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Frequency of Pin Tract Infection Among Patients with Tibia Fracture Treated with AO External Fixator

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External fixator; Pin tract infection; Tibia fracture; AO Fixator

1. Abstract

1.1. Introduction: The management of open tibial fractures remains a challenge for the orthopedic surgeons as various post-operative complications are associated with external fixation of tibia fracture.

1.2. Objectives: To determine frequency of pin track infection among patients with tibia fracture treated with AO external fixator.

1.3. Material and Methods: This Descriptive case series study was carried out Department of Orthopedics, Medical Teaching Institute Lady Reading Hospital from February , 2022 till December, 2022 on 110 Patients, aged 20 to 60 years of either gender with open fracture tibia Gustillo-Anderson type II or type IIIA were enrolled using non-probability consecutive sampling technique. All patients with tibia fracture underwent AO external fixation and reduction. Frequency of pin tract infection was noted. Data was entered and analyzed using SPSS 22.

1.4. Results: In our study 110 patients were enrolled with mean age of 36.7±11.5 years. There were 56.4% males and 43.6% female patients. Mean duration of injury was 14.6±7.6 hours. Hypertension was present in 30.9% patients. Diabetes was present in 16.4% patients. Smoking was present in 36.4% patients. Obesity was present in 41.6% patients. Pin tract infection was present in 16.4% patients.

1.5. Conclusion: Our study concludes that the incidence of pin tract infection is high.

2. Introduction

The incidence of complex and compound fractures of long bones is on an increasing trend due to increasing number of high energy trauma events in recent times [1]. Tibia is the most common long bone fractured due its vulnerable subcutaneous location. Delayed union and non-union due to infection are some of the commonly acquired complications [2]. The overall global incidence of tibial fractures is 51.7 per 100,000 a year, and the incidence of diaphyseal and distal tibia fractures is 15.7 and 9.1 respectively per 100,000 a year [3]. Tibial fractures are caused by high energy. These fractures are often associated with knee stiffness and deformities. Compartment syndrome and vascular injury is also common. These fractures have four elements which needs addressing i.e. articular surface depression, condylar separation, soft tissue damage and metaphyseal extension of the fracture [4].

The anatomy of the tibial plateau is complex and should be keeping in mind during the reduction [5]. The nature of these fractures demands active intervention especially due to the nature of the fracture involving a joint. A clinician's goal is to provide a solution or a form of treatment that restores the normal anatomy, by providing optimal stability and mobility of the joint along with pain relief and causing minimal postoperative complications [6,7].

AO external fixation is the treatment of choice in open fracture tibia. Pin tract infection (PTI) is unfortunately considered a universal complication of this device, and incidence ranging from 6.6% to 56.6% have been reported [8].

In study by Faaiz et al [9], 117 patients were enrolled, 81% were males and 19% were females with an overall mean age of 24.7±9.35 years. Pin tract infection was documented in 23.9% patients.

The rationale of this study is to determine frequency of pin tract infection because many patients with open tibial fractures are regularly reported at our facility and majority of them are initially temporarily stabilized with locally made external fixators which are economically feasible for low-income patients. Once the soft tissues are healed, definitive fracture fixation is carried out. The current study was planned to determine the frequency of pin tract infection after external fixation of tibia.

3. Materials and Methods

This Descriptive case series study was carried out Department of Orthopedics, Medical Teaching Institute Lady Reading Hospital Peshawar from February , 2022 till December, 2022 on 110 Patients, aged 20 to 60 years of either gender with open fracture tibia Gustillo-Anderson type II or type IIIA were enrolled using non-probability consecutive sampling technique. Patients with open fractures tibia received after 24 hours and Fractures with intra-articular extension, bilateral tibial fractures, open fractures with bone loss, segmental fractures, associated pelvic and acetabulum fractures, ipsilateral open femur fracture requiring external fixator were excluded from the study.

After approval from hospital ethical board, patients fulfilling the inclusion criteria were enrolled from orthopedic emergency of Medical Teaching Institute Lady Reading Hospital. A written informed consent was taken after explaining the purpose of study. Demographic data including age, gender, diabetes, hypertension, smoking, obesity and duration of injury was noted. Complete history was taken and physical examination was done. Baseline labs including CBC, LFT, RFT, serum electrolyte and chest x ray was done for general anesthesia fitness.

Surgery was done under general or spinal anaesthesia as decided by anesthetist. Wound was washed with 3 to 9 litres of normal saline and extensive debridement of the wound was done. Fracture was reduced directly through the wound or indirectly without opening the fracture site when extensive comminution was present on X-ray. A locally made Arbeitsgemeinschaft für Osteosynthesefragen (AO) external fixator (ESMECO) with at least 4 Schanz screws was used. The standard technique of external fixator application was adopted in all cases. No tourniquet was used. Appropriate size Schanz screws were used (6mm diameter in adults). In every case the screw diameter was <33% of the diameter of the bone. All cases were done by a qualified orthopaedic surgeon with minimum 3 years of experience. The wound was left open or partially closed depending upon the degree of contamination and coverage of the bone. The affected limb was elevated for 24 hours. Patients were discharged on the 2nd post-operative day. Only those patients were retained who needed further debridement, wound closure or additional fracture fixation. A uniform protocol of for pin tract care was started from the second post-operative day. Each pin site was cleaned with sterile gauze and pyodine daily. After cleaning, each pin site was covered with dry sterile gauze. On the 4th post-operative day, the leg, the frame and the pin site was washed with water and soap, dried with a towel, and the pin site was covered with sterile dry gauze. Non-weight bearing with crutches was allowed. Patients were followed during admission and after discharge on a fortnightly basis till 8th week to look for pin tract infection. Data was collected in specially designed proforma and then analyzed by using SPSS version 22.0.

4. Results

In our study 110 patients were enrolled with mean age of 36.7±11.5 years (Table 1).

There were 56.4% males and 43.6% female patients (Table 2).

Mean duration of injury was 14.6±7.6 hours (Table 3).

Hypertension was present in 30.9% patients (Table 4).

Diabetes was present in 16.4% patients (Table 6).

Obesity was present in 41.6% patients (Table 7).

Pin tract infection was present in 16.4% patients (Table 8).

Data stratification was done for age groups, gender, hypertension, smoking, obesity, diabetes and duration of injury (Table 9-15).

Table 1: Age of sampled population

	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	110	20	60	36.8	11.522

Table 2: Gender distribution

Gender	Frequency	Percent
Male	62	56.4
Female	48	43.6
Total	110	100

Table 3: Duration of injury

	N	Minimum	Maximum	Mean	Std. Deviation
Duration of injury (hours)	110	1	24	14.64	7.692

Table 4: Frequency of hypertension

Hypertension	Frequency	Percent
Yes	34	30.9
No	76	69.1
Total	110	100

Table 5: Frequency of diabetes

Diabetes	Frequency	Percent
Yes	18	16.4
No	92	83.6
Total	110	100

Table 6: Frequency of smoking

Smoking	Frequency	Percent
Yes	40	36.4
No	70	63.6
Total	110	100

Table 7: Frequency of over weight

Over weight	Frequency	Percent
Yes	46	41.8
No	64	58.2
Total	110	100

Table 8: Frequency of pin tract infection

Pin tract infection	Frequency	Percent
Yes	18	16.4
No	92	83.6
Total	110	100

Table 9: Data stratification for frequency of pin tract infection and age groups

			Pin tract infection		Total
			Yes	No	
Age groups	20-40 years	Count	13	59	72
		% within Age groups	18.10%	81.90%	100.00%
	41-60 years	Count	5	33	38
		% within Age groups	13.20%	86.80%	100.00%
p-value 0.509					

Table 10: Data stratification for frequency of pin tract infection and gender

			Pin tract infection		Total
			Yes	No	
Gender	Male	Count	9	53	62
		% within Gender	14.50%	85.50%	100.00%
	Female	Count	9	39	48
		% within Gender	18.80%	81.20%	100.00%
p-value 0.552					

Table 11: Data stratification for frequency of pin tract infection and hypertension

			Pin tract infection		Total
			Yes	No	
Hypertension	Yes	Count	2	32	34
		% within Hypertension	5.90%	94.10%	100.00%
	No	Count	16	60	76
		% within Hypertension	21.10%	78.90%	100.00%
p-value 0.047					

Table 12: Data stratification for frequency of pin tract infection and smoking

			Pin tract infection		Total
			Yes	No	
Smoking	Yes	Count	7	33	40
		% within Smoking	17.50%	82.50%	100.00%
	No	Count	11	59	70
		% within Smoking	15.70%	84.30%	100.00%
p-value 0.808					

Table 13: Data stratification for frequency of pin tract infection and over weight

			Pin tract infection		Total
			Yes	No	
Over weight	Yes	Count	7	39	46
		% within Over weight	15.20%	84.80%	100.00%
	No	Count	11	53	64
		% within Over weight	17.20%	82.80%	100.00%
p-value 0.783					

Table 14: Data stratification for frequency of pin tract infection and diabetes

			Pin tract infection		Total
			Yes	No	
Diabetes	Yes	Count	3	15	18
		% within Diabetes	16.70%	83.30%	100.00%
	No	Count	15	77	92
		% within Diabetes	16.30%	83.70%	100.00%
p-value 0.970					

Table 15: Data stratification for frequency of pin tract infection and duration of injury

			Pin tract infection		Total
			Yes	No	
Duration of injury	Equal to or less than 12 hours	Count	18	26	44
		% within Duration of injury	40.90%	59.10%	100.00%
	More than 12 hours	Count	0	66	66
		% within Duration of injury	0.00%	100.00%	100.00%
p-value 0.001					

5. Discussion

Fractures of the tibial shaft have an incidence of 17-21 per 100,000 population, represent 2% of all fractures and 36.7% of all long bone fractures in adults. Due to the specific anatomical features of the tibia (exposed position in body and limited soft tissue coverage), more than 15% of its fractures are classified as open, representing the most common 44.4% of open long bone injuries [10]. External fixation is an essential component of the modern orthopedic surgeon's armamentarium and is widely used in traumatology and reconstructive surgery. This treatment modality is unfortunately associated with the almost universal complication of pin track infection [11]. Metal pin are used to apply skeletal traction or external fixation devices in the management of orthopedic fractures. These percutaneous pins protrude though the skin.

The way in which they are treated after insertion may affect the incidence of pin site infection [12]. The management of open tibial fractures continues to be major therapeutic problem because the poor soft tissue coverage and blood supply of the tibial shaft which make these fractures vulnerable to nonunion and infection [13]. Treatment of open tibial fractures includes stabilization of fractures to facilitate early mobilization and taking care of the soft tissues to achieve healing without infection. Bony stabilization can be done in open fractures in variety of ways such as un-dreamed intra-medullary solid nail, pain plasters and external fixation. The aim of this study was to determine frequency of pin tract infection after external fixation of tibia fracture.

In our study 110 patients were enrolled with mean age of 36.7±11.5 years. There were 56.4% males and 43.6% female patients. Mean duration of injury was 14.6±7.6 hours. Hypertension was present in 30.9% patients. Diabetes was present in 16.4% patients. Smoking was present in 36.4% patients. Obesity was present in 41.6% patients. Pin tract infection was present in 16.4% patients.

Similar results were observed in another study conducted by Shtarker H et al[14] in which mean age was 30 years with SD±1.81. 70% patients were male while 30% patients were female. The higher male to female ratio of 6.14:1 could be attributed to their increased activities. Females in society are held back at home whereas males being bread-winner (in majority of cases) for the family spend more time outside and are thus more prone to bomb blasts, fi re arm injuries and vehicular accidents.

The frequency of pin tract infection was highly variable in different studies found in literature. In a study conducted in Peshawar on 152 patients, mean age was 28 years with SD±2.33. 77% patients were male while 23% patients were female. 47% fractures on left side and 53% patients had fracture on right. 28% patients had pin tract infection [15].

In another study of the 117 patients, 95(81%) were males and 22(19%) were females with an overall mean age of 24.7±9.35 years. Pin tract infection was documented in 28(23.9%) patients. [9] Lobst CA reported 24% frequency of pin tract infection. [16] Gustilo RB et al. recorded pin tract infection of 28% in his study. [17] However, compared to previous studies the rate of pin tract infection is much less in our study. This can be attributed to the fact that we did not apply any external fixator in emergency room. We did all these procedure in the operation theatre after complete pre-operative preparation of the patient. We also tried to keep our drilling velocity low. Moreover though we used I.V. antibiotics while the patients were in the ward, we sent them home on oral antibiotics. Thus antibiotics were for a reasonably longer time.

6. Conclusion

Pin tract infection is common after external fixation of tibia. Majority of pin tract infections were of minor grade, and resolved with pin tract care and antibiotics without affecting the definitive fracture fixation and bone healing.

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