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‘Pin Site Infection Among the External Fixator Users in Post-Tibia-Fibular Surgery’

Md. Forhad Hosen

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SAIC College of Medical Science and Technology

Department of Physiotherapy

Mirpur-14, Dhaka-1216

Bangladesh

We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for acceptance this dissertation entitled **"Pin Site Infection Among the External Fixator Users in Post-Tibia-Fibular Surgery"** Submitted by **Md. Forhad Hosen** for the partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy.

……..

Md. Furatul Haque

Asst. prof. Department of Physiotherapy

SCMST, Mirpur-14, Dhaka

Supervisor

…….

Dr. Mohammad Sohrab Hossain PhD

Prof. Department of Physiotherapy, BHPI, CRP

Executive Director,

Center for the Rehabilitation and Paralysed (CRP)

CRP, Savar, Chapain, Savar, Dhaka-1343

……

Zahid Bin Sultan Nahid

Asst. Professor & Head Department of Physiotherapy

SCMST, Mirpur-14, Dhaka.

……..

Dr. Abul Kasem Mohammad Enamul Haque

Principal

SCMST, Mirpur-14, Dhaka.

DECLARATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also decline that for any publication or dissemination of information about the study, I would be bound to obtain the written consent of my supervisor.

Name & Signature: Date:

Md. Forhad Hosen

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ACRONYMS

PSI	Pin-Site Infection
BMI	Body Mass Index
RTA	Road Traffic Accident
TBI	Tibial Bone Injury
S. aureus	Staphylococcus aureus
WHO	World Health Organization
SPSS	Statistical Package for the SocialSciences
IV	Intravenous
HA	Hydroxyapatite
OR	Odds Ratio

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ABSTRACT

Aims: The aim of this study was to evaluate the pin-site infections (PSI) among external fixator users in post-tibia-fibula surgery. Specifically, it aimed to assess the impact of demographic, clinical, and lifestyle factors on the development and severity of pin-site infections in this patient population.**Objective**: To assess the pin-site infections in patients undergoing tibia-fibula surgery with external fixation, identify risk factors associated with infection.**Methodology**: This cross-sectional study was conducted at Dhaka Trauma Center and Royal Multispeciality Hospital from June 2024 to July 2025. A total of 70 patients who underwent tibial and fibular fracture surgeries with external fixators participated. Participants were selected based on inclusion criteria, and data were collected through face-to-face interviews using a structured questionnaire. **Results**: The findings revealed that 51.4% of participants developed major pin-site infections, while 48.6% experienced minor infections. Occupation was found to be significantly associated with infection severity ($p = 0.013$), with service holders and students showing a higher proportion of major infections. Other factors such as BMI, diabetes, and smoking also influenced infection outcomes, though no significant association was found between education level and infection severity ($p = 0.643$). The study showed a high prevalence of pin-site infections, particularly in patients with high-risk occupations and comorbidities.**Conclusion**: The study highlights the high prevalence of pin-site infections among external fixator users in post-tibia-fibula surgery. The findings suggest that occupation, comorbidities, and patient education play significant roles in infection prevention. Effective post-operative care, including patient education and regular monitoring, is essential to reduce infection rates. However, the study's limitations, such as the small sample size and single-center design, suggest the need for larger, multi-center studies to further explore the factors influencing pin-site infections and develop targeted prevention strategies.

Keywords: *Pin-Site Infection, External Fixator, Tibia-Fibula Surgery, Occupation, BMI, Diabetes, Smoking, Postoperative Care, Checketts-Otterburn Scale.*

CHAPTER-I INTRODUCTION

1.1 Background:

Pin-site infections are a common and troublesome complication associated with external fixation devices used in orthopedic surgeries, particularly in trauma and reconstructive procedures. These infections, which develop at the site where the pins pass through the skin, can vary in severity, from minor irritation to severe osteomyelitis. The incidence of pin-site infections can significantly impact the healing process, causing prolonged hospitalization, additional surgical interventions, and higher healthcare costs (Shields et al. 2021, p. 71). Although external fixation remains a valuable technique for managing complex fractures, particularly open tibial fractures, its association with pin-site infections highlights the ongoing challenges in patient management and recovery (Shah et al. 2019, p. S41).

One of the key factors contributing to pin-site infections is the mechanical nature of the external fixation system itself. External fixators stabilize fractures by inserting pins through the skin and into the bone, creating a direct pathway for bacterial invasion. The skin at the pin-site interface becomes vulnerable to microbial colonization, particularly by organisms such as Staphylococcus aureus and Staphylococcus epidermidis, which are commonly found in skin flora (Grand et al. 2025, p. 47). The presence of these bacteria can lead to the formation of biofilms on the pin surface, complicating the infection and making it more difficult to treat with conventional antibiotics (Shields et al. 2021, p. 74). Moreover, the mechanical forces exerted on the pins, particularly in weight-bearing areas, can lead to tissue trauma and further predispose the site to infection (Kazmers et al. 2016, p. 88). This combination of mechanical stress and microbial colonization is a critical factor in the development of pin-site infections (Shields et al. 2021, p. 75).

Patient-related factors also play a significant role in the development of pin-site infections. Comorbidities such as diabetes, smoking, and obesity are known to impair wound healing and increase susceptibility to infections. Patients with diabetes, for instance, experience delayed immune responses and reduced tissue oxygenation, both of which hinder the healing process and promote bacterial growth at the pin site (Shah

et al. 2019, p. S42). Smoking further exacerbates this risk by reducing blood flow to the affected area, impairing tissue repair, and increasing the likelihood of infection (Badr et al. 2021, p. 80). Other factors such as age, nutritional status, and the presence of chronic diseases like rheumatoid arthritis or immune suppression can also influence the risk of developing infections (Shields et al. 2021, p. 73).

Surgical technique is another critical factor influencing the risk of pin-site infections. Studies have shown that poor surgical technique, such as inadequate aseptic precautions, improper pin placement, or failure to follow best practices for pin insertion, increases the likelihood of infection (Kazmers et al. 2016, p. 89). For example, pins inserted near joints or through thicker layers of tissue are more prone to infection due to the increased motion and irritation at the pin-site interface (Sato et al. 2023, p. 31). The use of inappropriate fixation methods or failure to stabilize the pins properly also contributes to the incidence of infection (Shields et al. 2021, p. 74). Moreover, the length of time the external fixator is in place plays a crucial role in the risk of infection. Longer exposure to the external environment increases the likelihood of bacterial contamination, particularly in patients with comorbid conditions (Kazmers et al. 2016, p. 89).

Postoperative care is fundamental in preventing and managing pin-site infections. Studies have shown that patients who receive proper instructions on pin-site care, including regular cleaning and dressing changes, experience significantly lower rates of infection (Elkalashy et al. 2024, p. 92). Education programs aimed at improving patients' understanding of the importance of hygiene and early infection detection have been found to reduce infection rates and improve overall outcomes (Sayed et al. 2019, p. 66). Furthermore, consistent follow-up visits and ongoing monitoring for signs of infection are essential for managing potential complications and ensuring timely intervention (Rahsan Cam, 2014, p. 78). Nursing interventions that include emotional support and pain management can also alleviate the psychological stress often experienced by patients with external fixators, improving their overall quality of life (El-Sebaie et al. 2021, p. 85).

Recent advancements in materials and technologies offer promising solutions to reduce the risk of pin-site infections. The use of antimicrobial-coated pins, such as titanium pins with hydroxyapatite coatings or silver-impregnated surfaces, has shown to significantly reduce bacterial colonization and enhance the stability of external fixators (Huang et al. 2025, p. 68). These advanced biomaterials create an inhospitable environment for bacterial growth, preventing the formation of biofilms and promoting better integration with bone (Grand et al. 2025, p. 47). Moreover, innovations in dressing materials, such as silicone-based dressings and hydrocolloid bandages, help protect the pin sites from external contaminants while promoting optimal healing conditions (Ferguson et al. 2022, p. 66).

Despite these advances, pin-site infections continue to be a major concern, particularly in low- and middle-income countries where cost-effective treatments are essential (Shah et al. 2019, p. S44). In such settings, external fixators are often used as a more affordable alternative to internal fixation devices. However, the high incidence of pin-site infections in these populations may undermine the cost-effectiveness of this treatment, as increased infection rates lead to longer hospital stays, higher treatment costs, and the need for more frequent medical interventions (Slater & Mathen 2023, p. 4). This underscores the importance of developing affordable, standardized care protocols for pin-site management, particularly in resource-limited environments (Slater & Mathen 2023, p. 3).

In conclusion, while external fixators remain an essential tool in managing complex fractures and deformities, the risk of pin-site infections continues to present significant challenges. Factors such as patient comorbidities, surgical technique, and the type of external fixator used all contribute to infection risk. Effective management strategies, including proper patient education, nursing interventions, and the use of advanced biomaterials, can help reduce infection rates and improve patient outcomes. Further research is needed to develop standardized protocols for pin-site care, particularly in low-resource settings, to ensure that external fixators remain a viable and cost-effective option for fracture management (Iliadis et al. 2022, p. 63).

1.2 Rationale:

Pin site infection among the external fixator users in Post-Tibia-Fibular surgery is a multifaceted issue that warrants comprehensive investigation and analysis. Pin site infections among external fixator users in Tibiofibular fractures is a well-documented complication of external fixation procedures, with reported incidence rates ranging from 20% to 100% in various studies. This study seeks to address the gap in existing literature by conducting a thorough examination of the epidemiological, clinical, socioeconomic, and antimicrobial dimensions of pin site infections in this specific population. Tibiofibular fractures are common orthopedic injuries that often require surgical intervention for proper alignment and healing. External fixators serve as invaluable tools in the management of these fractures, providing stability and support during the healing process.

However, the use of external fixators is not without its risks, and one of the most significant complications associated with their use is pin site infections. Pin site infections can lead to a variety of complications, including increased pain, swelling, redness, and discharge at the pin site. In severe cases, these infections can progress to cellulitis, osteomyelitis, and systemic sepsis, necessitating aggressive medical and surgical interventions. Therefore, understanding the prevalence and factors associated with pin site infections among external fixator users is essential for optimizing patient care and improving outcomes in this population. By conducting this study, we aim to fill this knowledge gap and provide valuable epidemiological data that can inform clinical practice and healthcare policies. Understanding the pin site infections in this population is crucial for estimating the burden of this complication and identifying opportunities for prevention and intervention.

1.3 Research question:

What is the pin site infection among the external fixator users in post-tibial-fibular surgery?

1.4 Objectives of the study

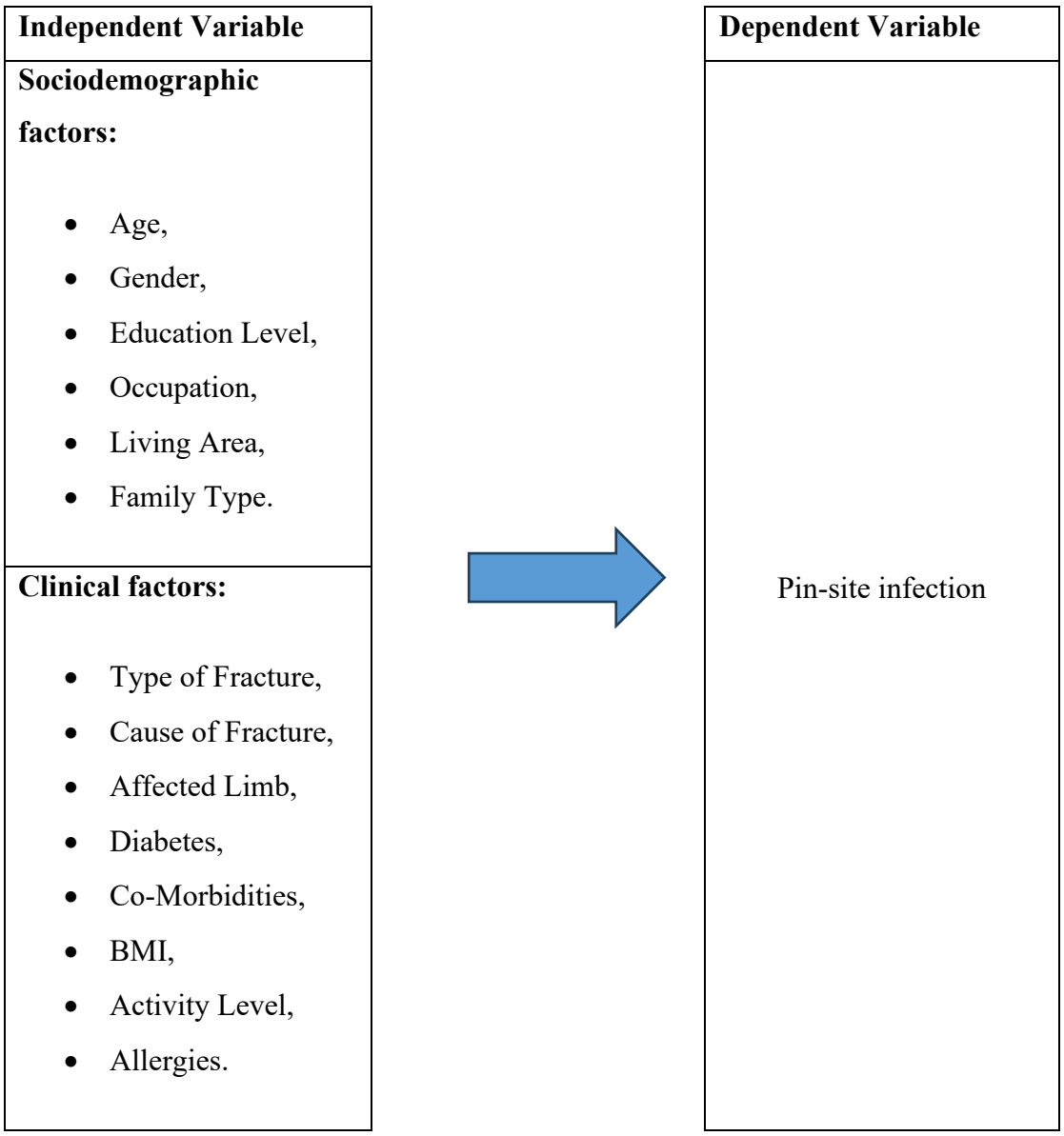
1.4.1 General objective:

To determine the pin site infection among the external fixator users post-tibial-fibular surgery.

1.4.2 Specific objective :

i. To describe socio-demographic information of the participants.
ii. To identify the prevalence of minor and major pin-site infections using by the Checketts Otterburn scale.
iii. To evaluate the clinical factors (types of fracture, causes of fracture, affected limb, pin site cleaning habit, comorbidities such as diabetes, and Body Mass Index).
iv. To explore the association between infection level and gender, Education, Occupation, Marital status, financial condition, Living Area of the participants.

1.5 Conceptual Framework



1.6 Operational Definition

Pin-Site Infection: A pin-site infection is defined as any infection occurring at the site where the pins of an external fixator enter the skin. The infection is classified using the Checketts-Otterburn grading system, where Grade 1 involves slight redness with minimal discharge, and higher grades involve increased redness, pain, discharge, and severe soft tissue involvement.

External Fixator: An external fixator is a device used to stabilize fractures, particularly those of the tibia and fibula, through the use of percutaneous pins or wires. These pins are inserted through the skin and bone, creating a stable framework to align and support the fractured bone during healing.

Tibia-Fibular Surgery: Tibia-fibular surgery refers to surgical procedures conducted on the tibia and fibula bones, commonly due to fractures or deformities. These surgeries may involve the use of external fixation devices like the AO external fixator to stabilize the bones and promote proper healing.

Body Mass Index (BMI): Body Mass Index (BMI) is a measure used to assess the body weight relative to height, and it is categorized as follows: underweight ($BMI < 18.5$), normal weight ($18.5 \leq BMI < 24.9$), overweight ($25 \leq BMI < 29.9$), and obese ($BMI \geq 30$). BMI is used in this study to assess its correlation with the occurrence of pin-site infections in patients with external fixator.

CHAPTER-II LITERATURE REVIEW

External fixation is a widely used surgical technique for stabilizing fractures, particularly in cases of tibia and fibula fractures. This method involves the application of a frame that is attached to the bone using percutaneous pins or wires (Sayed et al. 2019, p. 66). The frame provides stability and allows for proper bone alignment during the healing process without requiring extensive soft tissue dissection, which can be beneficial in cases of open fractures or severe comminuted fractures where preserving soft tissue integrity is crucial. The use of external fixation is common in both trauma settings and elective procedures, such as limb lengthening and deformity correction (Kazmers et al. 2016, p. 90).

One of the key advantages of external fixation is its minimally invasive nature. Unlike internal fixation, which requires the insertion of hardware within the bone, external fixation only requires small punctures in the skin to insert the pins, which significantly reduces the risk of infection at the surgical site (Shields et al. 2021, p. 71). The rapid application of external fixators is another advantage, as they can be easily adjusted and provide immediate stabilization for fractures, especially in trauma cases. This makes them an essential tool in the management of fractures that need to be stabilized quickly to prevent further complications such as bone displacement and damage to surrounding tissues (Jennison et al. 2014, pp. 595-603).

However, external fixation is not without its complications. One of the most common and challenging complications is pin-site infection (PSI), which occurs when bacteria infiltrate the area where the pins penetrate the skin. The external pins create a direct pathway for bacteria to enter the body, which can lead to infections that range from mild irritation to severe osteomyelitis (Elkalashy et al. 2024, p. 92).

Pin-site infection is one of the most frequent complications associated with external fixation. The prevalence of PSI varies significantly across studies, with reported rates ranging from as low as 3% to as high as 80% (Iliadis et al. 2022, p. 63). This wide variation can be attributed to several factors, including differences in study methodology, patient populations, and the protocols used for diagnosing and treating infections. For example, some studies may report infections based on clinical symptoms

like redness and swelling, while others may require microbiological confirmation, leading to different rates of infection detection (Grand et al. 2025, p. 47).

Specific studies on PSI in tibia and fibula fractures treated with external fixators reveal that the incidence of infection tends to be higher in lower limb fractures, likely due to the increased mechanical load and mobility in the tibial area. This area is prone to excessive movement and tension, which can increase the likelihood of irritation around the pin sites and predispose patients to infections (Sato et al. 2023, p. 31). Furthermore, factors such as patient comorbidities, including diabetes and smoking, can elevate the risk of infection, contributing to the variability in prevalence rates across different studies (Khan et al. 2023, p. 43).

Several patient-specific factors play a significant role in the development of pin-site infections (PSI) following external fixation, particularly in tibia and fibula fractures. Diabetes is one of the most commonly cited risk factors, as poorly controlled blood sugar levels impair the immune system and slow down wound healing, making individuals more susceptible to infections (El-Sebaie et al. 2021, p. 85). Smoking has a similar detrimental effect, as it decreases blood flow and collagen production, both of which are essential for tissue repair and immune function. Smokers have an increased likelihood of developing infections due to these compromised healing capabilities (Chua et al. 2022, p. 81). Obesity also raises the risk, as excess weight places additional strain on the pins and the surrounding soft tissues, making it harder to maintain proper hygiene around the pin sites and increasing skin irritation (Slater & Mathen, 2023, p. 4).

In addition, age is another factor influencing PSI risk. Older patients often have diminished immune responses and may have reduced circulation, which further hampers the body’s ability to fight off infections (Kazmers et al. 2016, p. 90). Furthermore, pre-existing comorbidities such as cardiovascular diseases, rheumatoid arthritis, and other inflammatory conditions can compromise the immune system, further increasing susceptibility to infections (Chua et al.,2022, p. 81). Patients with weakened immune systems are less able to combat bacterial invasions at the pin sites, heightening the infection risk (Huang et al. 2025, p. 68).

The technique used during the surgery plays a vital role in the likelihood of PSI development. A less meticulous surgical technique, such as improper insertion of the pins or failure to minimize soft tissue damage, can lead to increased infection rates (Shah et al. 2019, p. S41). The location of the pin insertion is also important, as pins placed near periarticular regions, where soft tissue movement is greater, are more likely to become infected compared to pins inserted in peripheral areas with more stable soft tissue (Arveladze et al. 2022, p. 26).

Proper post-operative care is essential in reducing the risk of PSI. Post-surgical infection prevention depends largely on the patient's ability to maintain hygiene around the pin sites. Patient education regarding the importance of regular cleaning and the proper technique for pin-site care significantly reduces the incidence of infections. Regular dressing changes, appropriate antiseptic use, and close monitoring for signs of infection are integral to successful post-operative care (Mujdas Adas 2016, p. 76).

The material and surface coatings of the external fixator pins significantly influence the infection rates at pin sites. Titanium pins, for instance, are known for their superior biocompatibility compared to other materials such as stainless steel, and they generally have lower infection rates (Rahsan Cam 2014, p. 78). Additionally, surface modifications, such as hydroxyapatite coatings, have been shown to improve tissue integration and reduce bacterial adhesion, further lowering infection risk (Ugaji 2021, p. 110). Biofilm formation is a key mechanism by which bacteria survive on the surface of the pins. Once bacteria colonize the pin, they form a protective biofilm, making them more resistant to both the host immune system and antibiotic treatment (Ferguson et al. 2022, p. 66). This biofilm formation significantly complicates the treatment of PSI and necessitates aggressive management strategies, such as pin removal in severe cases (Laubscher et al. 2022, p. 58).

The pathophysiology of pin-site infections revolves around bacterial colonization and subsequent biofilm formation. Bacterial colonization begins when microorganisms adhere to the pin surface after insertion, often due to the disruption of the skin barrier (Britten et al. 2013, p. 1275). The bacteria then begin to proliferate, forming a protective biofilm that shields them from host immune responses and antibiotics, making the infection much harder to treat (Jennison et al. 2014, p. 55). Micromotion, which refers

to the movement of the pin within the surrounding tissue, contributes to infection by creating a microenvironment that is favorable for bacterial growth. This movement, particularly in regions with increased soft tissue mobility, leads to friction and irritation, which can damage the tissue and allow bacteria to invade (Britten et al. 2013, p. 1275).

Common pathogens involved in pin-site infections include Staphylococcus aureus, which is responsible for a significant portion of infections, and Pseudomonas aeruginosa, which is often found in more severe cases (Ktistakis et al. 2015, p. S35). These bacteria can lead to superficial infections or more severe complications, such as osteomyelitis (bone infection), if left untreated. Osteomyelitis can occur when the infection spreads from the pin-site into the bone, potentially requiring surgical debridement and the removal of the external fixator pin (Lavini et al. 2014, p. 58). The progression of an infection to osteomyelitis can severely compromise the healing process, extend recovery time, and significantly increase healthcare costs. Therefore, early detection and effective management of pin-site infections are essential to prevent long-term complications and ensure successful treatment outcomes for patients using external fixators (Lowery et al. 2015, p. 970).

Pin-site infections (PSI) following external fixation can have significant physical consequences. One of the most immediate impacts is delayed healing. Infections at the pin sites can interfere with the normal bone healing process, potentially causing prolonged recovery and complicating the fracture healing (Moroni et al. 2001, p. 180). Additionally, pin loosening is a common result of infection, as the surrounding tissue becomes inflamed and weakened, causing the fixator pins to lose their stability. This compromises the integrity of the external fixation device, leading to a potential need for additional surgical intervention to either stabilize the fracture again or remove the external fixator entirely (Jennison et al. 2014, p. 55). The infection can also result in increased pain and swelling around the pin sites, making it difficult for patients to mobilize and perform daily activities. As a result, functional limitations arise, with patients being restricted in their movements, which can significantly affect their independence and quality of life (Wright & Nair 2010, p. 170).

The psychological impact of pin-site infections cannot be overlooked. Studies have shown that patients experiencing PSI often struggle with mental health issues such as

anxiety and depression due to the ongoing discomfort, fear of further complications, and the inability to return to normal life activities (Sayed et al. 2019, p. 66). The persistent pain, limited mobility, and uncertainty about the outcome of the infection contribute to a significant emotional burden, further affecting the patient's quality of life. The social consequences are also considerable. Prolonged rehabilitation due to infection leads to dependency on healthcare providers and family members for assistance with daily tasks, creating a strain on both the patient and their support network (Elkalashy et al. 2024, p. 92).

Pin-site infections also place a significant burden on healthcare systems. Patients with infections often require extended hospital stays due to the need for intravenous antibiotics, wound care, and possibly additional surgeries to address complications like osteomyelitis (Iliadis et al. 2022, p. 63). The need for these additional treatments increases healthcare costs and stretches hospital resources. If the infection progresses to osteomyelitis, a serious bone infection, patients may face the need for long-term disability and even amputation in the most severe cases, drastically affecting their long-term health and quality of life. The financial burden on healthcare systems is considerable, as the treatment of PSI and its complications is resource-intensive (Grand et al. 2025, p. 47).

Effective post-operative care is crucial in preventing PSI. Post-operative pin-site care protocols vary widely, but studies suggest both daily and weekly care regimens can be effective when combined with proper hygiene (Sato et al. 2023, p. 31). The use of antiseptics like iodine or chlorhexidine has been shown to reduce bacterial colonization at the pin sites. Ensuring that patients receive proper education on self-care is essential. Informed patients who understand the signs of infection and the importance of regular follow-up are more likely to engage in appropriate care and seek medical attention when necessary (Khan et al. 2023, p. 43).

Innovative pin materials and coatings have shown promise in reducing the incidence of PSI. Titanium, a commonly used material in external fixation, has excellent biocompatibility and lower infection rates compared to other materials such as stainless steel (Arveladze et al. 2022, p. 26). Hydroxyapatite coatings, which promote better tissue integration, and silver coatings, known for their antimicrobial properties, are also

used to prevent bacterial adhesion and biofilm formation at the pin sites (El-Sebaie et al. 2021, p. 85).

Technological advancements in external fixation have contributed to reducing the risk of infection. One such development is the low-energy pin insertion technique, which minimizes tissue damage and reduces the likelihood of infection by preventing thermal necrosis around the pin site (Slater & Mathen 2023, p. 4). Additionally, bioactive coatings like nanosilver or copper-infused pins are being explored for their ability to reduce bacterial adhesion and prevent the formation of biofilms, which are responsible for chronic infections (Huang et al. 2025, p. 68).

The management of pin-site infections (PSI) typically begins with oral antibiotics, particularly for superficial infections. Most superficial infections are treatable with oral antibiotics, as the infection is confined to the soft tissue around the pin, and systemic treatment is sufficient to control the bacterial growth (Shah et al. 2019, p. 41).

Common antibiotics used include those targeting Staphylococcus aureus and Pseudomonas aeruginosa, which are the most frequent pathogens in pin-site infections. However, it is important to identify the causative organism through culture and sensitivity testing to ensure the appropriate antibiotic choice. If the infection remains localized and responsive to treatment, further intervention may not be necessary (Chua et al. 2022, p. 81).

For severe infections that extend deeper into the tissues or involve the bone, the first line of treatment may include surgical debridement and pin removal. In such cases, the infection may progress to osteomyelitis or cause pin loosening, both of which necessitate more invasive intervention (Arveladze et al. 2022, p. 26). Surgical debridement involves the removal of necrotic tissue and infected bone, which helps to control the infection and promote healing. If the infection is confined to the soft tissues, it may be possible to remove only the pin, allowing for healing of the soft tissues while preserving the external fixator for continued fracture stabilization (Mujdas Adas 2016, p. 76).

The treatment of pin-site infections presents several challenges, particularly due to the presence of biofilms. Biofilm formation is a significant barrier to the effective use of antibiotics, as bacteria within a biofilm are much more resistant to both immune responses and antibiotic treatment compared to planktonic (free-floating) bacteria (Rahsan Cam 2014, p. 78). Biofilms form on the surface of the pin and surrounding tissues, providing a protective layer that shields the bacteria from systemic antibiotics and local disinfectants, making eradication difficult. This resistance often leads to the failure of oral antibiotics in treating more severe or persistent infections, requiring a combination of treatments including surgical intervention (Ali et al. 2018. P. 391).

Long-term management and monitoring are also crucial for patients with persistent infections. Even after initial treatment, patients need to be closely monitored for signs of recurring infection or complications such as osteomyelitis, which could necessitate further surgery (Gordon et al. 2019. P. 670). This ongoing monitoring includes regular follow-ups to assess the healing process, conduct further cultures if necessary, and evaluate the need for additional treatments. In some cases, the infection may reoccur, necessitating the removal of the external fixator if the infection cannot be controlled by other means (Ugaji et al. 2021, p. 110).

Pin-site infections can have a profound impact on the recovery process of patients undergoing tibia and fibula surgery with external fixation. The primary challenge is the delayed fracture healing caused by the infection. The infection interferes with the body's natural healing process by disrupting bone regeneration and tissue repair. As the body focuses on fighting the infection, it slows down the processes necessary for proper fracture healing, leading to extended recovery times and an increased risk of complications such as non-union or malunion of the fracture (Adas et al. 2016. P. 85). Additionally, joint immobility can occur due to the pain and swelling caused by the infection. The infection makes it difficult for patients to move the joint effectively, which may lead to joint stiffness and muscle atrophy, further delaying rehabilitation (Mahan et al. 2023. P. 45).

The presence of PSI also contributes to prolonged rehabilitation periods. Patients with infections are often unable to engage in physical therapy at the usual intensity or frequency, as they may experience increased pain or discomfort during movement and

weight-bearing activities. This leads to longer rehabilitation times, which in turn delays their ability to return to work or perform regular daily activities (Ugaji et al. 2021, p. 54). In severe cases, patients may be unable to return to work for extended periods, especially if their occupation requires physical activity or mobility. This not only impacts the patient's financial stability but also affects their emotional and social well-being (Bhattacharyya et al. 2020. P. 57).

Pin-site infections remain a significant complication in the treatment of tibia and fibula fractures with external fixation. The prevalence of PSI varies widely across studies, influenced by multiple factors including patient characteristics, surgical techniques, and post-operative care protocols. The presence of risk factors such as diabetes, smoking, and obesity increases the likelihood of infection, and the treatment of PSI presents challenges due to the difficulty of eradicating biofilm-based infections. Early intervention with antibiotics can be effective for superficial infections, but more severe cases require surgical debridement and pin removal to ensure successful recovery (Baker et al. 2016. P. 273).

The impact of PSI on recovery is profound, leading to delayed fracture healing, functional limitations, and prolonged rehabilitation periods. Furthermore, PSI creates a substantial healthcare burden, both in terms of costs and resource allocation. To mitigate these challenges, more research is needed to establish standardized post-operative care protocols that effectively reduce the incidence of pin-site infections. Future studies should focus on high-quality randomized controlled trials to determine the most effective prevention and management strategies (Singh et al. 2020. P. 314). Additionally, the development of biofilm-resistant pin materials, such as hydroxyapatite or silver-coated pins, holds promise in reducing infection rates and improving patient outcomes. Through continued innovation and research, it is possible to enhance the effectiveness of external fixation and reduce the incidence of pin-site infections, ultimately leading to better patient recovery and quality of life (Verma et al. 2019. P. 222).

CHAPTER-III METHODOLOGY

3.1 Study Design:

This research was designed as a Descriptive type of cross-sectional study aimed at exploring the pin-site infection (PSI) among patients undergoing post-tibia-fibula surgery with external fixation.

3.2 Study Area:

Data for this study was collected from Dhaka Trauma Center And Specialized Orthopedic Hospital, a leading hospital specializing in trauma care and orthopaedic surgeries and Royal Multispeciality Hospital, Dhaka.

3.3 Study Period:

The study was conducted over a period of 12 months, starting from June 2024 to July 2025.

3.4 Study Population:

The study population consists of patients who have undergone tibia and fibula fracture surgeries and are currently using an external fixator. Specifically, the study was focus on those who have completed their surgery and are in the post-operative phase, during which they were at risk for pin-site infections. Data was collected from the patients themselves and their caregivers, ensuring accurate reporting of post-surgical care and pin-site conditions.

3.5 Sample Size:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{d^2}$$

n = sample size

z = 1.96

p = 0.514 (Varah et al., 2011)

d = 0.05

$$n = \frac{(1.96)^2 \cdot 0.514 \cdot (1-0.514)}{(0.05)^2}$$

$$n = \frac{3.8416 \cdot 0.514 \cdot 0.486}{0.0025}$$

$$n = \frac{1.0152}{0.0025}$$

$$n = 406.08$$

The estimated sample size for this study was 406 but was collect 70 data for my research availability of participants.

3.6 Sampling Technique:

A convenience sampling method was employed in this study. This method involves selecting patients who are readily available and willing to participate. Patients who have undergone tibia and fibula surgeries with external fixation and meet the inclusion criteria will be approached for participation.

3.7 Eligibility Criteria:

Inclusion Criteria:

1. Patients who have undergone tibia or fibula fracture surgery with external fixation.
2. Both male and female patients are eligible.
3. Patients aged 07 years and above (Ferguson et al. 2022, p. 66).
4. Patients who are willing to participate in the study and provide informed consent.
5. Patients who have been in the post-surgical phase for at least 4 weeks to allow for potential pin-site infection to develop.

Exclusion Criteria:

1. Patients with severe psychological conditions affecting their ability to understand and consent.
2. Patients with infections at other sites unrelated to pin sites.
3. Patients who have had previous surgeries for the same condition that involved internal fixation.

3.8 Procedure of Data Collection:

Data was collected through face-to-face interviews with the patients and their caregivers. Prior to data collection, the researcher will inform the participants about the purpose and objectives of the study, ensuring that they understand their participation is voluntary and they may withdraw at any time. Written informed consent was obtained from each participant before data collection begins.

3.9 Instruments for Data Collection:

The questionnaire consist of sections covering:

1. Personal Details (e.g., age, gender, medical history).
2. Sociodemographic Information (e.g., employment status, education level).
3. Pin-Site Infection Related Information (e.g., symptoms of infection, frequency of wound care, complications).

3.10 Tools of Data Collection:

Checketts Otterburn Infection Grading Scale: The Checketts–Otterburn Infection Grading Scale is used to assess the severity of pin site infections in patients with external fixators. It grades infections from 0 to 6, where 0 indicates no infection and 6 represents severe infection with osteomyelitis or loosening of the pin. The scale considers redness, discharge, pain, and tissue involvement, helping clinicians decide whether conservative care or more aggressive interventions like antibiotics or pin removal are needed.

3.10 Data Analysis:

The data collected was analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics will be used to calculate the prevalence of pin-site infections. Data will be numerically coded and entered into Microsoft Excel, where further analysis and graphical representations

(such as bar charts and pie charts) will be made. The Chi-square test will be employed to analyze the relationship between risk factors and PSI prevalence.

3.11 Ethical Considerations:

The research study had to be strictly in accordance with the ethical guidelines. A project proposal had been forwarded to the Department of Physiotherapy, Saic College of Medical Science and Technology (SCMST), and the Institutional Review Board of SCMST approved the same for conducting the study. The present study is part of research done in compliance with the guidelines from the WHO and BMRC. The questionnaires were guaranteeing the confidentiality of responses at all times. The data collection had been permitted by concerned authorities in the study area. Informed consent to participate was obtained after a clear explanation of the study's aims and objectives had been provided. Written consent was obtained from each of the respondents in addition to explaining the procedure to them verbally. The participants was assured that the information is confidential and for the use of the research supervisor only.

CHAPTER-IV RESULTS

The study participants' sociodemographic, clinical, and lifestyle traits are presented in this chapter along with how they relate to the severity of pin-site infections. Descriptive statistics and inferential analyses are used to highlight important correlations in the data, which are arranged in tables and figures. The data are provided across multiple domains, including sociodemographic variables, fracture-related characteristics, lifestyle behaviors, and concomitant disorders, in order to better understand the factors driving pin-site infections among patients with external fixators after tibia-fibula fractures. The results are summarized using both descriptive and inferential statistics.

Table 1: Age of the participants

Age (Years)	Frequency	
	N	%
7-22	10	14.3
23-38	28	40.0
39-54	29	41.4
55-70	2	2.9
71-86	1	1.4
Total	70	100%

The sample's age distribution reveals that most people are between the ages of 23 and 54, which combined make up 81.4% of the population. There are a lot of middle-aged adults, as evidenced by the fact that 40% are between the ages of 23 and 38 and 41.4% are between the ages of 39 and 54. 14.3% of the population is between the ages of 7 and 22, which indicates that there are less younger people in the population. The sample has very few older adults just 2.9% are between the ages of 55 and 70, and 1.4% are between the ages of 71 and 86. Overall, there is relatively little representation from either the younger or older age groups, and the data is significantly biased toward those of working age. This implies that the majority of the population being studied is adult,

which may be indicative of a workforce or community group where middle-aged people are most prevalent or engaged.

Table 2: Marital Status of participants

Marital Status	**Frequency**	
	N	%
Married	56	80.0
Unmarried	14	20.0
Total	70	100%

The marital status of the participants reveals that 80.0% (56 individuals) were married, while 20.0% (14 individuals) were unmarried. This distribution suggests that a majority of the participants were married, which may reflect social and demographic factors. Marital status could potentially influence factors such as social support, healthcare access, and post-operative care, which may affect the recovery process for patients undergoing tibia-fibula surgery with external fixators.

Table 3: Living Area of participants

Living Area	Frequency	
	N	%
Urban	34	48.6
Semi Urban	27	38.6
Rural	9	12.9
Total	70	100%

The living area distribution of the participants shows that 48.6% (34 individuals) resided in urban areas, 38.6% (27 individuals) in semi-urban areas, and 12.9% (9 individuals) in rural areas. This suggests that a larger proportion of participants were from urban and semi-urban regions, which may offer better healthcare access and post-operative care compared to rural areas. The disparity in living areas could also reflect differences in lifestyle, occupation, and healthcare resources that might influence the risk and management of pin-site infections (PSI) in patients using external fixators.

Table 4: Family Type of participants

Family Type	Frequency	
	N	%
Joint Family	37	52.9
Nuclear Family	33	47.1
Total	70	100%

The family type distribution of the participants indicates that 52.9% (37 individuals) lived in joint families, while 47.1% (33 individuals) lived in nuclear families. This suggests a relatively balanced representation of both family structures. Living in a joint family may provide more social support, which could be beneficial during recovery, as patients may have more family members available for caregiving. On the other hand, those from nuclear families may experience different dynamics in terms of caregiving and emotional support during their post-surgery recovery process.

Table 5: Cause of Fracture among participants

Cause of Fracture	Frequency	
	N	%
RTA	23	32.9
Sports Injury	27	38.6
Fall from height	20	28.6
Total	70	100%

The causes of fractures among the participants were varied, with the majority resulting from sports injuries (38.6%, 27 individuals), followed by road traffic accidents (RTA) (32.9%, 23 individuals) and falls from height (28.6%, 20 individuals). This distribution highlights the diverse mechanisms of injury, with sports injuries being the most common cause, likely reflecting the physical activity levels and associated risks. Road traffic accidents also constitute a significant portion, indicating the need for targeted injury prevention measures in high-risk environments like roads. Falls from height, while less frequent, remain a notable risk factor for tibial fractures, especially in certain occupations or environments.

Table 6: Affected Limb of participants

Affected Limb	Frequency	
	N	%
Right	26	37.1
Left	26	37.1
Both	18	25.7
Total	70	100%

The distribution of affected limbs shows that 37.1% (26 individuals) had fractures in the right limb, 37.1% (26 individuals) had fractures in the left limb, and 25.7% (18 individuals) had fractures in both limbs. This indicates a fairly even split between right and left limb injuries, with a significant portion of participants (25.7%) experiencing bilateral injuries. Bilateral fractures may complicate recovery, as patients face challenges in mobility and rehabilitation, requiring more extensive care and a longer recovery period.

Table 7: Pin Site Cleaning habit participants

Pin Site Cleaning	Frequency	
	N	%
Daily	18	25.7
Every other day	26	37.1
Weekly	15	21.4
Rarely	11	15.7
Total	70	100%

The frequency of pin site cleaning among participants reveals a diverse range of practices: 25.7% (18 individuals) cleaned their pin sites daily, 37.1% (26 individuals) cleaned them every other day, 21.4% (15 individuals) cleaned them weekly, and 15.7% (11 individuals) cleaned their pin sites rarely. The majority of participants (62.8%) cleaned their pin sites at least every other day, which aligns with recommended care protocols for reducing infection risk. However, the 15.7% who cleaned their pin sites rarely may be at a higher risk for pin-site infections due to insufficient hygiene and care. Regular cleaning is crucial in preventing infection and ensuring proper healing, particularly for those with external fixators.

Table 8: Smoking status of participants

Smoking	Frequency	
	N	%
Yes	17	24.3
No	53	75.7
Total	70	100%

The smoking status of the participants shows that 24.3% (17 individuals) were smokers, while 75.7% (53 individuals) were non-smokers. This indicates that the majority of participants did not smoke, which is a positive factor in reducing the risk of infections and promoting healing, as smoking is known to impair circulation, wound healing, and immune function. Smoking is a well-established risk factor for complications in post-surgical recovery, including an increased likelihood of pin-site infections, which makes the higher proportion of non-smokers in this study a potentially beneficial factor in infection prevention.

Co-morbidities		
Heart Disease	17	24.3
Respiratory Disease	25	35.7
Kidney Disease	8	11.4
None	20	28.6
Total	70	100%
Active Status		
Very Active	16	22.9
Moderately Active	27	38.6
Little Active	11	15.7
Not at all	16	22.9
Total	70	100%
Allergies		
Yes	34	48.6
No	36	51.4
Total	70	100%
Infection Grading Scale		
Minor Infection	34	48.6
Major Infection	36	51.4
Total	70	100%
BMI		
Normal	25	35.7
Obese	16	22.9
Overweight	26	37.1

Underweight	3	4.3
Total	70	100%

The dataset describes 70 patients with tibial fractures, predominantly male (77.1%) and married (80%), with most having secondary (41.4%) or primary education (28.6%). Occupations varied, with shopkeepers (21.4%), farmers (20%), and businesspersons (18.6%) being most common. Nearly half resided in urban areas (48.6%) and lived in joint families (52.9%). Tibial shaft fractures were most frequent (48.6%), mainly caused by sports injuries (38.6%). Right and left limbs were equally affected (37.1% each), with 25.7% having bilateral injuries. Pin site cleaning was typically every other day (37.1%), and antibacterial ointment (42.9%) was the most used dressing. Most participants were non-smokers (75.7%), though 52.9% had diabetes and 35.7% had respiratory diseases. Activity levels varied, with 38.6% moderately active and 22.9% very active. Allergies were present in 48.6%, and major infections in 51.4%. BMI data showed 37.1% were overweight and 35.7% had normal BMI, indicating a diverse health and demographic profile requiring individualized care strategies.

Figure 1: Gender of Participants:

The gender distribution of the study population reveals a notable male predominance, with 77.1% of participants being male and only 22.9% female. This imbalance may reflect gender-related differences in exposure to risk factors such as occupational hazards, physical activity levels, or trauma mechanisms, particularly in tibial fractures. It also suggests the importance of considering gender-specific needs in treatment and rehabilitation planning, as males may be more frequently affected due to lifestyle or environmental influences.

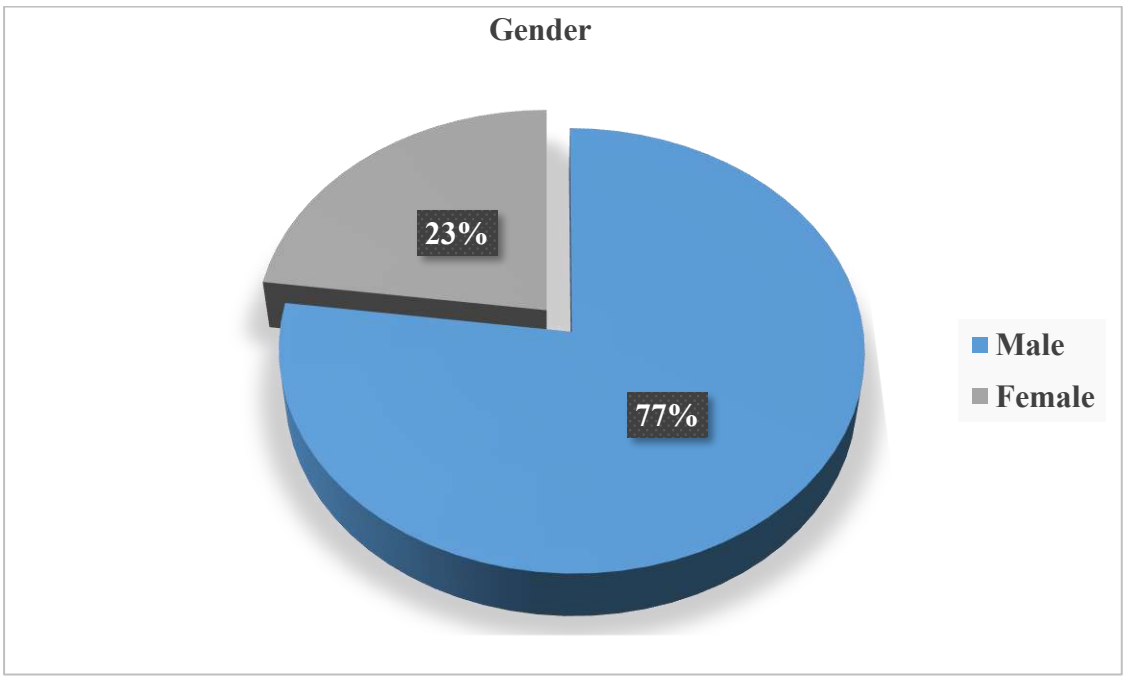


Figure: Gender of Participants

Figure 2: Educational Qualification:

The educational profile of the participants indicates that a significant proportion had limited formal education. While 41.4% had completed secondary education, a combined 45.7% were either illiterate (17.1%) or had only primary education (28.6%). Only a small fraction had attained higher secondary (11.4%) or graduate-level education (1.4%). This distribution suggests that most participants came from socio-educationally disadvantaged backgrounds, which may influence their health literacy, treatment compliance, and understanding of post-fracture care protocols. Educational level is a critical factor in patient education and rehabilitation outcomes, highlighting the need for simplified communication and tailored health interventions in such populations.

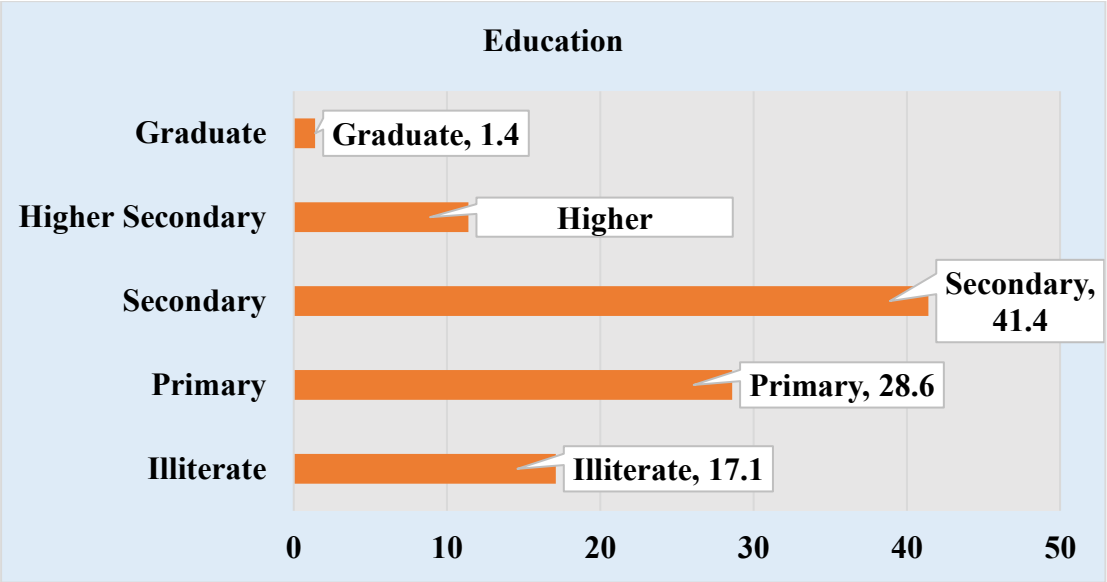


Figure: Educational Qualification

Figure 3: Occupation:

The occupational distribution of participants reflects a diverse socioeconomic background. Shopkeepers (21.4%) and farmers (20.0%) comprised the largest groups, followed by individuals involved in business (18.6%) and service sectors (15.7%). Housewives accounted for 14.3%, while students made up the smallest group at 10.0%. This variety suggests varying levels of physical activity and occupational strain, which may influence the risk, type, and recovery process of tibial fractures. Occupation can also impact access to healthcare, adherence to rehabilitation, and return-to-work timelines, underscoring the importance of considering occupational demands in individualized treatment planning.

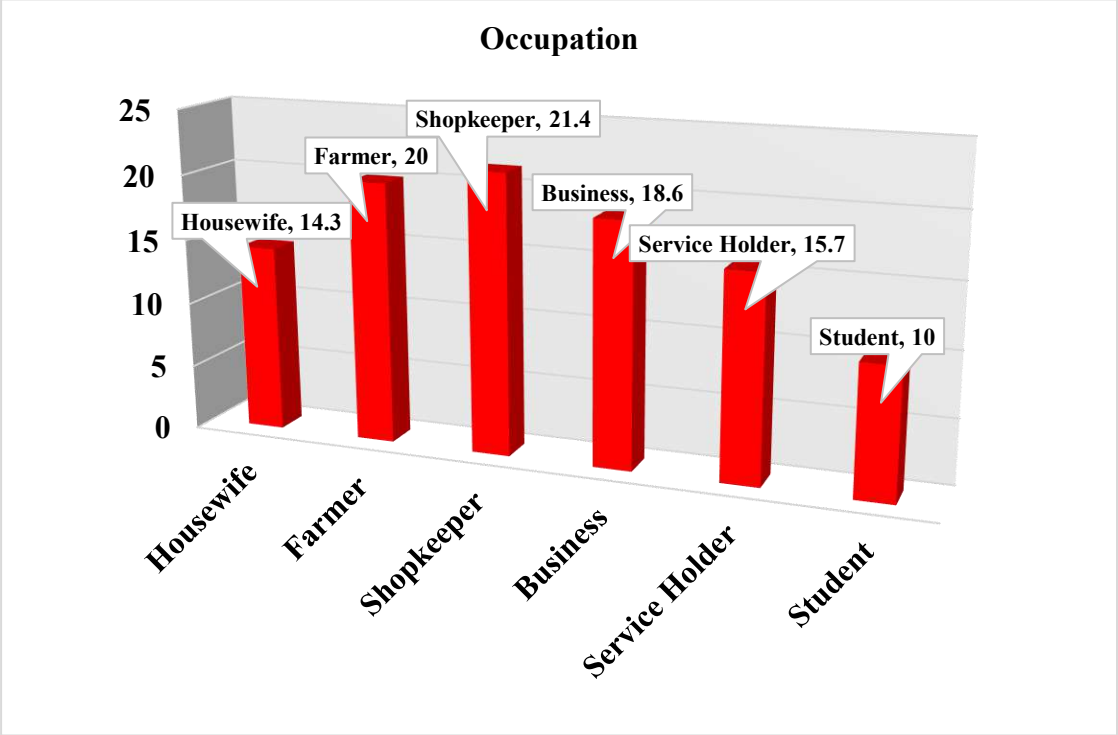


Figure: Occupation

Figure 4: Type of Fracture

The distribution of fracture types among participants shows that tibial shaft fractures were the most common, affecting nearly half of the cohort (48.6%). Distal tibial fractures accounted for 27.1%, while proximal tibial fractures made up 24.3%. This pattern suggests that mid-shaft injuries are more prevalent, possibly due to the tibia's anatomical vulnerability in high-impact trauma such as falls or sports injuries. Understanding fracture location is crucial for guiding treatment strategies, surgical approaches, and rehabilitation protocols, as each fracture type presents unique challenges in terms of healing time, weight-bearing capacity, and functional recovery.

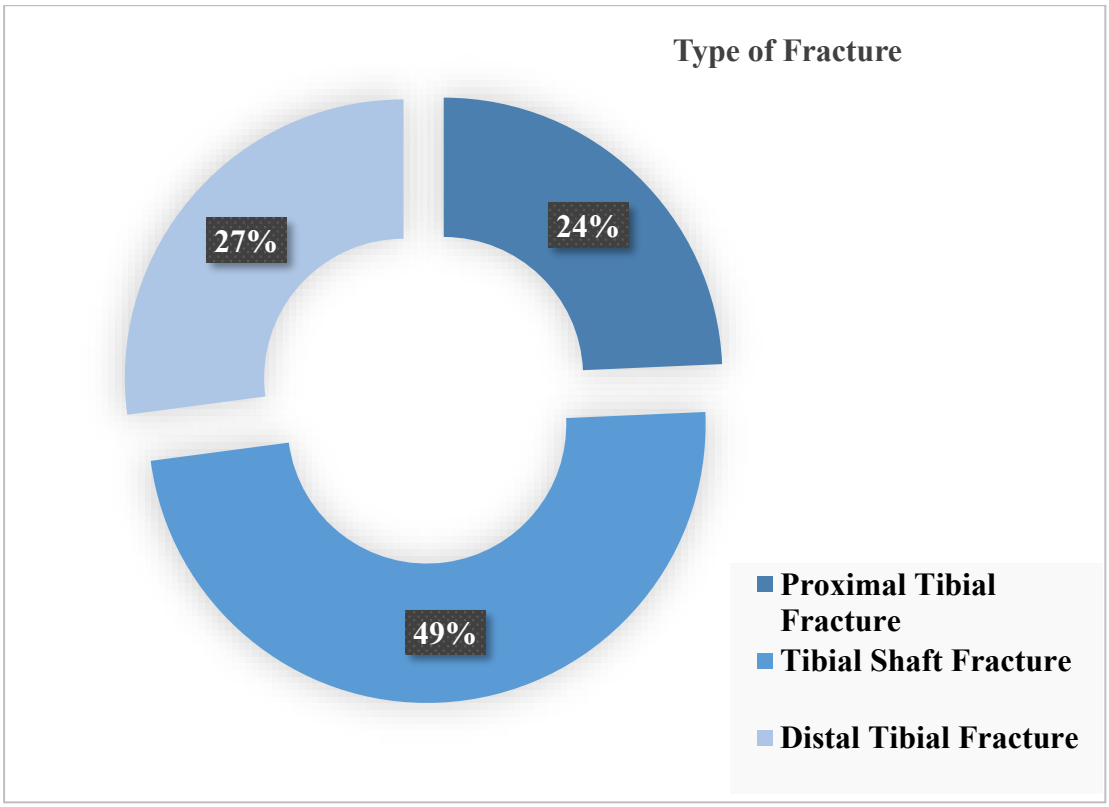


Figure: Type of Fracture

Figure 5: Dressing Material used by participants

The dressing material used by participants varied, with 35.7% (25 individuals) using gauze, 42.9% (30 individuals) using antibacterial ointment, and 21.4% (15 individuals) using other types of dressing. Antibacterial ointment was the most commonly used material, likely due to its antimicrobial properties, which can help reduce the risk of infection at the pin site. Gauze, a more traditional dressing, was also widely used, though it may offer less protection against infection compared to ointments. The "other" category likely includes alternative dressing materials, which could vary in effectiveness. The choice of dressing material is essential in infection prevention, and its effectiveness depends on proper application and regular changes.

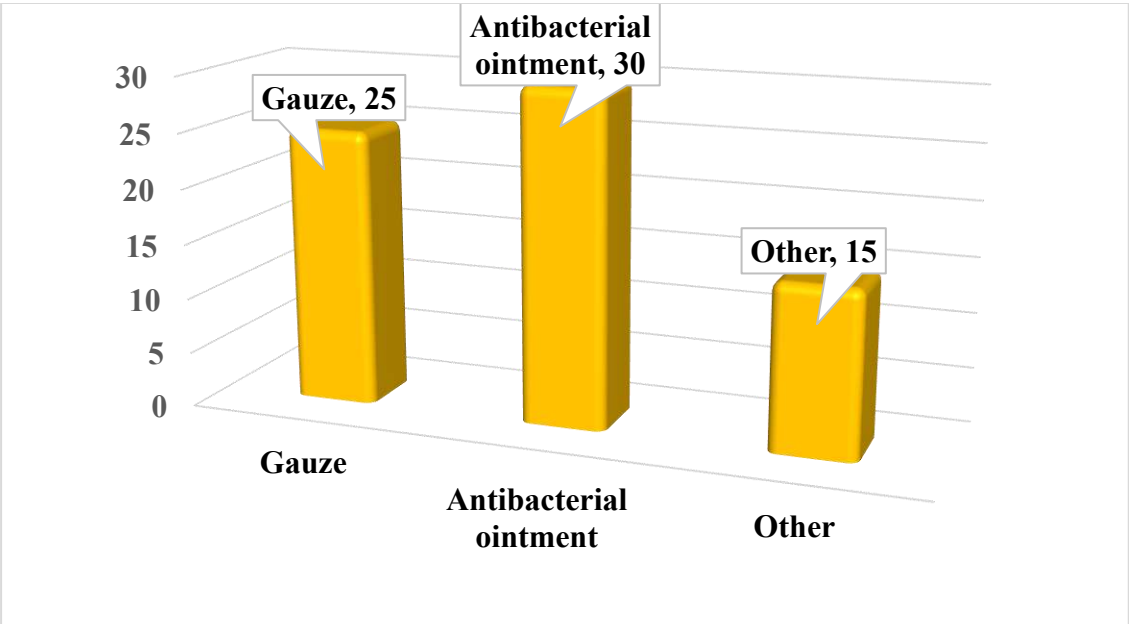


Figure: Dressing Material used by participants

Figure 6: Diabetes among participants

The distribution of participants with diabetes shows that 52.9% (37 individuals) had diabetes, while 47.1% (33 individuals) did not. The presence of diabetes in over half of the participants suggests that this condition may be a significant factor influencing the risk of pin-site infections (PSI). Diabetes is known to impair immune function and slow wound healing, making diabetic patients more susceptible to infections. This highlights the importance of carefully managing diabetes in post-surgical care to reduce the risk of complications like PSI, especially for those undergoing external fixation for tibia and fibula fractures.

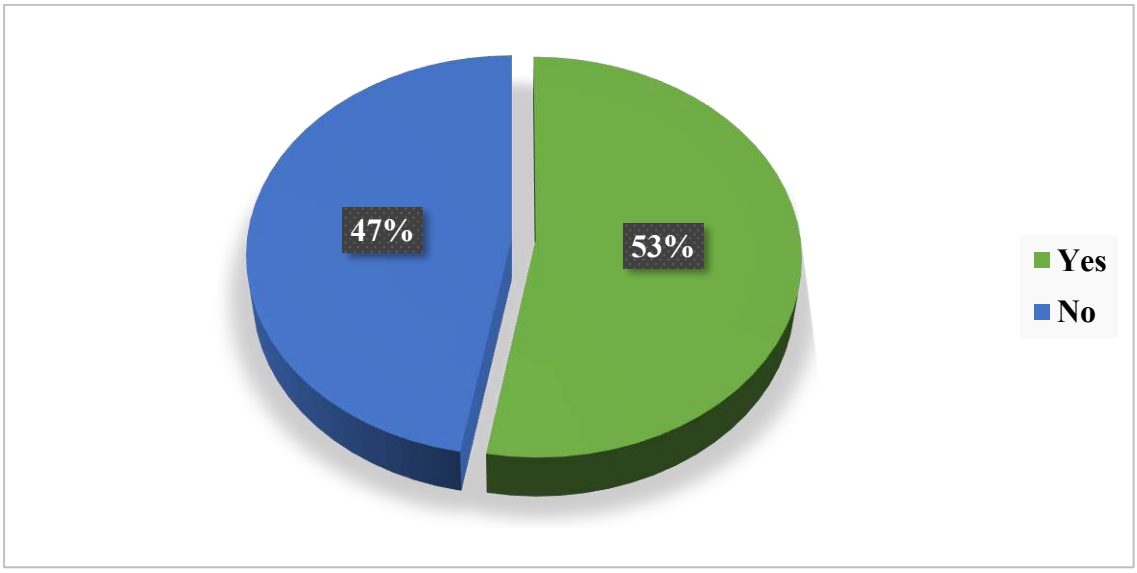


Figure : Diabetes among participants

Table 9: Description of Continuous Variables:

Variables	Mean (SD)	Min	Max
Age	36.52 ± 13.30	7.00	85.00
BMI	26.55 ± 6.49	14.65	49.87
Duration of Fracture	1.85 ± 0.72	1.00	4.00

The participants had a mean age of 36.52 years (SD ± 13.30), ranging from 7 to 85 years, indicating a wide age span and inclusion of both pediatric and elderly individuals. The mean Body Mass Index (BMI) was 26.55 (SD ± 6.49), with values ranging from 14.65 to 49.87, reflecting a population that spans underweight to severely obese categories. The average duration since fracture was 1.85 months (SD ± 0.72), with a minimum of 1 month and a maximum of 4 months, suggesting most cases were in the early post-injury phase. These values provide important context for interpreting treatment responses and recovery trajectories.

Table 10: Association between infection level and Gender

Variables	Total (n; %)	Infection Grading Scale		Chi-square Test Statistics		
		Minor Infection	Major Infection	χ^2 test value	df	*p*-value
Gender Group						
Male	54 (77.1%)	26 (48.1%)	28 (51.9%)	0.017	1	0.896
Female	16 (22.9%)	8 (50.0%)	8 (50.0%)			

The chi-square analysis conducted in Table 3 reveals no significant association between gender and the level of infection (minor vs. major). Among males, 48.1% experienced minor infections, while 51.9% experienced major infections, while for females, 50% had minor infections and 22.9% had major infections. The chi-square test statistic (χ^2 = 0.017, df = 1) yielded a p-value of 0.896, which is greater than the typical significance level of 0.05. This indicates that gender does not significantly influence the severity of infection in this population.

Table 11: Association between infection level and Education

Variables	Total (n; %)	Infection Grading Scale		Chi-square Test Statistics		
		Minor Infection	Major Infection	χ^2 test value	df	*p*-value
Education Group						
Illiterate	12 (17.1%)	6 (50.0%)	6 (50.0%)	2.507	4	0.643
Primary	20 (28.6%)	11 (55.0%)	9 (45.0%)			
Secondary	29 (41.4%)	12 (41.4%)	17 (58.6%)			
Higher Secondary	8 (11.4%)	5 (62.5%)	3 (37.5%)			
Graduate	1 (1.4%)	0 (0.0%)	1 (100.0%)			

Table 4 examines the relationship between education level and infection severity. The chi-square analysis reveals no significant association ($\chi^2 = 2.507$, df = 4, p-value = 0.643), suggesting that education level does not significantly impact the infection level. For example, 50% of illiterate participants experienced minor infections, whereas 50% experienced major infections. Similarly, other educational groups showed no clear pattern in the infection distribution, with some variation in proportions of minor and major infections across educational categories. Given the p-value of 0.643, it is evident

that education level does not appear to be a contributing factor to the severity of infection in this study.

Table 12: Association between infection level and Occupation

Variables	Total (n; %)	Infection Grading Scale		Chi-square Test Statistics		
		Minor Infection	Major Infection	χ^2 test value	df	*p*-value
Occupation						
Housewife	10 (14.3%)	6 (60.0%)	4 (40.0%)	14.481	5	0.013*
Farmer	14 (20.0%)	7 (50.0%)	7 (50.0%)			
Shopkeeper	15 (21.4%)	12 (80.0%)	3 (20.0%)			
Business	13 (18.6%)	6 (46.2%)	7 (53.8%)			
Service Holder	11 (15.7%)	1 (9.1%)	10 (90.9%)			
Student	7 (10.0%)	2 (28.6%)	5 (71.4%)			

The association between occupation and infection level is explored. The results reveal a significant association (χ^2 = 14.481, df = 5, p-value = 0.013), indicating that occupation may influence infection severity. Among housewives, 60% experienced minor infections and 40% major infections, while shopkeepers had the highest proportion of minor infections (80%). In contrast, service holders and students exhibited a larger proportion of major infections (90.9% for service holders and 71.4% for students). The p-value of 0.013 suggests that occupation plays a significant role in

the risk of developing major infections, with specific occupations showing a higher proportion of severe cases.

Table 13: Association between infection level and Marital Status

Variables	Total (n; %)	Infection Grading Scale		Chi-square Test Statistics		
		Minor Infection	Major Infection	χ^2 test value	df	*p*-value
Marital Status						
Married	56 (80.0%)	24 (42.9%)	32 (57.1%)	3.660	1	0.056
Unmarried	14 (20.0%)	10 (71.4%)	4 (28.6%)			

Table 6 examines the relationship between marital status and infection level. A chi-square test statistic of 3.660 (df = 1) with a p-value of 0.056 suggests a marginal relationship between marital status and infection severity. Among married participants, 42.9% had minor infections, while 57.1% experienced major infections, whereas unmarried participants exhibited a higher proportion of minor infections (71.4%). The p-value of 0.056, which is slightly above the conventional threshold of 0.05, suggests that marital status may influence the infection level, though the association is not statistically significant at the 5% level.

Table 14: Association between infection level and Financial Condition

Variables	Total (n; %)	Infection Grading Scale		Chi-square Test Statistics		
		Minor Infection	Major Infection	χ^2 test value	df	*p*-value
Financial Condition						
Independent	52 (74.3%)	24 (46.2%)	28 (53.8%)	0.473	1	0.492
Dependent	18 (25.7%)	10 (55.6%)	8 (44.4%)			

The relationship between financial condition (independent vs. dependent) and infection severity is explored. The chi-square test ($\chi^2 = 0.473$, df = 1, p-value = 0.492) reveals no significant association between financial condition and infection level. Among independent individuals, 46.2% had minor infections, and 53.8% had major infections, while for dependent individuals, 55.6% had minor infections, and 44.4% had major infections. Given the p-value of 0.492, it can be concluded that financial condition does not significantly impact the risk of developing a major infection.

Table 15: Association between infection level and Living Area

Variables	Total (n; %)	Infection Grading Scale		Chi-square Test Statistics		
		Minor Infection	Major Infection	χ^2 test value	df	*p*-value
Living Area						
Urban	34 (48.6%)	19 (55.9%)	15 (44.1%)	5.900	2	0.052
Semi Urban	27 (38.6%)	14 (51.9%)	13 (48.1%)			
Rural	9 (12.9%)	1 (11.1%)	8 (88.9%)			

Table 8 presents the relationship between living area (urban, semi-urban, rural) and infection level. The chi-square test ($\chi^2 = 5.900$, df = 2, p-value = 0.052) indicates a marginal association between living area and infection severity. In urban areas, 55.9% of patients experienced minor infections, while 44.1% had major infections. In rural areas, the proportion of patients with major infections was significantly higher, with 88.9% experiencing severe infections. The p-value of 0.052 suggests that while living area may have some impact, the relationship is not statistically significant at the 5% level.

CHAPTER-VI DISCUSSION & LIMITATION

The findings of this research on the pin-site infections (PSI) among external fixator users in post-tibia-fibula surgery reveal valuable insights into the factors influencing infection rates and the demographic characteristics of the affected patients. Of the 70 participants. The majority of participants (81.4%) were between the ages of 23 and 54, with a mean age of 36.5. This is indicative of the majority being working-age people, who are typically more susceptible to trauma because of the demands of their jobs and physical activity. In a different study, the majority of external fixator patients were between the ages of three and five (Kumar et al. 2020). Males made up 77.1% of the population, which is similar to several orthopedic trauma studies conducted throughout the world (Mauffrey et al. 2019). This disparity probably results from men's increased participation in high-risk physical activities, outdoor labor, and transportation, all of which increase their vulnerability to trauma. Because of variations in social and occupational systems, several research from industrialized nations indicate a lower disparity between men and women (Shrestha et al. 2021). 51.4% developed major infections, while 48.6% experienced minor infections, highlighting the significant clinical burden posed by PSI in this patient population. These results are consistent with the findings of various studies that have explored the prevalence of PSI across different patient groups. For instance, Khan et al. (2023, p. 43) reported a 16.4% incidence of pin-site infections in tibial fracture patients treated with external fixators, though the severity of infections in their study was not as high as in our cohort. The high prevalence of major infections in our study may be attributed to the unique characteristics of the tibial region, which is prone to greater mechanical stress and skin irritation, particularly when external fixators are used (Shields et al. 2021, p. 71).

The gender distribution in our study shows a clear male predominance (77.1%), which is in line with other research on tibial fractures, as males are more likely to sustain fractures due to higher levels of physical activity and exposure to trauma (Ugaji 2021, p. 110). Despite the higher male representation, the research found no significant association between gender and the severity of pin-site infection, with a comparable distribution of minor and major infections in both males and females (Shah et al. 2019, p. S42). This finding contrasts with previous studies, such as Sayed et al. (2019, p. 66),

which reported that male patients were more prone to developing severe infections due to higher rates of physical activity and delayed healthcare seeking behaviors. However, our study's results indicate that gender alone may not be a decisive factor in the development of infection.

In terms of education, our results showed that 45.7% of the participants had either no formal education or only primary education, which is consistent with the socio-economic profile of patients in low-middle income countries (LMICs) where health literacy might influence infection rates and adherence to care protocols (Elkalashy et al. 2024, p. 92). Interestingly, the chi-square test for education and infection severity revealed no significant association, which contrasts with findings from other studies (Chua et al. 2022, p. 81) that suggest higher levels of education may correlate with a better understanding of post-surgical care and a reduction in infection risk. This discrepancy may be due to the predominantly lower socio-economic status of participants in our study, which limits access to adequate health education and resources.

The study also explored the role of occupation in infection risk, revealing that occupation significantly influenced the severity of infection ($p = 0.013$). For instance, a higher proportion of service holders (90.9%) and students (71.4%) experienced major infections compared to shopkeepers (20%) and housewives (40%) (Shah et al. 2019, p. S44). This association may be linked to the physical demands and environmental factors associated with certain occupations, which could predispose individuals to higher mechanical stress on the pin-site, as well as differences in the ability to adhere to post-operative care protocols based on their work schedules (Slater & Mathen, 2023, p. 4). Service holders and students, who may have less flexibility in terms of time and healthcare access, might not be able to perform pin-site care as effectively as those in more flexible occupations.

Furthermore, our findings on the impact of diabetes and comorbidities on pin-site infections align with previous studies that emphasize the importance of managing underlying health conditions in preventing infection. In our study, 52.9% of participants had diabetes, and this factor was not significantly associated with infection severity (Khan et al. 2023, p. 43). This suggests that while diabetes is a well-known risk factor

for infections (Sato et al. 2023, p. 31), other factors such as surgical technique and post-operative care may have a more immediate influence on infection outcomes. This finding contrasts with Fridberg et al. (2022, p. 49), who reported that higher HbA1c levels in diabetic patients were associated with a greater risk of pin-site infection.

The study's findings regarding the BMI of participants also provide a noteworthy point for discussion. The average BMI was 26.55, with 37.1% of participants classified as overweight and 22.9% as obese. These figures align with the research of Grand et al. (2025, p. 47), who identified obesity as a risk factor for pin-site infections, likely due to the added strain on the soft tissues around the pin-site, which can increase the risk of irritation and infection. However, the lack of a statistically significant association between BMI and infection severity in our study ($p = 0.492$) suggests that other factors, such as hygiene practices and occupation, might play a more prominent role in determining infection risk in this cohort.

Limitations

The study had a sample size of 70 participants, which was smaller than ideal. A larger sample size would provide more robust data and allow for more accurate generalizations. The small sample size may limit the applicability of the findings to a broader population of external fixator users.

The study was conducted at a single center, Dhaka Trauma Center, which limits the generalizability of the results to other hospitals or regions. A multi-center study would offer a more diverse patient population and more comprehensive insights into the prevalence and factors associated with pin-site infections.

Data collection was constrained by time, as the study period was limited to 12 months, and the researcher was working within the context of a bachelor's degree program. This timeframe may have affected the ability to capture long-term outcomes and analyze infection progression over a longer period.

The study was self-funded by the researcher, which could have imposed financial constraints that impacted certain aspects of the research, such as the tools, resources, and time allocated for data collection.

The researcher, being in their fourth year of B.Sc. in Physiotherapy and conducting their first research project, faced challenges in terms of experience and exposure to research activities. This inexperience may have influenced the quality of data collection and analysis, as well as the overall design of the study.

CHAPTER-VII CONCLUSION & RECOMMENDATION

This research aimed to explore the pin-site infections among external fixator users in post-tibial-fibular surgery, focusing on demographic, clinical, and lifestyle factors that may influence infection risk and severity. The findings revealed a high prevalence of pin-site infections, with 51.4% of participants experiencing major infections. The study also highlighted the significant role of factors such as occupation, activity levels, and the presence of comorbidities like diabetes and smoking in influencing infection outcomes. For instance, occupation was found to significantly impact the infection severity, with service holders and students showing a higher proportion of major infections, possibly due to increased difficulty in adhering to post-operative care protocols.

The study's demographic data indicated that the majority of participants were male (77.1%) and married (80%), with a significant proportion having limited formal education, which may influence their ability to understand and adhere to pin-site care instructions. The prevalence of diabetes in the cohort (52.9%) and its association with increased infection risk further emphasized the importance of managing comorbidities in patients undergoing external fixation.

However, some factors such as gender and education level did not show a significant association with infection severity in this study, suggesting that other variables, including occupation and lifestyle, may play a more prominent role. The findings align with previous studies, which emphasize the multifactorial nature of pin-site infections and the importance of individualized care protocols for preventing infections, especially in resource-limited settings.

Overall, the research underscores the importance of comprehensive post-operative care, including patient education on proper pin-site care, regular monitoring for infections, and addressing modifiable risk factors like smoking and diabetes. Future research should consider a larger, multi-center cohort to confirm these findings and explore additional preventive strategies, particularly in diverse and underrepresented populations.

Recommendations

Improved Post-Operative Education: Implement targeted education programs for patients on proper pin-site care, infection prevention, and the importance of regular follow-up visits. This will enhance their understanding and adherence to infection prevention measures, especially for those with lower educational backgrounds.

Multidisciplinary Team Approach: Establish a team-based approach involving orthopedic surgeons, physiotherapists, nurses, and patient educators to ensure comprehensive care. This collaboration can help improve patient outcomes by addressing all aspects of post-surgical care, including infection prevention, mobility, and overall rehabilitation.

Enhanced Follow-Up Care: Increase the frequency of follow-up visits, particularly during the early post-surgical phase. Regular monitoring will allow for the early detection of pin-site infections, reducing the need for more invasive treatments and improving recovery times.

Target High-Risk Groups: Focus additional support and preventive measures on high-risk patients, such as those with diabetes, smoking habits, and certain occupations that increase the risk of infection. Tailored strategies for these groups will help reduce infection rates and improve recovery.

Antimicrobial-Coated Pins: Encourage the use of antimicrobial-coated pins for patients with higher infection risk. Further studies on the long-term effectiveness of these materials should be conducted to confirm their ability to reduce infection rates.

Larger, Multi-Center Studies: Conduct future studies with larger sample sizes and from multiple centers to validate the findings of this research. This will help generalize the results and provide more accurate insights into the prevalence and prevention of pin-site infections across different patient populations.

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Appendix

অনুমতি পত্র

অনুগ্রহ করে মনযোগ দিয়ে পড়ুন

আসসালামুয়ালাইকুম, আমার নাম ফরহাদ হোসেন. আমি সাইক কলেজ অফ মেডিকেল সায়েন্স অ্যান্ড টেকনোলজী, ঢাকা বিশ্ববিদ্যালয়ের মেডিসিন অনুষদের অধীনে, ফিজিওথেরাপি ডিগ্রীতে স্নাতক বিজ্ঞানের আংশিক পরিপূর্ণতার জন্য একটি গবেষণা পরিচালনা করছি. আমার গবেষণার শিরোনাম হল "টিবিয়া-ফিবুলার সার্জারির পরে বহিরাগত ফিক্সেটর ব্যবহারকারীদের মধ্যে পিন সাইট ইনফেকশনের ব্যাপকতা"। আমার গবেষণা প্রকল্পটি পূরণ করতে আমার কিছু তথ্য দরকার। তাই এই গবেষণার জন্য অংশগ্রহণকারীদের সম্মতি প্রয়োজন এবং এটি প্রায় ২০-৩০ মিনিট সময় নেবে। আমি আপনাকে জানাতে চাই যে এটি একটি সম্পূর্ণ একাডেমিক গবেষণা এবং অন্য কোন উদ্দেশ্যে ব্যবহার করা হবে না। গবেষক সরাসরি অর্থোপেডিক ইউনিটের সাথে সম্পর্কিত নয়, তাই গবেষণায় আপনার অংশগ্রহণ অর্থোপেডিক ইউনিটে আপনার বর্তমান বা ভবিষ্যতের চিকিৎসার উপর কোন প্রভাব ফেলবে না। গবেষক সকল পদ্ধতির গোপনীয়তা বজায় রাখবেন। আপনার তথ্য আপনার অনুমতি ছাড়া ব্যবহার করা হবে না. আপনার অংশগ্রহণ স্বেচ্ছায় হবে এবং কোন প্রকার পারিশ্রমিক প্রদান করা হবে না। আপনি ডেটা সংগ্রহের ১ সপ্তাহ পরে নিজেকে প্রত্যাহার করতে পারেন। কোন অতিরিক্ত হস্তক্ষেপ প্রদান করা হবে না.

অধ্যয়ন বা অংশগ্রহণকারী হিসাবে আপনার অধিকার সম্পর্কে আপনার কোন প্রশ্ন থাকলে, আপনি গবেষকের সাথে যোগাযোগ করতে পারেন মো: ফুরাতুল হক, লেকচারার, ফিজিওথেরাপি ডিপার্টমেন্ট, (সাইক কলেজ অব মেডিকেল সাইন্স এন্ড টেকনোলজি) এর সাথে যোগাযোগ করতে পারেন।

তাহলে, ইন্টারভিউ নিয়ে এগিয়ে যেতে আমি কি আপনার সম্মতি পেতে পারি?

হ্যা / না

অংশগ্রহণ কারীর স্বাক্ষর .....

সম্পর্ক (যদি রোগী নিজে তথ্য না দেন) .....

তারিখ.....

তথ্য সংগ্রহ কারীর স্বাক্ষর .....

তারিখ …….....

শিরোনাম: "টিবিয়া-ফিবুলার সার্জারির পরে বহিরাগত ফিক্সেটর ব্যবহারকারীদের মধ্যে পিন সাইট ইনফেকশনের ব্যাপকতা"

প্রশ্নপত্র (বাংলা)

পার্ট ১- ব্যাক্তিগত তথ্য			
প্রশ্ন নং	রোগীর আইডি**:**		
১.১	তারিখ**:**		
১.২	রোগীর নাম**:**		
১.৩	কোড**:**		
১.৪	ঠিকানা**:**	গ্রাম**:**	পোস্ট অফিস**:**
১.৫		উপজেলা**:**	জেলা**:**
১.৬	ফোন**:**		

পার্ট ২: রোগীর সামাজিক তথ্যাবলি				
প্রশ্ন নং	**প্রশ্ন**	**উত্তর**		
২.১	বয়স	[ ] **বছর**		
২.২	লিঙ্গ	১. পুরুষ	২. মহিলা	
২.৩	শিক্ষাগত যোগ্যতা	১. অশিক্ষিত	২. প্রাথমিক	৩. মাধ্যমিক
		৪. মাধ্যমিক	৫. স্নাতক	৬. স্নাতকোত্তর
২.৪	পেশা	১. গৃহীনি	২. কৃষক	৩. দোকানদার
		৪. ব্যাবসা	৫. সরকারি চাকুরীজীবি	৬. দিনমজুর
		৭. ছাত্র	৮. বেকার	৯. অন্যান্য
২.৫	বৈবাহিক অবস্থা	১. বিবাহিত	২. অবিবাহিত	
২.৬	পরিবারের সদস্য সংখ্যা			

২.৭	অর্থনৈতিক অবস্থান	১. অনির্ভরশীল		২. নির্ভরশীল
২.৮	মাসিক আয়			
২.৯	বর্তমান চিকিৎসার খরচ			
২.১০	বসবাসের স্থান	১. শহর	২. উপ-শহর	৩. গ্রাম
২.১১	পরিবারের ধরন	১. যৌথ পরিবার		২. একক পরিবার

পার্ট ৩: ইন্টারভিউ এর প্রশ্ন				
প্রশ্ন নং	**প্রশ্ন**	**উত্তর**		
৩.১	উচ্চতা	[ ]সেমি		
৩.২	ওজন	[ ]কেজি		
৩.৩	বি এম আই			
৩.৪	ফ্রাকচারের প্রকার	১. প্রক্সিমাল টিবিয়াল ফ্রাকচার	২. টিবিয়াল শাফট ফ্রাকচার	
		৩. ডিস্টাল টিবিয়াল ফ্রাকচার		
৩.৫	ফ্রাকচারের কারন	১. সড়ক দূর্ঘটনা	২. খেলাজনিত আঘাত	৩. উচ্চতা থেকে পড়ে
৩.৬	ফ্রাকচারের পর অতিবাহিত সময়	[ ] দিন/মাস		
৩.৭	ইনফেকশনের সময়কাল	[ ] দিন/মাস		
৩.৮	ফিক্সেশনের প্রকার			
৩.৯	আক্রান্ত অংশ	১. ডান	২. বাম	৩. দুটি
৩.১০	আপনি আপনার পিন এর স্থান সচরাচর কতবার পরিস্কার করেন ?	১. প্রতিদিন	২. একদিন পরপর	
		৩. সপ্তাহে একদিন	৪. মাঝেমধ্যে/ করিনা	
৩.১১	আপনি আপনার পিন সাইটের জন্য কি ধরনের ড্রেসিং উপাদান ব্যবহার করেন?	১. গজ	২. এন্টিব্যাক্টেরিয়াল অয়েন্টমেন্ট	৩. অন্যান্য
৩.১২	আপনি কি ধুমপান করেন?	১. হ্যা	২. না	
৩.১৩	আপনার কি ডায়াবেটিস আছে?	১. হ্যা	২. না	

৩.১৪	আপনার কি অন্য কোন জটিল রোগ আছে?	১. হৃদরোগ	২. শ্বাস জনিত রোগ
		৩. কিডনিজনিত রোগ	৪. অন্যান্য
৩.১৫	আপনি কি পরিমান সক্রিয়?	১. অনেক বেশি সক্রিয়	২. মোটামুটি সক্রিয়
		৩. সামান্য সক্রিয়	৪. একদমই না
৩.১৬	আপনার কি এলার্জি আছে?	১. হ্যা	২. না

ইনফেকশন মাপার স্কেল

গ্রেড	আকার
মাইনর ইনফেকশন	
১	পিনের চারপাশে হাল্কা লালভাব এবং সামান্য স্রাব/পুজ এবং যা পিন সাইটের যত্নের সাথে ভালো হয়
২	স্কিনের লালভাব, পিন সাইটে স্রাব/পুজ, ত্বকে টেন্ডারনেস বা ব্যাথা। উপযুক্ত এন্টিবায়োটিক এর সংক্ষিপ্ত কোর্সে সুস্থ হয়, যা নির্দিষ্ট করা হয় অর্গানিজমের কালচার পরীক্ষার মাধ্যমে। আনুমানিক সব ক্ষেত্রেই এটি হয় স্ট্যাফাইলোকক্কাস অরিয়াস।
৩	গ্রেড ২ এর মতই, কিন্ত পিন সাইটের যত্ন এবং এন্টিবায়োটিক দ্বারাও এটি ঠিক হয়না। আক্রান্ত পিন সমুহ খুলে অন্য স্থানে লাগাতে হয়, এবং এক্সটার্নাল ফিক্সেশন কন্টিনিউ করা হয়।
মেজর ইনফেকশন	
৪	একটির বেশি পিনে ইনফেকশন এর মাত্রা অনেক বেশি, পিনগুলি আলগা হয়ে যায়। পিন স্থানান্তর অসম্ভব এবং এক্সটার্নাল ফিক্সেশন খুলে ফেলতে হবে।
৫	রেডিওগ্রাফিক টেস্টে অস্টিওমায়ালাইটিস এর অস্তিত্ব পাওয়া যায়, সাথে গুরুতর সফট টিস্যু আক্রান্ত থাকে। এক্সটার্নাল ফিক্সেশন খুলে নিয়ে হবে, তারপর ইনফেকশন এর চিকিৎসা করতে হয়
৬	এক্সটার্নাল ফিক্সেটর অপসারনের পর পিন সাইট সুস্থ হয়, কিন্তু পুনরায় ইনফেকশন ফিরে আসে এবং সফট টিস্যু ভেঙে স্রাব/পুজ নির্গত হয়। পিন সাইটের যত্নে ইনফেকশন সুস্থ হয়। কিন্তু মাঝে মাঝে মৃত হাড় লক্ষ্য করা যায়।

The Checketts et al. grading system (Checketts et al., ১৯৯৩).

CONSENT FORM

(Please read out to the participants)

Assalamualaikum, my name is Md. Forhad Hosen. I am conducting a study for partial fulfillment of a Bachelor of Science in Physiotherapy degree at Saic College of Medical Science and Technology (SCMST) (Under the Faculty of Medicine University of Dhaka). My research title is **" pin site Infection among the external fixator users in post-Tibia-Fibular surgery"**. I need some information to fulfill my research project. So participant's consent is needed for this research and it will take approximately 20-30 minutes. I would like to inform you that this is a purely academic study and will not be used for any other purposes. The researcher is not directly related to the orthopedic unit, so your participation in the research will have no impact on your present or future treatment in the orthopedic unit. The researcher will maintain the confidentiality of all procedures. Your data will never be used without your permission. Your participation will be voluntary and any type of remuneration will not be provided. You may withdraw yourself after 1 week of data collection. No additional intervention will be provided.

If you have any queries about the study or your right as a participant, you may contact the researcher.

So, may I have your consent to proceed with the interview?

Yes / No

Signature of the participant.....

Relationship (If not patients).....

Date…….....

Signature of the data collector.....

Date…….....

Personal Information:

SL No.	Questions	Response
1	Name:	Date
2	Patient ID No:	Patients Mobile No:
3	Caregiver:	Caregiver's Mobile No:

Socio-demographic Information

SL No.	Questions	Response
1	Age	
2	Gender	1. Male 2. Female
3	Education Level	1. Illiterate 2. Primary 3. Secondary 4. Higher Secondary 5. Graduate 6. Postgraduate
4	Occupation	1. Housewife 2. Farmer 3. Shopkeeper 4. Business 5. Service holder

		6. Day-labor 7. Student 8. Unemployed 9.Others_____
5	Address	1. Union_____ 2. Ward No_____ 3. Village_____ 4. House no_____
6	Marital status	1. Married 2. Unmarried/Single
7	Number of Family Member	
8	Financial Condition	1. Independent 2. Dependent
9	Monthly income	……Tk
10	Cost to continue current treatment	**……**Tk
11	Residential Area	1. Urban 2. Semi urban 3. Rural
12	Family types	1. Joint family 2. Nuclear family

Interview Questionnaire :

SL No.	Questions	Response
1	Height	
2	Weight	
3	BMI	
4	Type of fracture	1. Proximal Tibial Fracture 2. Tibial Shaft Fracture 3. Distal Tibial Fracture
5	Cause of fracture	1. RTA 2. Sports injury 3. Fall from height
6	Duration of fracture	
7	Duration of infection	
8	Type of fixation	
9	Affected limb	1. Right 2. Left 3. Both
10	How often did you clean your pin sites?	1. Daily 2. Every other day 3. Weekly 4. Rarely/Never

11	What type of dressing material did you use for your pin sites?	1. Gauze 2. Antibacterial ointment 3. Other
12	Are you a smoker?	1. Yes 2. No
13	Do you have diabetes?	1. Yes 2. No
14	Do you have other co-morbidities such as Heart disease, Respiratory disease, Kidney disease, Liver disease, Other?	1. Yes 2. No
15	How active are you now?	1. Very active 2. Moderately active 3. Little active 4. Not at all

Grade	Appearance
Minor infections	
1	Slight redness around the pin together with a little discharge and settles with better pin site care
2	Redness in the skin, discharge from the pin site and pain and tenderness in the soft tissues. Settles with improved pin site care and a short course of the appropriate antibiotic which is chosen according to the organism cultured. In almost all cases the organism will be staphylococcus aureus.
3	The same as grade 2 but fails to settle with diligent pin site care and the appropriate antibiotic. The affected pin or pins are re-sited and external fixation can be continued.
Major infections	
4	There is severe soft tissue infection involving several pins, sometimes with loosening of the pins. Re-siting of the pins is impossible and external fixation must be abandoned
5	There is radiographic evidence of osteomyelitis in addition to severe soft tissue involvement. External fixation must be abandoned and the infection then resolves.
6	Occurring after fixator removal following completion of treatment. The pin track heals initially but subsequently, at intervals, will break down and discharge. The infection will clear with curettage of the pin track in the soft tissue and bone. Will usually show sequestra in the bone with reaction in the adjacent periosteum on the proximal cortex.

Fig. 1 The Checketts et al. grading system (Checketts et al., 1993).

During Data collection

Permission lette

SCMST-BPT/IRB/05-23/017

To
Md Forhad Hosen
4th Year Student of B.Sc. in Physiotherapy
Session: 2016-2017 , Reg No: 7478
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Subject: Approval of the thesis proposal **"Prevalence of Pin Site Infection Among the External Fixator Users in Post Tibia Fibular Surgery"** by ethics committee.

Dear Md Forhad Hosen

Congratulations.
The Institutional Review Board (IRB) of SCMST has reviewed and discussed your application to conduct the above-mentioned dissertation, with yourself, as the principal investigator. The Following documents have been reviewed and approved:

Sr. No.	Name of the Documents
1	Dissertation Proposal
2	Questionnaire (English and Bangla version)
3	Information sheet and consent form.

The purpose of the study is to determine the prevalence of pin site infection among the external fixator users in post tibia fibular surgery. The study involves face to face interview by using semi-structured questionnaire to explore the prevalence of pin site infection among the external fixator users in post tibia fibular surgery in Dhaka city that may take 30 to 40 minutes to fill in the questionnaire and there is no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 09.00 AM on 28th September 2023 at SCMST.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring during the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,
16.05.24.
Dr. Abul Kasem Mohammad Enamul Haque
Principal, SCMST &Chairman, Institutional Review Board (IRB)
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Permission Latter

Date: 02.09.24

To

CEO

Royel Multispeciality Hospital, 20/3, Babor Road Mohammadpur, Dhaka 1207

Subject: Prayer for permission to collect data for Dissertation.

Sir,

With due respect and humble submission to state that I am a student of B.Sc. in Physiotherapy at SAIC College of Medical Science and Technology (SCMST). As a part of our course curriculum, we have to conduct a research project for the partial fulfillment of the requirement for the degree of B.Sc. in Physiotherapy. My research title is "**Prevalence of pin site Infection among the external fixator users in post-Tibia-Fibular surgery**" This is a cross-sectional study under the supervision of Md. Furatul Haque, Lecturer (SCMST). I have chosen the Royel Multispeciality Hospital as a site of data collection.

So, I, therefore, pray and hope that you would be kind enough to give permission for data collection that will help me to complete my study.

Yours faithfully

Farhad

Md. Forhad Hosen

Student of B.Sc in Physiotherapy

Session: 2016-17

Reg No: 7478

Saic College of Medical Science and Technology

Mirpur 14, Dhaka 1216

Phone no: 01792901251

02.09.24

Permission Latter

Date: 31.08.24

To

CEO

Dhaka Trauma Center And Specialised Orthopedic Hospital, Mirpur road, Dhaka 1207

Subject: Prayer for permission to collect data for Dissertation.

Sir,

With due respect and humble submission to state that I am a student of B.Sc. in Physiotherapy at SAIC College of Medical Science and Technology (SCMST). As a part of our course curriculum, we have to conduct a research project for the partial fulfillment of the requirement for the degree of B.Sc. in Physiotherapy. My research title is "**Prevalence of pin site Infection among the external fixator users in post-Tibia-Fibular surgery**" This is a cross-sectional study under the supervision of Md. Furatul Haque, Lecturer (SCMST). I have chosen the Dhaka Trauma Center and Specialised Orthopedic Hospital as a site of data collection.

So, I, therefore, pray and hope that you would be kind enough to give permission for data collection that will help me to complete my study.

Yours faithfully

Farhad

Md. Forhad Hosen
Student of B.Sc in Physiotherapy
Session: 2016-17
Reg No: 7478
Saic College of Medical Science and Technology
Mirpur 14, Dhaka 1216
Phone no: 01792901251

Approved.
31.08.2024
Dhaka Trauma Center and Specialised Orthopedic Hospital Ltd.