

NURSING CARE IN PATIENTS WITH EXTERNAL FIXATION

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Abstract

External fixation is a surgical treatment used to stabilize bone and soft tissues at a distance from the operative or injury focus. They provide unobstructed access to the relevant skeletal and soft tissue structures for their initial assessment and also for secondary interventions needed to restore bony continuity and a functional soft tissue cover. It is an alternative to internal fixation, where the components used to provide stability are positioned entirely within the patient's body. This study aims to determine the importance of nursing care in patients who had used the external fixation. Nursing care is related to the prevention of complications from the use of external fixation, pressures in soft tissues and bone marrow and infection.

Keywords: External traction, fractures, immobilization, self-care, nursing care, infections.

Introduction

External fixation is a technique used to manage musculoskeletal conditions such as complex fractures or limb deformity (Jennison et al, 2014). (1). External fixator devices are applied using a surgical procedure whereby pins and/or wires are inserted through the skin into the bone. The pins and wires are then secured using a system of clamps, connectors or circular rings to create a scaffold system.(2,3). The sites where the pins or wires enter the skin are commonly referred to as pin sites. External fixation can be used to immobilise fractures if other methods of immobilisation, such as a plaster cast, are unlikely to be effective; for example, when there are multiple fragments of bone or when there has been extensive loss of skin or bone. (3). It can also be used to help correct bone deformities or as part of limb lengthening procedures. Clinicians use external fixation in orthopedic trauma, pediatric orthopedics, and plastic surgery for an array of different pathology. Indications for external fixation devices:(4,5).

- Unstable pelvic ring injuries
- Comminuted periarticular fractures such as pilon, distal femur, tibial plateau, elbow, and distal radius fractures
- Fractures with large amounts of soft tissue swelling
- Fractures in a patient that is hemodynamically unstable or cannot undergo an open procedure
- Comminuted long bone fractures
- Fractures with significant bone loss
- Open fractures with soft tissue loss
- Limb deformity and limb lengthening
- Osteomyelitis with bone loss
- Immobilization of joint after soft tissue flap
- Arthrodesis
- Nonunion
- Malunion
- Infection
- Traction to aid in intraoperative fracture reduction (22,23).

Contraindications

External fixation is a relatively safe minimally invasive procedure and can provide significant benefit to the patient when used in the correct setting. As such, there are limited contraindications for its use in orthopedics. (5). Relative contraindications include an obese patient where safely placing pins would be difficult. A non-compliant patient is a relative contraindication because he or she may not follow up for the removal of the device. (5,6). Also, peri-prosthetic fractures can limit the bone stock available to place the pins. General contraindications include patient refusal, unable to withstand the procedure physiologically.(6).

The following items are necessary for a standard uniplanar external fixation device using blunt pins:15-blade scalpel, Dissection scissors, Soft tissue retractors, Size-specific trocar with soft tissue protectant sleeve, Corresponding drill bit, T-handle wrench, Tapping drill, Corresponding size pins, Bars, Clamps, C-arm fluoroscopy. (6,7)

Technique

External fixation is used to stabilize different bones across the body, but the overall technique of application remains the same. The first step includes incising the skin over the pin insertion site. Care is necessary that skin and muscle are not tenting on the pin because this may lead to inflammation and pin infections.(9,10,11).

Pelvis

External fixation in the pelvis is common for both provisional and definitive fixation. The two main pin locations are the iliac wing and the anterior inferior iliac spine. For iliac wing pins, a small incision is made to bone approximately 2 cm posterior to the anterior superior iliac spine. The target insertion site is the gluteal ridge because this is the strongest and widest portion of the iliac wing. (13).

Upper Extremity

Humeral fractures rarely require external fixation for stabilization but are sometimes used with a morbidly obese patient or when there is gross contamination or open wounds. Pins are placed anterolaterally in the proximal humerus and posterolaterally in the distal humerus.(7).

Lower Extremity

Pin placement for femur stabilization can be directly lateral or anterolaterally. Care must be taken to avoid joint penetration. Likewise, these same anterolateral distal femur pins can be used in conjunction with subcutaneous anteromedial tibial pins placed at least 14mm distal to the joint line. The knee should be secured at 5 to 15 degrees of flexion. (5,6).

Pin Site Care

Pin site care is essential to reduce infection rates but the technique of which varies considerably. (12,15,23). If skin drainage or erythema surrounds the pins, then providing pin care three times a day should commence until the infection clears.(16,23).

Complications:

- Pin site infection (22)
- Osteomyelitis
- Frame or pin/wire failure or loosening
- Malunion
- Non-union
- Soft-tissue impalement
- Neurovascular injury
- Compartment syndrome
- Refracture around pin (15,16,17).

Nurses' role

The nurse specialist is able to expertly support patients through a period of change and adjustment, helping reduce the risk that they will not accept the frame and/or not adhere to treatment. Actively involving patients in care planning and evaluation contributes to a holistic, patient-centred approach where care is individualised. Appropriate involvement of the multidisciplinary team, both in the acute and community setting, helps provide patients with the skills and resources to self-care. Factors, such as depression and destructive behaviour, need to be carefully considered when planning discharge from hospital, especially if patients are expected to manage their frame and pin sites themselves between outpatient follow-up visits (18). The use of self-management programmes may help them to develop coping strategies (14). Nurses are ideally placed to support patients with external fixator devices, in particular helping them look after the pin sites. Providing verbal and written information will help patients understand the importance of caring for pin sites effectively and identifying infection quickly. Pin sites also need to be reviewed regularly and checked for signs of inflammation, irritation, infection or pin loosening. (19, Ceroni et al, 2016).

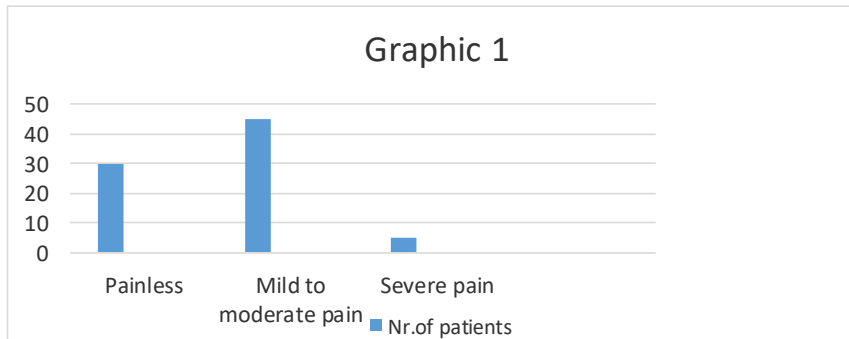
Material and Methods

This is a quantitative and analytical study. Information was taken from medical and nursing cards, for a period of 1 year, 2020-2021, in the service of the Trauma and \Orthopedic Hospital in Tirana, to determine the importance of nursing care in preventing complications and the progress of rehabilitation of patients with fractures and luxationes.

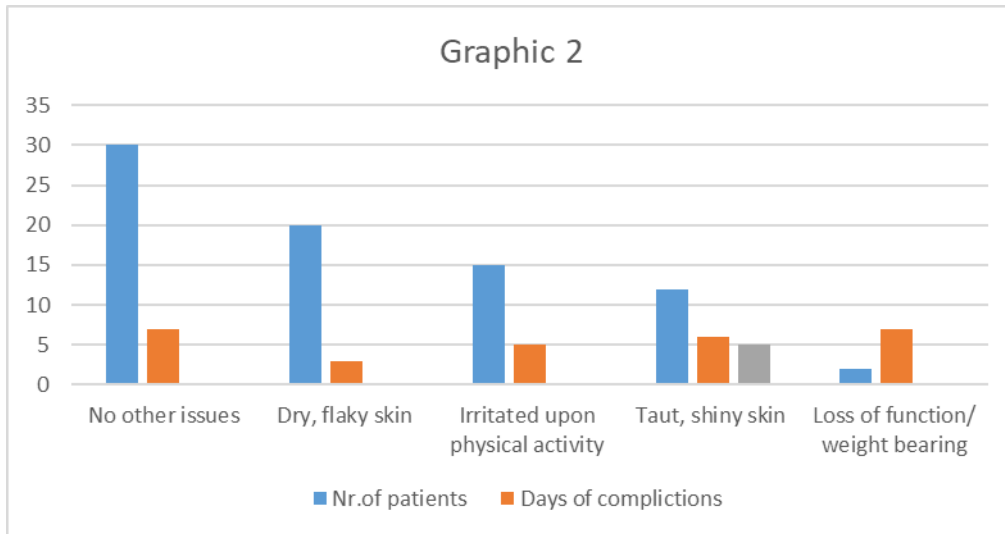
	Pain	Redness	Discharge	Swelling	General symptoms
60 patients Calm	<ul style="list-style-type: none"> • May be painless • Only mild pain • Reduces after application of fixator 	<ul style="list-style-type: none"> • Often none • Sometimes a little • Not spreading 	<ul style="list-style-type: none"> • Sometimes none • Sometimes minor 	<ul style="list-style-type: none"> • No swelling 	<ul style="list-style-type: none"> • No other issues
15 patients Irritated	<ul style="list-style-type: none"> • Mild to moderate • Uncomfortable 	<ul style="list-style-type: none"> • Some redness but not spreading • No hot or taut skin 	<ul style="list-style-type: none"> • 'Weepy' • Begins to weep when it did not before/increased amount of discharge • Remains the same consistency and colour 	<ul style="list-style-type: none"> • Swelling around pin site only, not spreading 	<ul style="list-style-type: none"> • Skin movement around the pin • Allergy to antiseptic • Irritated upon physical activity • Itchy (owing to reaction/allergy)

			<ul style="list-style-type: none"> • Can be persistent in specific pin sites • Sometimes bleeding • No odour • Dressing changes needed more often 		<ul style="list-style-type: none"> • Dry, flaky skin • Does not respond to antibiotics Infected <ul style="list-style-type: none"> • May affect all pin sites or just one or two
5 patients Infected	<ul style="list-style-type: none"> • Severe • Sudden • Increased intensity • Throbbing/stinging • Joints nearby may be painful • Unable to weight-bear • Unrelenting on rest • Poor response to analgesia 	<ul style="list-style-type: none"> • Deep red • Angry looking • Spreading • Definite borders • Associated with heat 	<ul style="list-style-type: none"> • Increased consistency • Change in consistency • Thicker/more viscous • Sometimes unpleasant odour • Change in colour • Sometimes purulent • Dressing changes needed much more frequently 	<ul style="list-style-type: none"> • Localised swelling around affected pin site • May spread • May be severe 	<ul style="list-style-type: none"> • Feeling unwell • Fever • Taut, shiny skin • Loss of function/weight bearing • Tired/lethargic • Disturbed sleep • Loss of appetite • Responds to antibiotics

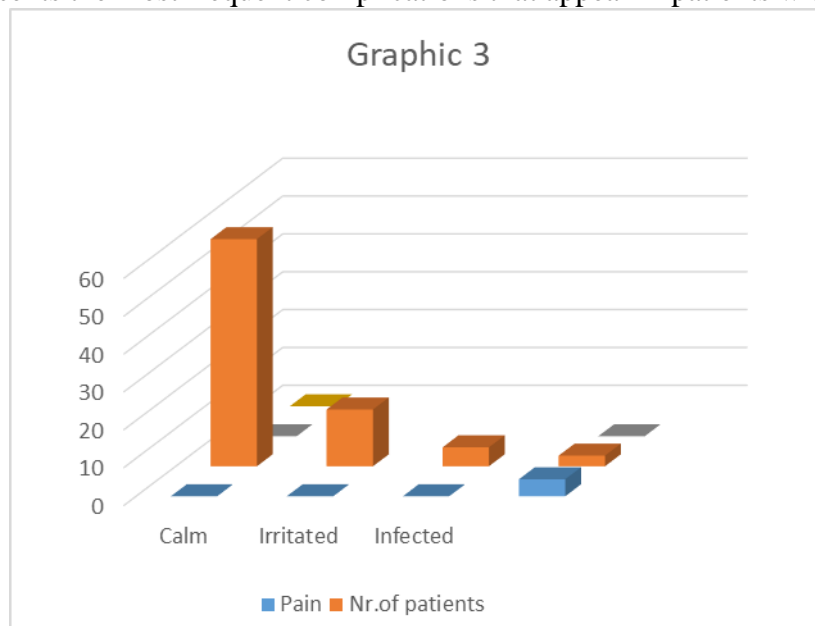
In the study, were included 80 patients, to whom was applied the external fixator. as can be seen from the table, 60 of these patients tolerated well the external fixation and reported few side effects. Such as: a little pain, which was reduced after application of fixator and sometimes a little redness. Sometimes minor discharge, no swelling and no other issues. 15 of these patients reported that they had mild to moderate pain, and general symptoms such as: Dry, flaky skin, swelling around pin site only, not spreading, etc.. 5 of these patients had not tolerate the external traction and had complications, such as severe pain, localised swelling around affected pin site, feeling unwell, fever, taut, shiny skin, etc...



The first Graph presents pain tolerance in patients with an external fixator.



The second graph presents the most frequent complications that appear in patients with an external fixator.



The third graph presents the complications of the external fixator and the intensity of the pain and its frequency, as one of the most frequent complications of the external fixator.

Results

In the study, were included 80 patients, who had used the external fixation. From the study of these cases it resulted that: With the increase of nursing staff knowledge in the assistance provided to traumatized patients, 60 of these patients tolerated well the external fixation and referred that had not suffered any complications from it. 15 of the patients said they had not tolerate the external fixation at first, they referred that they had not move the articulations. 5 of the patients had not tolerate the external traction and had complications, such as constant pain, infection and compartment syndrome.

Conclusions

External fixation plays a vital role in fracture care today. Not only can it temporarily stabilize fractures, but it can provide definitive fixation as well. The use of external fixation in a damage control setting can prevent the so-called “second hit” phenomenon because of the quick application, decreased blood loss, and minimally invasive application. Furthermore, by giving time for the soft tissues swelling to subside in severe injuries, the risk of infection and wound complication proportionally decreases.

Recommendations

An interprofessional approach is crucial for maximizing treatment benefits and reducing morbidity. These patients are often polytrauma patients and require management in the intensive care unit. Daily assessments by the orthopedic and orthopedic specialty-trained nursing teams are essential for monitoring pin site infections, soft tissue integrity, and neurovascular status. Nursing also provides post-procedure monitoring, wound dressing, medication administration, and should report any issues to the treating clinician. Thus, the interprofessional healthcare team approach is the optimal means to drive positive patient outcomes with external fixation.

References

- [1]. Jennison T et al (2014) Prevention of infection in external fixator pin sites. *Acta Biomaterialia*; 10: 2, 595-603.
- [2]. Behrens F, Johnson WD, Koch TW, Kovacevic N. Bending stiffness of unilateral and bilateral fixator frames. *Clin Orthop Relat Res*. 1983 Sep;(178):103-10.
- [3]. Kowalski M, Schemitsch EH, Harrington RM, Chapman JR, Swiontkowski MF. Comparative biomechanical evaluation of different external fixation sidebars: stainless-steel tubes versus carbon fiber rods. *J Orthop Trauma*. 1996;10(7):470-5.
- [4]. Fragomen AT, Rozbruch SR. The mechanics of external fixation. *HSS J*. 2007 Feb;3(1):13-29.
- [5]. Beltran MJ, Collinge CA, Patzkowski JC, Masini BD, Blease RE, Hsu JR., Skeletal Trauma Research Consortium (STReC). The safe zone for external fixator pins in the femur. *J Orthop Trauma*. 2012 Nov;26(11):643-7.
- [6]. Nayagam S. Safe corridors in external fixation: the lower leg (tibia, fibula, hindfoot and forefoot). *Strategies Trauma Limb Reconstr*. 2007 Dec;2(2-3):105-10.
- [7]. Bible JE, Mir HR. External Fixation: Principles and Applications. *J Am Acad Orthop Surg*. 2015 Nov;23(11):683-90.
- [8]. Wojahn RD, Gardner MJ. Fixation of Anterior Pelvic Ring Injuries. *J Am Acad Orthop Surg*. 2019 Sep 15;27(18):667-676.
- [9]. Fragomen AT, Rozbruch SR (2007) The mechanics of external fixation. *HSS Journal*; 3: 1, 13-29.
- [10]. Ziran BH, Smith WR, Anglen JO, Tornetta P. External fixation: how to make it work. *J Bone Joint Surg Am*. 2007 Jul;89(7):1620-32.
- [11]. Britten S et al (2013) Ilizarov fixator pin site care: the role of crusts in the prevention of infection. *Injury*; 44: 1275-1278.
- [12]. Davis R et al (2005) The care of pin sites with external fixation. *Journal of Bone and Joint Surgery*; 87B: 5, 716-719.
- [13]. Calafi LA, Routt ML. Anterior pelvic external fixation: is there an optimal placement for the supra-acetabular pin? *Am J Orthop (Belle Mead NJ)*. 2013 Dec;42(12):E125-7.
- [14]. Dheensa S, Thomas S (2012) Investigating the relationship between coping, quality of life and depression/anxiety in patients with external fixation devices. *International Journal of Orthopaedic and Trauma Nursing*; 16: 1, 30-38.
- [15]. Ktistakis I, Guerado E, Giannoudis PV. Pin-site care: can we reduce the incidence of infections? *Injury*. 2015 Sep;46 Suppl 3:S35-9.
- [16]. Clint SA et al (2010) The “Good, Bad and Ugly” pin site grading system: A reliable and memorable method for documenting and monitoring ring fixator pin sites. *Injury*; 41:2, 147-150.
- [17]. Lee D et al (2017) Indications and complications of crown halo vest placement: a review. *Journal of Clinical Neuroscience*; 40: 27-33.
- [18]. Patterson MM (2005) Multicentre pin care study. *Orthopaedic Nursing*; 24: 5, 349-60.

- [19]. Limb M (2003) Psychological issues relating to external fixation of fractures. *Nursing Times*; 99: 44, 28. Lobst CA (2017) Pin-track infection: past, present and future. *Journal of Limb Lengthening and Reconstruction*; 3: 2, 78-84.
- [20]. Santy-Tomlinson J et al (2011) Calm, irritated or infected? The experience of the inflammatory states and symptoms of pin site infection and irritation during external fixation: a grounded theory study. *Journal of Clinical Nursing*; 20: 21-22, 3163-3173.
- [21]. Timms A et al (2011) *Guidance on Pin Site Care*. London: Royal College of Nursing. [Bit.ly/ RCNPinSite](https://bit.ly/RCNPinSite)
Walker J (2012) Pin site infection in orthopaedic external fixation devices. *British Journal of Nursing*; 21: 3, 149-151.
- [22]. Kazmers NH et al (2016) Prevention of pin site infection in external fixation: a review of the literature. *Strategies in Trauma and Limb Reconstruction*; 11: 2, 75-85.
- [23]. Lethaby A et al (2013) Pin site care for preventing infections associated with external bone fixators and pins. *Cochrane Database of Systematic Reviews*; 12: CD004551.