Original Article

A comparison between the effects of simple and traction splints on pain intensity in patients with femur fractures

Alireza Irajpour, Nariman Sadeghi Kaji[1], Fatemeh Nazari, Reza Azizkhani[2], Akbar Hassan Zadeh[3]

Abstract

Background: Fractures of femur are among the most important causes of mortality in musculoskeletal injuries. Owning to lack of adequate research to compare various techniques of fracture stabilization, there has not yet been an agreement over a protocol to utilize a specific type of splint for femoral fracture immobilization. This study was thus conducted to compare the effects of simple and traction splints on pain intensityimmediately after and at the 1st, 6th, and 12thh after splinting among patients with femur fracture in the centers affiliated to Isfahan University of Medical Sciences (Isfahan, Iran).

Materials and Methods: This quasi-experimental study was performed on 32 patients with femur fractures. Prehospital emergency ambulances were divided into two groups of simple and traction splints using a table of random numbers. Continuous convenient sampling was employed in each group to use either a simple or a traction splint for the patients with femur fractures. Pain intensity of the patients was then measured by a visual analogue scale (VAS) immediately, 1 h, 6 h, and 12 h after splinting. The effects of the two techniques were finally compared.

Results: After splinting, pain intensity decreased significantly in both groups ($P = 0.0001$ in both groups). The reductions were significantly more in the traction splint group at the 1st, 6th ($P = 0.0001$), and 12thh after splinting ($P = 0.02$) compared with the simple splint group. There was no significant difference in pain intensity immediately after splintingbetween the two groups ($P = 0.441$).

Conclusion: The significant difference in pain reduction between the simple and traction splint groups at the 1st, 6th, and 12thh after splinting emphasizes the superiority of traction splints.

Key words: Fracture of femur, prehospital emergency care, traction splint

Introduction

Musculoskeletal system injuries, including fractures of femoral shaft, are major causes of mortality or disability in adults.[1] The most prevalent cause of femoral fracture is falling or accident with vehicles.[2] The majority of such fractures occur in the middle and upper third area during activities such as skiing and bike riding. Such injuries are also seen as a result of falls, sports accidents, work-related accidents, accidents with vehicles, and in some special cases in children abuse.[3] As the femoral bone is the largest and the main weight-bearing bone in the body, femoral fracture and its treatment are associated with long-term disabilities.[4,5] In fact, complications and mortality of femoral fracture have been reported in 46% and approximately 20-54% of the cases, respectively.[6] A study in Sweden has estimated the annual prevalence of femoral fracture as 9.9-10 in every 100,000 people.[7] Following femoral fractures, severe contraction of large muscles surrounding the hip can stretch the two ends of the broken bone toward each other and thus create harsh pain.[8,9] Prehospital care and transportation of patients at scenes of accident are often performed by trained staff in prehospital emergency systems.[10] The main goal of such systems is to save life, prevent injury, and reduce pain exacerbation prior to the main treatment.[11] A leading strategy, at both levels of basic and advanced emergency services is immobilization of musculoskeletal injuries.[10,12] Timely and accurate interventions of emergency nurses can save the lives of patients, prevent further injuries, and particularly reduce pain in patients with femoral fractures.[8,11] Splints, including simple and traction splints, are among the tools used for immobilization. However, due to their features and especially the way they are used, there is no consensus regarding the usage of a specific splint in a particular situation.[8] In closed femoral fractures, the most commonly used splints are long wooden splints and traction splints, each of which have their own advantages and disadvantages.[12] As the simplest splint type, wooden splints fix the organ and prevent the conversion of a closed

Nursing and Midwifery Care Research Center, Faculty of Nursing and Midwifery, [1]Medical–Surgical Nursing, Faculty of Nursing and Midwifery, [2] Department of Emergency Medicine, Faculty of Medicine, [3]Department of Statistics, Faculty of Health, Isfahan University of Medical Sciences, Isfahan, Iran

Address for correspondence: Dr. Alireza Irajpour, Nursing and Midwifery Care Research Center, Faculty of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran. E-mail: irajpour@nm.mui.ac.ir

fracture to an open fracture. They thus reduce pain in closed bone fractures.[8] Traction splints are also common tools of treating femoral fractures in injured patients admitted in prehospital emergency units.[9,13] Therefore, many emergency medicine and nursing references have called traction splints as one of the most effective practices in prehospital emergency.[14] Although various immobilization tools (other types of splints) can reduce patients'pain to some extent, some believe that in special cases, such as femoral fractures, traction splint can be applied.[15,16] Some specialists even believe in it as the most effective way to reduce adverse effects of femoral fractures, that is, pain.[8] Despite the mentioned benefits, using traction splints is accompanied by uncertainty owing to some complications such as damage to the neuromuscular system and/or pressure to the femoral neurovascular system as the femoral region contains femoral, sciatic, and popliteal nerves, as well as relevant blood vessels.[8,12] As a result, Bledsoe and Barnes emphasized the necessity of reconsidering the use of traction splints in prehospital emergency.[17] Similarly, Wood *et al.* stated that inserting a traction splint can prolong the presence of the prehospital emergency personnel at the scene of accident. On the other hand, inserting a traction splint by two staff members is associated with manipulating the injured organs to create tension and can thus exacerbate pain intensity or injury. In addition, possible difficulty in using traction splints during patient transfer in prehospital emergency systems has made the use of other types of simple wooden splints acceptable. Therefore, despite the advantages of traction splints compared with simple splints, their application is still under debate due to the related complications and arguments about their effects on complications of femoral fracture, including pain. However, the recommendation of the American College of Surgeons Committee on Trauma and Illinois Department of Healthcare in the United States indicated for equipping all ambulance units with traction splints in prehospital emergency.[18] As prehospital emergency nurses and technicians are responsible for splinting in prehospital conditions,[8,12] it is necessary to query the effectiveness of various splint types on femoral fracture outcomes and mostly importantly pain. Therefore, this study aimed to determine and compare the impacts of using simple and traction splints on pain intensity of patients with femoral fracture immediately and at the 1st, 6th and 12th h after splinting in health centers affiliated to Isfahan University of Medical Sciences, Isfahan, Iran.

Materials and Methods

This was a quasi-experimental study on 30 patients who were diagnosed with a closed femoral shaft fracture by ambulance nurses based on the instructions of American Association of Surgeons. Patients were included if they aged 15-65 years, were not addicted to any drugs, provided informed consents to participate in the study, and had full consciousness when completing the questionnaires. The subjects were all transferred to one of Alzahra, Isa Ibn Maryam, Amin, Kashani, Shariati, or Gharazi Hospitals by the prehospital emergency services of Isfahan. Other inclusion criteria were maintaining the splint on the injured organ for at least for 12 h after splinting and using morphine sulfate as a painkiller. Accordingly, patients were excluded if they were unwilling to continue participation, developed any problems incompatible with the inclusion criteria, and did not have the splint on the injured organ for 12 h. Randomized sampling method was first used by allocating 31prehospital emergency codes. Continuous convenient sampling method was then employed for placement of the selected splints. The personnel participated in 10 sessions about splint placement techniques (simple and traction) based on the instruction of the American Association of Emergency Physicians (2011). They then took a test and were selected for splinting if they obtained the whole 13 scores of the test. After explaining the conditions for the subjects and obtaining their informed consent, one of the two splints was placed for them. Pain intensity was measured using a visual analogue scale (VAS) from 0 (no pain) to 10 (the highest pain intensity) immediately and at the 1st, 6th, and 12th h after splinting. For adjustment and matching the conditions based on the issued protocol by the Isfahan Disaster and Emergency Management Center, 5 mg of morphine sulfate was used for all patients immediately before splinting. A two-part questionnaire was used for data collection. The first part covered demographic data. The second part included the mechanism of the accident, the injured site, pain intensity at different times. It also assessed times related to prehospital emergency care provision, that is, the times of reaching the accident location, using morphine sulfate, splinting, and delivering the patient to the hospital, and splint replacement. The time and amount of using morphine sulfate as an intervening factor during the first 12 h were also recorded. Data analysis was conducted using descriptive statistics such as frequency distribution, mean and standard deviation (SD), and inferential tests including analysis of variance (ANOVA), independent*t*-test and Chi-square test in $SPSS_{18}$(SPSS Inc., Chicago, IL, USA).

Results

Of the 35 patients with femoral shaft fracture in the simple splint group, one subject was excluded due to addiction and another due to unwillingness to continue participation. A third patient was also excluded after a diagnosis of floating rib fractures. The traction splint group consisted of 34 subjects among whom twodid not consent to continue. There were thus totally 32 subjects in each group.

The mean ages of the participants in the simple and traction splint groups were 29 (14.1) and 31 (14.8) years, respectively. There was no significant difference between the two groups in terms of age (t = 0.6; P = 0.547). Males constituted 87.5% (n = 28) of the simple splint group and 90.6% (n = 29) of the traction splint group. Chi-square test did not show significant differences in sex distribution between the two groups (χ^2 = 0.16; P = 0.698). In addition, frequency distribution of marital status was not significantly different between the two groups, either. Moreover, after excluding the mentioned patients and determining the final number of left and right injured legs, no significant differences were found between femoral fractures in the right and left legs. There were no significant differences between the two groups regarding the frequency of injury mechanisms (falling from height, vehicle accident, sport events, and occupational accidents). However, both groups had higher numbers of vehicle accidents. The spent time in the scene showed no significant difference between the two groups (P = 0.0001).

As indicated in Table 1, pain intensity decreased consistently in the simple splint group from the beginning of splinting until the end of the 12thh (mean reduction between every two measurements: 0.53 units). However, in the traction splint group, pain intensity showed higher decreased at a higher rate between during the 1sth after splinting (1.2 units) compared with the next two measurements (mean reduction: 0.66 units).

In the simple splint group, mean score of pain intensity significantly reduced at the 12thh compared with immediately after splinting (f = 15.7; P = 0.0001). A similar significant reduction was also observed in the traction splint group (f = 47.5; P = 0.0001). There was no significant difference between the two groups in mean scores of pain intensity immediately after splinting (P = 0.441). In contrast, measurements at the 1st, 6th, and 12thh after splinting revealed significant differences between the two groups in terms of pain intensity (P = 0.0001 and P = 0.0001, and P = 0.02, respectively).

Table 1: Pain intensity of patients with femur fractures at different times stratified by splint types

Pain intensity	Simple splint	Traction splint	*P*
Immediately after splinting	6.7 (1.4)	6.4 (1.2)	0.4410
1 h after splinting	6.0 (1.3)	4.8 (1.0)	0.0001
6 h after splinting	5.4 (0.9)	4.2 (1.0)	0.0001
12 h after splinting	5.1 (1.2)	4.0 (1.0)	0.0200
F	15.7	47.5	
P	0.0001	0.0001	

Values are expressed as mean (SD)

Discussion

The findings of this study indicated pain intensity in patients with femoral fractures immobilized with simple splints to be lower pain at 1st, 6th, and 12thh after splinting compared with immediately after splinting. Moreover, the reduction trend continued during the hours after splinting. For the same reason, Beck *et al.*,[8] Lockey,[11] Saygi *et al.*,[19] Anderson *et al.*,[20] and many reference books have emphasized the application of simple splint to reduce pain.

On the other hand, scores of pain intensity of patients whose femoral fractures were immobilized with traction splints significantly reduced over time. Although Wood *et al.*[13] reported contrasting results, Limmer,[16] Houghton *et al.*,[21] and Chu *et al.*[22] suggested findings similar to ours. Such reduction could have been caused by decreased muscle resistance around the injured bone. To be more precise, after musculoskeletal injuries, the muscles notably contract and thus produce severe pain. A traction splint stretches the muscles consistently and gradually reduces pain as muscle spasm is relieved.

Furthermore, we found the mean reduction of pain intensity score during the first 12 h to be higher in the traction splint group compared with the simple splint group. This finding was in accordance with the results of Lockey,[11] Chu *et al.*,[22] and Ellis[23] and also the guidelines of the American Association of Emergency Physicians.[12]

Among the challenges of using traction splints are the required splinting time in the scene of accident and the need for two staff members for their placement.[24] However, we could not find a significant difference in the spent time for splinting between the traction and simple splint groups, which may emphasize the possibility of replacing traction splints instead of simple splints. Besides, in this study, we observed higher efficiency of traction splints in pain reduction at 1st and 6th h after splinting. In addition, using tract splints was more advantageous for patients with femoral fractures. Similar results were reported by El-Dakhakhni,[9] American College of Emergency Physicians,[12] Chaplean,[15] and Booth[25] who confirmed the positive effects of traction splints and their superiority over simple splints.

Acknowledgments

Many appreciations go to the esteemed Vice Chancellory of Research and Technology in Isfahan University of Medical Sciences supporting this study financially and also the Dean and Research Deputy of School of Nursing and Midwifery, and all the patients who assisted us in conducting this study. We also thank the nursing staff of prehospital emergency care Department of Isfahan and

Emergency, Departments of Alzahra, Kashani, Isa Ibn Maryam, Amin, Gharazi, and Shariati Hospitals in Isfahan, Iran.

References

1. Sukumaran S, Henry JM, Beard D, Lawrenson R, Gordon MW, O'Donnell JJ, *et al*. Prehospital trauma management: A national study of paramedic activities. Emerg Med J 2005;22:60-3.1.
2. Rogers FB, Shackford SR, Vane DW, Kaups KL, Harris F. Prompt fixation of isolated femur fractures in a rural trauma center: A study examining the timing of fixation and resource allocation. J Trauma 1994;36:774-7.
3. Achlert B.Emergency Medical Technician with Pocket Guide: EMT in Action. New York: McGraw-Hill Companies, Incorporated; 2008. p. 534-43.
4. Campbell WC, CanaleST. Campbell's Operative Orthopaedics. 10th ed. Philadelphia: Mosby; 2003. p. 650-80.
5. McDougall T. Orthopaedic update: Assessment of limb injury. Australas Emerg Nurs J 1999;2:26-8.
6. Mansson E, Ruter A, Vikstrom T. Femoral shaft fractures and the prehospital use of traction splints. Scand J Trauma Resusc Emerg Med 2006;14:26-9.
7. Salminen ST, Pihlajamäki HK, AvikainenVJ, Böstman OM. Population based epidemiologic and morphologic study of femoral shaft fractures. Clin Orthop Relat Res 2000;372:241-9.
8. American Academy of Orthopaedic Surgeons, Beck RJ, Pollak AN, RahmSJ.Intermediate Emergency Care and Transportation of the Sick and Injured. New York: Jones and Bartlett Learning; 2005. p. 804-24.
9. El-Dakhakhny AM. Impact of an educational program on nurses' performance toward children in Thomas traction. Int J Orthop Trauma Nurs 2010;14:206-19.
10. Roudsari BS, Nathens AB, Cameron P, Civil I, GruenRL, Koepsell TD, *et al*. International comparison of prehospital trauma care systems. Injury 2007;38:993-1000.
11. Lockey DJ. Prehospital trauma management. Resuscitation 2001;48:5-15.
12. American College of Emergency Physicians.Critical Care Transport. New York: Jones and Bartlett Learning; 2009. p. 347-50
13. Wood SP, Vrahas M, Wedel SK. Femur fracture immobilization with traction splints in multisystem trauma patients. Prehosp Emerg Care 2003;7:241-3.
14. Ross H, Lockhart J. Keeping practical orthopaedic nursing skills alive: Developing a photographic traction guide. J Orthop Nurs 2007;11:38-42.
15. ChapleanW. Emergency Medical Technician. Philadelphia: Mosby. 2007. p. 548-54.
16. Limmer, D. Christopher, J. Lee, B. EMT Complete: A Basic Worktext. New York: Pearson and Brady; 2007. p. 796-830.
17. Bledeso B, Barnes D. Traction splint. An EMS relic? JEMS 2004;29:64-9.
18. Abarbanell NR. Prehospital midthigh trauma and traction splint use: Recommendations for treatment protocols. Am J Emerg Med 2001;19:137-40.
19. Saygi B, Ozkan K, Eceviz E, Tetik C, Sen C. Skin traction and placebo effect in the preoperative pain control of patients with collum and intertrochanteric femur fractures. Bull NYU Hosp Jt Dis 2010;68:15-7.
20. Anderson GH, Harper WM, Connolly CD, Badham J, Goodrich N, Gregg PJ. Preoperative skin traction for fractures of the proximal femur: A randomised prospective trial. J Bone Joint Surg Br 1993;75:794-6.
21. Houghton K, Houghton K, Peregrina M, Gillies D, Herden J. A small trial of the nursing care of patients immobilised with a Thomas splint. J Orthop Nurs 2003;7:201-4.
22. Chu RS, Browne GJ, Lam LT. Traction splinting of femoral shaft fractures in a paediatric emergency department: Time is of the essence? Emerg Med (Fremantle) 2003;15:447-52.
23. Ellis H. The Thomas splint. J Perioper Pract 2007;17:38-9.
24. Spaite DW, Tse DJ, Valenzuela TD, Criss EA, Meislin HW, Mahoney M, *et al*. The impact of injury severity and prehospital procedures on scene time in victims of major trauma. Ann Emerg Med 1991;20:1299-305.
25. Booth J. Traction update? J Orthop Nurs 2002;6:230-5.

How to cite this article: Irajpour A, Kaji NS, Nazari F, Azizkhani R, Zadeh AH. A comparison between the effects of simple and traction splints on pain intensity in patients with femur fractures. Iranian J Nursing Midwifery Res 2012;17:530-33.

Source of Support: Vice Chancellory of Research and Technology in Isfahan University of Medical Sciences. **Conflict of Interest:** None.