J Orthop Spine Trauma. 2023 June; 9(2): 59-61. DOI: 10.18502/jost.v9i2.12622

Review Article

A Current Concept Review for the Use of External Fixators in Elderly Patients with Intertrochanteric Fracture

Alireza Moharrami[1,*], Mir Mansour Moazen Jamshidi[2], Soroush Alaeddini[3], Mazaher Ebrahimian[4], Amir Reza Mafi[5]

[1] Resident, Joint Reconstruction Research Center, Tehran University of Medical Sciences, Tehran, Iran
[2] Associate Professor, Department of Orthopedics, School of Medicine, Zanjan University of Medical Sciences, Zanjan, Iran
[3] Student of Medicine, School of Medicine, Iran University of Medical Sciences, Tehran, Iran
[4] Resident, Department of Orthopedics, Sina Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran
[5] General Practitioner, Tehran University of Medical Sciences, Tehran, Iran

[*]Corresponding author: Alireza Moharrami; Joint Reconstruction Research Center, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98-9122432839, Email: a.moharramy@gmail.com

Received: 11 November 2022; **Revised:** 23 January 2022; **Accepted:** 04 February 2023

Abstract

Intertrochanteric (IT) fractures are responsible for almost half of the fractures in the elderly. The financial burdens of IT fractures are considerable, not only because of their influence on morbidity and mortality but also because they might lead to functional limitation, alleviated quality of life, and a limited possibility to work. There are several methods of fixations for IT fractures, such as cephalomedullary nailing, dynamic hip screw (DHS), proximal femur plate, and external fixator. Most of the patients with this fracture were unsuitable for anesthesia and surgical procedure. The external fixator is a fast, non-invasive, and bloodless method for fixation which would be performed with light sedation. In the present study, we reviewed recent literature regarding external fixators for IT fractures.

Keywords: External Fixation; Intertrochanteric Fracture; Hip

Citation: Moharrami A, Moazen Jamshidi MM, Alaeddini S, Ebrahimian M, Mafi AR. **A Current Concept Review for the Use of External Fixators in Elderly Patients with Intertrochanteric Fracture.** *J Orthop Spine Trauma* 2023; 9(2): 59-61.

Background

Intertrochanteric (IT) fractures are responsible for almost half of the fractures in the elderly (1). They are considered amongst the most frequent fractures in elderly members of societies over the next 50 years due to the exponential increase in life expectancy and rate of osteoporosis. The financial burdens of IT fractures are considerable, not only because of their influence on morbidity and mortality but also because they might lead to functional limitation, alleviated quality of life, and a limited possibility to work (2). There are several methods of fixations for this fracture, such as cephalomedullary nailing, dynamic hip screw (DHS), proximal femur plate, and external fixator. Most of the patients with this fracture were unsuitable for anesthesia and surgical procedure. The external fixator is a fast, non-invasive, and bloodless method for fixation which would be performed with light sedation. Herein, we reviewed the recent literature on external fixators for IT fracture.

IT Fractures

IT fractures are extracapsular fractures of the proximal femur and are located between the greater and lesser trochanter of the femur. The IT region is distal to the neck of the femur and consists of trabecular bone.

The etiology of IT fracture is mostly osteoporosis due to a low-energy mechanism. Meanwhile, it can happen in both young and senior members of the population. It is more frequent among women, with a female-to-male ratio between 2:1 and 8:1 (3). These fractures are associated with high morbidity and mortality along with other types of hip fractures. At present, annually, 280000 hip fractures occur, and nearly half of them are IT fractures (4). These fractures are mainly caused by ground-level falls in the elderly population. In contrast, a high-energy mechanism accounts for most IT fractures in the younger population.

For IT fractures, there are two mainly used classification systems, the Evans-Jensen system and AO Foundation/Orthopedic Trauma Association (AO/OTA) classification (5, 6).

The Evans-Jensen system categorized IT fractures by dislocation, the number of fragments, and types of displaced fragments. Type I fracture is a 2-part fracture, type II fracture is a 3-part fracture, and type III is a 4-part fracture. There are two types of fractures in type I: one nondisplaced and the other displaced by two fragments but stable. Meanwhile, type II consists of unstable three fragments with two types of involvement: posterolateral or posteromedial. A very rare subtype of fracture is a three-fragment fracture with greater trochanteric involvement and a reverse oblique fracture line.

In AO/OTA classification, IT fractures consist of 31A classes and are divided into 31A1, 31A2, and 31A3 types. 31A1 type is a simple pertrochanteric fracture without lateral wall involvement, and it comprises three subgroups: 31A1 is a single trochanteric fracture in greater or lesser trochanter, 31A2 is a two-fragment fracture without lateral wall involvement, and 31A3 is a mildly comminuted fracture without lateral wall involvement. 31A2 includes pertrochanteric lateral wall incompetent fractures with one (31A2.2) or two or more (31A2.3) intermediate fragments. 31A3 type is IT fractures with oblique (31A3.1), transverse (31A3.2), or multi-fragmentary or wedge-shaped (31A3.3) fracture lines (Figure 1) (6, 7).

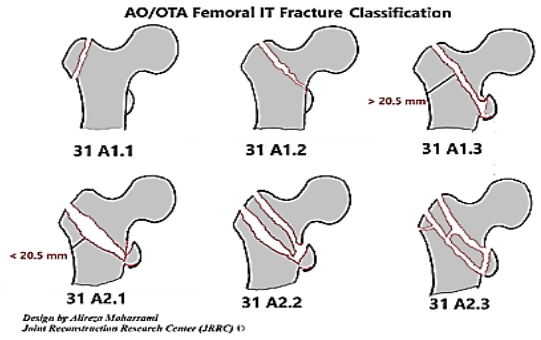

Figure 1. The AO Foundation/Orthopedic Trauma Association (AO/OTA) classification of intertrochanteric (IT) fracture (8)

Methods of Fixation

Non-operative treatment for IT fractures is highly unsafe due to the elevated chance of pneumonia, urinary tract infection (UTI), or deep vein thrombosis (DVT). Non-operative treatment is only recommended for non-ambulatory patients or patients with a higher risk of postoperative mortality (9). Operative management of these fractures is urgent, not emergent, and because of high preoperative comorbidities can be optimized to reduce morbidity and mortality. The treatment of choice is mainly based on the fracture pattern and its stability. Intramedullary nailing and sliding hip screw (SHS) or DHS are the main internal fixation options. Indications for DHS include stable fractures with an intact lateral wall. In contrast, the indications for intramedullary nailing are unstable fractures, including fractures with posteromedial cortex, thin lateral wall, dislocated lesser trochanter fractures, subtrochanteric extension of the fracture, and reverse oblique fractures (10, 11).

External Fixations

External fixators were not used widely in the past for IT fracture treatment. Primary uses of external fixators in hip fractures resulted in the discontinuation of this method because of a high prevalence of complications such as loosening of the pins, infection, or varus collapse of the femoral head (12). With the advent of hydroxyapatite-coated external fixators and a better understanding of healing mechanisms in patients with osteoporosis, using external fixators as a less invasive alternative was widely considered (13). Additionally, there was a huge satisfaction toward external fixators in European population. Recently, external fixation in IT fractures drew attention due to its substantial advantages, such as shorter operation time, less bleeding, and the possibility of utilizing it without general anesthesia. Using local anesthesia is one of the major advantages of this method compared to others, and in numerous studies, external fixators were recommended for patients with a high risk of anesthesia (12).

Indications and Contraindications of External Fixation: The indications for using external fixators in patients with IT fractures are as follows:

1- American Society of Anesthesiologists (ASA) class III and IV (12)
2- Patients with AO/OTA A1 and A2 types of fractures (13)
3- Patients with multiple injuries and IT fractures (14)

Applying external fixators is contraindicated in conditions, including diabetes mellitus (DM), due to the higher rate of pin infection (15) and the presence of urinary incontinence as an infection risk factor (16).

Advantages and Disadvantages of External Fixation: In several studies, various advantages have been mentioned for the external fixation method, such as significantly less operation time and less blood loss, hence lower prevalence of blood transfusion, low cost, satisfactory stability, reduction of pain, less radiation exposure, and early weight-bearing ability following procedure (13, 14). External fixators play a major role in fracture stability in either stable or unstable fractures because of their tension band effect and load-sharing enhancement (15).

In contrast, the main disadvantages of external fixations are a deep infection that might need pin removal or superficial pin tract infection that can be treated by daily dressing and oral antibiotics (15, 16). However, pin tract infection has decreased with the advent of hydroxyapatite-coated pins compared to conventional pins (15). Knee stiffness was observed in some patients with some types of external fixators, but it can be resolved after fixator removal (2). Meanwhile, variation and limb shortening due to varus collapse are frequent in both internal and external fixations in unstable or severely osteoporotic IT fractures. Additionally, hydroxyapatite-coated pins are connected to a lower risk of varus collapse due to bone ingrowth into the coating. However, fracture non-union is mainly infrequent because these types of fractures occur through vascular cancellous bone (15, 17).

The Types of External Fixation for IT Fractures

Numerous types of external fixators have been employed in several studies. For instance, monolateral external fixation, such as Orthofix external fixator frame (Verona, Italy), has been used in some studies and has shown promising results as it can be used for patients with comorbidities as an option with minimal complications (15). In one comparison between external fixation (Orthofix) and SHS in the elderly population, external fixator has been suggested as a safe treatment for IT fractures as its application takes half the time of internal fixator, has less risk of blood loss and less postoperative pain, and according to the authors, it should be considered as an option for the elderly and frail population, especially with multiple injuries or unstable or complex fractures (14).

Another type of external fixator is the Ilizarov circular or semicircular fixator. It has advantages such as worldwide accessibility and less cost compared to other special trochanteric fixators. However, main disadvantages of Ilizarov fixators are pin tract infection and inconvenience due to their clumsy construction. Nevertheless, a properly applied semicircular Ilizarov external fixator without skin tension or thermal damage can be expected to be tolerated very well (2).

Postoperative Cares

Post-operative mobilization must be considered within the first day. For stable fractures, partial weight-bearing followed by full weight-bearing can be allowed within 6 to 12 hours of surgery. In unstable fractures, toe-touch weight-bearing with the help of crutches is desirable for the first six weeks. Pin site infection is the main complication of external fixators and should be considered in daily dressing of the pin site.

A routine clinical visit should be every two weeks for four weeks and then monthly. In every visit, the pin site should be appropriately investigated. Hip and knee range of motion (ROM), quadriceps strength, and ambulation with or without support should be evaluated. Rehabilitation should be considered for hip and knee ROM restoration. External fixators can be removed after signs of fracture union appear in radiography (15).

Conclusion

External fixators should be considered in frail patients suffering from IT fractures with multiple comorbidities and injuries due to their advantages, such as low cost, the possibility to be used under local anesthesia, and less blood loss. However, their complications, such as pin tract infection and knee stiffness, should be considered and could be reduced by appropriate wound care and rehabilitation.

Conflict of Interest

The authors declare no conflict of interest in this study.

Acknowledgements

None.

References

1. Sharma A, Sethi A, Sharma S. Treatment of stable intertrochanteric fractures of the femur with proximal femoral nail versus dynamic hip screw: A comparative study. *Rev Bras Ortop*. 2018;53(4):477-81. doi: 10.1016/j.rboe.2017.07.008. [PubMed: 30027082]. [PubMed Central: PMC6052185].
2. Tomak Y, Kocaoglu M, Piskin A, Yildiz C, Gulman B, Tomak L. Treatment of intertrochanteric fractures in geriatric patients with a modified external fixator. *Injury*. 2005;36(5):635-43. doi: 10.1016/j.injury.2004.10.013. [PubMed: 15826624].
3. Chang SM, Hou ZY, Hu SJ, Du SC. Intertrochanteric femur fracture treatment in Asia: What we know and what the world can learn. *Orthop Clin North Am*. 2020;51(2):189-205. doi: 10.1016/j.ocl.2019.11.011. [PubMed: 32138857].
4. Yang Y, Lin X. Epidemiological features of 877 cases with hip fraction. *Zhonghua Liu Xing Bing Xue Za Zhi*. 2014;35(4):446-8. [In Chinese]. [PubMed: 25009039].
5. Jensen JS. Classification of trochanteric fractures. *Acta Orthop Scand*. 1980;51(5):803-10. doi: 10.3109/17453678008990877. [PubMed: 7468173].
6. Meinberg EG, Agel J, Roberts CS, Karam MD, Kellam JF. Fracture and dislocation classification compendium-2018. *J Orthop Trauma*. 2018;32(Suppl 1):S1-S170. doi: 10.1097/BOT.0000000000001063. [PubMed: 29256945].
7. Kani KK, Porrino JA, Mulcahy H, Chew FS. Fragility fractures of the proximal femur: Review and update for radiologists. *Skeletal Radiol*. 2019;48(1):29-45. doi: 10.1007/s00256-018-3008-3. [PubMed: 29959502].
8. Hoseini Zare N, Moharrami A, Mortazavi SMJ. The importance of the lateral femoral wall thickness in intertrochanteric fracture: Educational corner. *J Orthop Spine Trauma*. 2020;6(1):14-5. doi: 10.18502/jost.v6i1.4536.
9. Wang F, Meng C, Cao XB, Chen Q, Xu XF, Chen Q. Hemiarthroplasty for the treatment of complicated femoral intertrochanteric fracture in elderly patients. *Zhongguo Gu Shang*. 2018;31(9):818-23. [In Chinese]. doi: 10.3969/j.issn.1003-0034.2018.09.008. [PubMed: 30332874].
10. Khoori M, Moharrami A, Hoseini Zare N, Mortazavi SJ. The importance of length of the cephalomedullary nails for fixation of the proximal femoral fractures: An educational corner. *J Orthop Spine Trauma*. 2021;6(3):55-6. doi: 10.18502/jost.v6i3.4963.
11. Salehi M, Moharrami A, Hoseini Zare N, Moazen Jamshidi MM, Mortazavi SJ. Choosing device in intertrochanteric fracture based on AO/OTA classification: Educational corner. *J Orthop Spine Trauma*. 2022;8(1):27-30. doi: 10.18502/jost.v8i1.9042.
12. Moradi A, Moradi M, Emadzadeh M, Bagheri F. Comparison of the dynamic hip screw with the dynamic hip external fixator for intertrochanteric fractures: Report of a randomized controlled trial. *Arch Bone Jt Surg*. 2021;9(6):665-76. doi: 10.22038/ABJS.2021.53705.2672. [PubMed: 35106332]. [PubMed Central: PMC8765197].
13. Kazemian GH, Emami M, Manafi A, Najafi F, Najafi MA. External fixation vs. skeletal traction for treatment of intertrochanteric fractures in the elderly. *Trauma Mon*. 2016;21(1):e15477. doi: 10.5812/traumamon.15477. [PubMed: 27218039]. [PubMed Central: PMC4869414].
14. Vossinakis IC, Badras LS. The external fixator compared with the sliding hip screw for pertrochanteric fractures of the femur. *J Bone Joint Surg Br*. 2002;84(1):23-9. doi: 10.1302/0301-620x.84b1.12034. [PubMed: 11837827].
15. Yousry AH, Chotai PN, El Ghazaly SA, Fayyad TA, Abdelgawad AA. Outcomes of trochanteric external fixation for geriatric inter-trochanteric hip fractures. *J Orthop*. 2015;12(4):174-8. doi: 10.1016/j.jor.2015.05.019. [PubMed: 26566315]. [PubMed Central: PMC4602004].
16. Vossinakis IC, Badras LS. Management of pertrochanteric fractures in high-risk patients with an external fixation. *Int Orthop*. 2001;25(4):219-22. doi: 10.1007/s002640100238. [PubMed: 11561494]. [PubMed Central: PMC3620822].
17. Moazen Jamshidi MM, Moharrami A, Tabatabaei Irani P, Ghasemi MA, Mafi AR, Mortazavi SJ. Intrapelvic migration of dynamic hip screw postoperatively leading to total hip arthroplasty: A case report. *J Orthop Spine Trauma*. 2022;8(2):69-71. doi: 10.18502/jost.v8i2.9316.