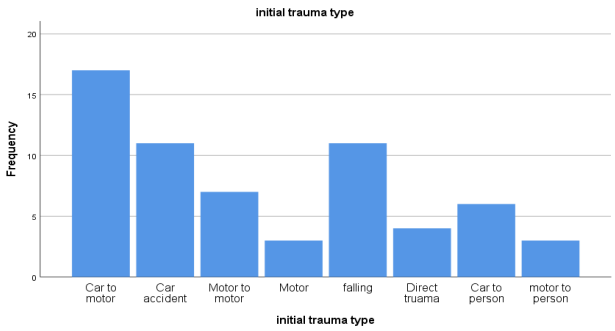

Figure 1: Figure 1: Distribution of initial trauma mechanisms leading to knee dislocation

The inclusion criteria for this study were as follows: all patients with knee dislocation due to any cause. The exclusion criteria were: congenital knee abnormalities, previous knee dislocation or ligamentous injuries, knee surgeries, bone fractures in the same limb, death of the patient within the first six months after knee dislocation, lack of informed consent to enter the study, and lack of access to the patient. This research was conducted after obtaining permission from the Bioethics Committee of Isfahan University of Medical Science. A checklist was used to gather data, which included items such as demographics, BMI, initial treatment method, knee dislocation correlated injuries, severity of pain, mechanism of injury, incidence of recurrent dislocation, and incidence of knee joint instability. Demographics, BMI, initial treatment, and correlated injuries were gathered from the patients' medical records. The patients were then followed up for six months, and their clinical conditions were examined and recorded during follow-up visits.

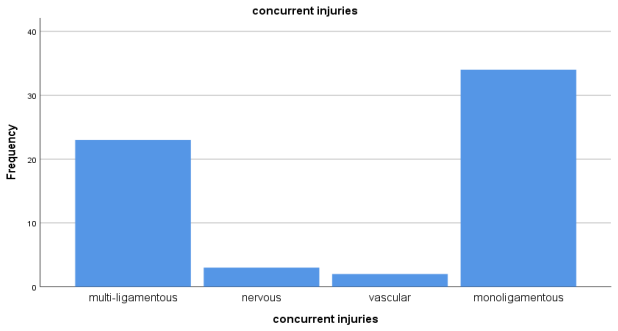

Figure 2: Frequency of concomitant injuries associated with knee dislocation

The severity of pain was examined using the Wong-Baker FACES Pain Rating Scale, and patients rated their pain from 1 to 10. Correlated knee dislocation injuries included nervous, vascular, and ligamentous injuries. Nervous injury was confirmed by examining the tibial and peroneal nerves and the movement and sensation of the distal part of the affected limb. Vascular injury was confirmed by examining distal pulses and the presence of distal perfusion disorders. Knee instability was also examined by testing knee flexion, extension, and rotation, as well as dorsiflexion and plantar flexion of the ankle in a standing position. After completing data gathering, the data were analyzed using IBM SPSS v25. Descriptive data analysis was performed for demographic and clinical variables, including the average, standard deviation, and mean. Chi-square was used to compare clinical outcomes between the two groups of treatments.

Results

A total of 62 patients were enrolled in our study, selected based on predefined inclusion and exclusion criteria from a pool of 257 patients with knee dislocations during the specified period.

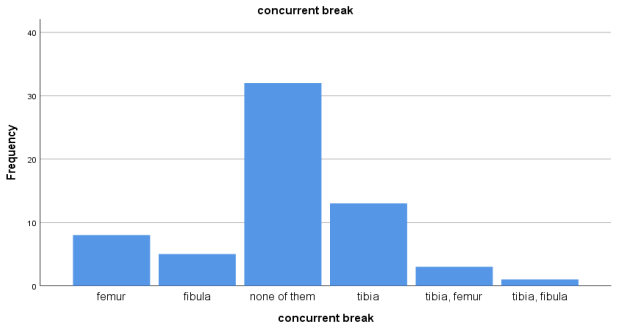

Figure 3: Distribution of associated lower-limb fractures in patients with knee dislocation

Among the participants, 11 were female and 51 were male. The distribution of affected limbs was evenly split, with 32 patients experiencing dislocation in the right limb and 32 in the left limb with no instance of bilateral dislocations various causes were identified with the most frequent being respectively motor vehicle accidents, car accidents, and falls. The distribution of trauma mechanisms is shown in Figure 1.

Concomitant with knee dislocation, concurrent multi-ligamentous, nervous, and vascular injuries were observed. The predominant co-occurring injury in our study was ligamentous in nature. The frequency of concomitant injuries is illustrated in Figure 2.

Additionally, lower limb bone fractures were documented as concurrent events. Tibia and femur fractures were the most prevalent types of fractures encountered in this study. Associated lower-limb fractures are summarized in Figure 3.

Trauma was characterized as open in 50 and closed traumatic injuries, 12 cases.

The two distinct initial treatment modalities included 35 bracing treatment, and 27 external fixators. In terms of clinical efficacy re-dislocation occurred in 5 patients from the bracing group, and none in. However, statistical analysis did not reveal a significant difference between the two groups in this regard. The pain severity scores at 1 month after surgery, was 44.22 in the bracing group and 21.69 in the external fixator group.

The application of Mann-Whitney U test demonstrated a significant reduction in pain score within the external fixator group.

Table 1: Contingency table of relapse according to treatment type

			Type of treatment		
			External fixator	Braces	Total
Reflux	Yes	Count	0	5	5
		Expected Count	2.2	2.8	5.0
	No	Count	27	30	57
		Expected Count	24.8	32.2	57.0
Total		Count	27	35	62
		Expected Count	27.0	35.0	62.0

At 3-months post-surgery, the pain severity score remained lower in the external fixator group 43.17 in the bracing group versus 22.5 in the external fixator group. Statistical analysis once again confirmed the significance of this finding ($p<0.01$). Pain severity trends over time for both treatment groups are presented in Figure 4.

In terms of the time taken to resume work activities, the mean duration was 12.6 months in the external fixator group, and 6.8 months in brace group. However, the one-tailed p-value analysis did not establish statistical significance, although a significant difference was observed using the two-tailed p-value.

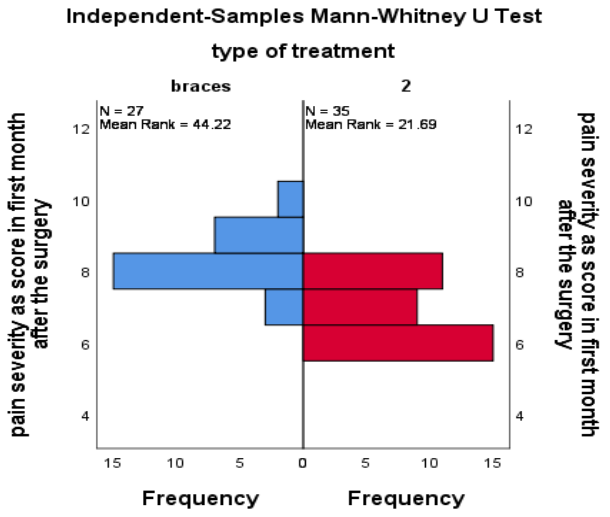

Figure 4: Comparison of pain severity scores between brace and external fixator groups at 1 and 3 months post-treatment

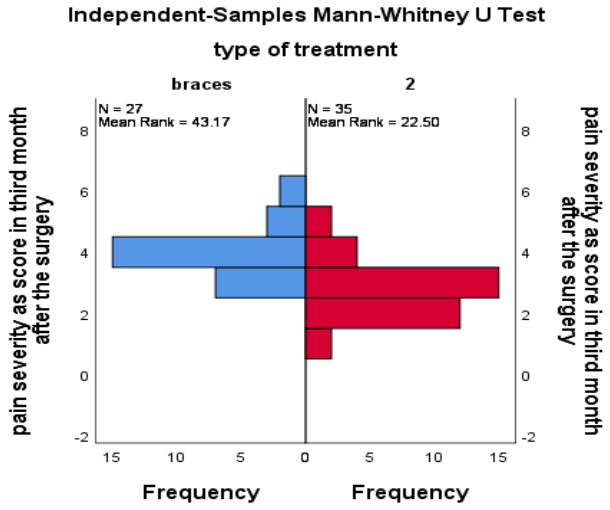

Figure 5: Comparison of rehabilitation duration and time to return to work between treatment groups

In the context of rehabilitation duration, the bracing group exhibited a mean duration of 3.2 weeks, whereas the external fixator group required an average of 9.5 weeks. Despite these differences, the analytical

test failed to demonstrate one-tailed significance between the two groups. A comparison of rehabilitation duration and time to return to work is shown in Figure 5.

Discussion

In this investigation, our primary objective was to examine the clinical outcomes and distinctive characteristics of patients afflicted by knee dislocation, an infrequent musculoskeletal trauma. The estimated incidence rate of this particular injury is approximately 0.02%.[9, 10] Following reduction, two principal modalities are employed to stabilize the affected joint: namely, bracing and employment of external fixators.[11] The cardinal focal point of our inquiry was centered upon the impact of bracing interventions on mitigating the severity of pain scores in individuals affected by knee dislocation.

Our study encountered various limitations, chief among them the constraint imposed by a restricted sample size. Furthermore, the absence of a control group for comparative evaluation of the clinical outcomes between the two treatment modalities constituted another noteworthy drawback. An additional constraint pertained to the dearth of radiographic data, thereby precluding comprehensive assessment of patient injuries; consequently, our data acquisition was reliant solely upon clinical records.

Our study findings have brought to light several noteworthy outcomes. Treatment administered via external fixators demonstrated a propensity for reduced incidence of dislocation and lower pain scores. In contrast, the use of braces potentially made abbreviated rehabilitation periods and quicker resumption of occupational activities easier. As alluded to in prior segments, the analysis of causative factors contributing to knee dislocations was undertaken, with motorcycle-related accidents emerging as the most prevalent etiological factor, thereby corroborating earlier investigations.[12-16]

Additionally, our results revealed a heightened prevalence of knee dislocation among males, with a male-to-female ratio of 5:1 or greater,

The higher rate of 5:1 in males is consistent with prior research.[17-19] The average age of participants was 42 years, surpassing the mean age observed in prior investigations.[17-19] Moreover, a predilection for closed traumas among the afflicted individuals, with knee dislocation is similar to earlier studies.[19-22]

The concomitant injuries, most frequently encountered were multi-ligamentous, neural, and vascular injuries, in that order. It is worth noting that in other studies, vascular injuries have exhibited an equivalent or greater prevalence relative to neural injuries.[23, 24]

Conclusion

Our findings advocate that braces and external fixators each represent viable modalities for initial management of knee dislocations, with distinct benefits for the afflicted individuals. Notwithstanding, the determination of the definitive standard for treatment necessitates the undertaking of meticulously controlled clinical trials.

Acknowledgement

The current clinical trial study was financed by the IUMS Deputy Research, Isfahan, Iran. We appreciatively thank the Vice Chancellor for research, IUMS.

References

1. Anazor FC, Baryeh K, Davies NC. Knee joint dislocation: overview and current concepts. Br J Hosp Med (Lond). 2021 Dec 2; 82(12): 1-10. doi: 10.12968/hmed.2021.0466. Epub 2021 Dec 28. PMID: 34983230.
2. Fanelli GC. Knee Dislocation and Multiple Ligament Injuries of the Knee. Sports Med Arthrosc Rev. 2018 Dec; 26(4): 150-152. doi: 10.1097/JSA.0000000000000220. PMID: 30395055.
3. Mohseni M, Mabrouk A, Simon LV. Knee dislocation. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 [cited 2022 Nov 14]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470595/
4. Medina O, Arom GA, Yeranosian MG, Petrigliano FA, McAllister DR. Vascular and nerve injury after knee dislocation: a systematic review. Clin Orthop Relat Res. 2014 Sep; 472(9): 2621-9. doi: 10.1007/s11999-014-3511-3. PMID: 24554457; PMCID: PMC4117866.
5. Niall DM, Nutton RW, Keating JF. Palsy of the common peroneal nerve after traumatic dislocation of the knee. J Bone Joint Surg Br. 2005 May; 87(5): 664-7. doi: 10.1302/0301-620X.87B5.15607. PMID: 15855368.
6. Peskun CJ, Whelan DB. Outcomes of operative and nonoperative treatment of multiligament knee injuries: an evidence-based review. Sports Med Arthrosc Rev. 2011 Jun; 19(2): 167-73. doi: 10.1097/JSA.0b013e3182107d5f. PMID: 21540715.
7. Levy BA, Krych AJ, Shah JP, Morgan JA, Stuart MJ. Staged protocol for initial management of the dislocated knee. Knee Surg Sports Traumatol Arthrosc. 2010 Dec; 18(12): 1630-7. doi: 10.1007/s00167-010-1209-y. Epub 2010 Jul 16. PMID: 20635077.
8. Fanelli GC. Multiple Ligament Injured Knee: Initial Assessment and Treatment. Clin Sports Med. 2019 Apr; 38(2): 193-198. doi: 10.1016/j.csm.2018.11.004. Epub 2019 Jan 19. PMID: 30878043.
9. Peskun CJ, Levy BA, Fanelli GC, Stannard JP, Stuart MJ, MacDonald PB, Marx RG, Boyd JL, Whelan DB. Diagnosis and management of knee dislocations. Phys

Sportsmed. 2010 Dec; 38(4): 101-11. doi: 10.3810/psm.2010.12.1832. PMID: 21150149.
10. Hegyes MS, Richardson MW, Miller MD. Knee dislocation. Complications of nonoperative and operative management. Clin Sports Med. 2000 Jul; 19(3): 519-43. doi: 10.1016/s0278-5919(05)70222-2. PMID: 10918964.
11. Murphy CI, Roessler PP, Lawyer TJ, Musahl V. Acute knee dislocations. In: Margheritini F, Espregueira-Mendes J, Gobbi A, editors. Complex knee ligament injuries. Berlin, Heidelberg: Springer; 2019. p. 123-13. doi: 10.1007/978-3-662-58245-9_11
12. Sillanpää PJ, Kannus P, Niemi ST, Rolf C, Felländer-Tsai L, Mattila VM. Incidence of knee dislocation and concomitant vascular injury requiring surgery: a nationwide study. J Trauma Acute Care Surg. 2014 Mar; 76(3): 715-9. doi: 10.1097/TA.0000000000000136. PMID: 24553539.
13. Edwards GA, Sarasin SM, Davies AP. Dislocation of the knee: an epidemic in waiting? J Emerg Med. 2013 Jan; 44(1): 68-71. doi: 10.1016/j.jemermed.2011.06.064. Epub 2011 Nov 6. PMID: 22056550.
14. Pace A, Fergusson C. Spontaneous non-traumatic dislocation of the knee. Acta Orthop Belg. 2004 Oct; 70(5): 498-501. PMID: 15587043.
15. Sharma H, Singh GK, Gupta M, Moss M. Type IIIB tibial intercondylar eminence fracture associated with a complex knee dislocation in a grossly obese adult. Knee Surg Sports Traumatol Arthrosc. 2005 May; 13(4): 313-6. doi: 10.1007/s00167-004-0520-x. Epub 2004 Oct 1. PMID: 15875163.
16. Shetty RR, Mostofi SB, Housden PL. Knee dislocation of a morbidly obese patient: a case report. J Orthop Surg (Hong Kong). 2005 Apr; 13(1): 76-8. doi: 10.1177/230949900501300114. PMID: 15872406.
17. Eranki V, Begg C, Wallace B. Outcomes of operatively treated acute knee dislocations. Open Orthop J. 2010 Jan 19; 4: 22-30. doi: 10.2174/1874325001004010022. PMID: 20224661; PMCID: PMC2836735.
18. Ríos A, Villa A, Fahandezh H, de José C, Vaquero J. Results after treatment of traumatic knee dislocations: a report of 26 cases. J Trauma. 2003 Sep; 55(3): 489-94. doi: 10.1097/01.TA.0000043921.09208.76. PMID: 14501892.
19. Talbot M, Berry G, Fernandes J, Ranger P. Knee dislocations: experience at the Hôpital du Sacré-Coeur de Montréal. Can J Surg. 2004 Feb; 47(1): 20-4. PMID: 14997920; PMCID: PMC3211817.
20. Harner CD, Waltrip RL, Bennett CH, Francis KA, Cole B, Irrgang JJ. Surgical management of knee dislocations. J Bone Joint Surg Am. 2004 Feb; 86(2): 262-73. doi: 10.2106/00004623-200402000-00008. PMID: 14960670.
21. King JJ 3rd, Cerynik DL, Blair JA, Harding SP, Tom JA. Surgical outcomes after traumatic open knee dislocation. Knee Surg Sports Traumatol Arthrosc. 2009 Sep; 17(9): 1027-32. doi: 10.1007/s00167-009-0721-4. Epub 2009 Feb 10. PMID: 19205664.
22. Ríos A, Villa A, Fahandezh H, de José C, Vaquero J. Results after treatment of traumatic knee dislocations: a report of 26 cases. J Trauma. 2003 Sep; 55(3): 489-94. doi: 10.1097/01.TA.0000043921.09208.76. PMID: 14501892.
23. Twaddle BC, Bidwell TA, Chapman JR. Knee dislocations: where are the lesions? A prospective evaluation of surgical findings in 63 cases. J Orthop Trauma. 2003 Mar; 17(3): 198-202. doi: 10.1097/00005131-200303000-00008. PMID: 12621261.
24. Parrado RH, Notrica DM. Vascular and Neurological Injury in Children With Posterior Traumatic Knee Dislocation. Am Surg. 2023 Jun; 89(6): 2791-2793. doi: 10.1177/00031348211050589. Epub 2021 Nov 6. PMID: 34747225.