2025 ABDUL WAJID SU91-MSAHW-S23-047 FAHS

Comparative Analysis of Open vs Percutaneous Transpedicular Fixation in Thoracolumbar Fractures Including its SSI Rate and Associated Causes

SUPERIOR UNIVERSITY

Thesis Submitted to

The Superior University Lahore

In Partial Fulfillment of the

Requirement for the Degree of

Master of Science in Allied Health Sciences

By

ABDUL WAJID

Roll No. SU91-MSAHW-S23-047

Session: 2023-2025

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Certificate of Approval

This is to certify that the research work presented in this thesis, titled **"Comparative analysis of open vs percutaneous transpedicular fixation in thoracolumbar fractures including its SSI rate and associated causes"**

" was conducted by **"Abdul Wajid"** under the supervision of **"Dr. Tasra Bibi."**

No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the Faculty of Allied Health Sciences, The Superior University, Lahore in partial fulfillment of the requirements for the degree of Master of Science in the field of "**Allied Health Sciences"** in Faculty of Allied Health Sciences at The Superior University, Lahore.

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DEDICATION

This thesis is dedicated to my beloved parents, who have always supported me through thick and thin, are the ones to whom I dedicate this thesis; without their assistance, I could not be here today. I also want to express my gratitude to my younger brother and sister, who provided me with ample time to finish my work, as well as moral and spiritual support and assistance in every way.

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Abdul Wajid

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LIST OF ABBREVIATIONS

RTA	Road side traffic accident
TB	Tuberculosis
SPSS	Statistical package for social sciences
SSI	Surgical site infection
CCI score	Charlson comorbidity Index
CT scan	Computed tomography scan
MRI	Magnetic resonance imaging
MIS	Minimal invasive surgery
ECG	Electro cardio graphy
PCBT	Percutaneous cortical bone trajectory
T1	Thoracic vertebral body one
L5	Lumbar vertebral body fifth
T11	Thoracic vertebral body eleven
L2	Lumbar vertebral body two
CSF	Cerebrospinal fluid
IV antibiotics	Intra venous antibiotics
ODI Score	Oswestry disability index score
TLICS	Thoracolumbar injury classification and severity score
VAS	Visual analogue scale

ABSTRACT

Introduction

The most frequent type of spinal fracture caused due to high-energy trauma is a thoracolumbar fracture. There are several different methods for treating these fractures, ranging from non-surgical to surgical options. There are two main methods for transpedicular fixation: open and percutaneous each of which has different advantages as well as disadvantages. After spine surgeries one of the leading causes of morbidity and mortality is SSI. A few studies directly compared the SSI rate between percutaneous and open fixation procedures. However, there is still controversy over how these treatments differ in terms of clinical outcomes, such as SSI rates and contributing factors.

Objective

To rule out which technique has the better outcomes for the patient and what is the effect of blood loss, operative duration, hypothermia, usage of unsterilized instruments, and underlying comorbidities on SSI.

Methodology

A comparative cohort study is conducted at PINS and a total of 160 patients are selected on a simple random sampling technique. 90 patients were operated with the open fixation technique and 70 were operated with the percutaneous fixation technique. Our inclusion criteria are both males and females of all ages. Patients who have different spinal injuries, complete cord injuries, patients with multiple traumas, and those patients who refused to fill out consent forms are excluded from the study. The surgeon decides on the TLICS score and which surgical technique is used to correct the deformity.

Results

Percutaneous fixation technique has a significant P value with the duration of the procedure, blood loss, implant failure, time to return to the normal routine, and surgical site infection with their P values respectively <0.001, 0.001, 0.01, <0.001 and 0.002.

Post-operative pain and nerve injury have no significant effect in both surgeries with their significance values respectively 0.095, 0.139. Usage of improper sterilization techniques, hypothermia, and comorbidity are the most common causes of SSI with their P values <0.001, 0.002 and 0.003. Operative time and blood loss have no statistically significant correlation with SSI and their p values are 0.188 and 0.192 respectively.

Conclusion

The results of the percutaneous fixation technique are better than those of the open fixation technique, and the patient's quality of life after surgery is improved after percutaneous fixation technique.

Key Words

Thoracolumbar fracture, percutaneous transpedicular screw fixation, open transpedicular screw fixation, surgical site infection.

Chapter 1

INTRODUCTION

Spine surgery is an important part of neurosurgery. Historically spine surgery has been performed by orthopedic surgeons from the previous 4 decades. Nowadays neurosurgeons were also performing spine surgeries. The first spine surgery was traced back to 1828 when Smith performed a laminectomy in the United States [1]. Over the past 20 years, interest has grown in the treatment of spinal fractures due to advanced surgical techniques, minimal invasive techniques and new inventions in the spinal instrumentation and surgical approaches. The spine is a wonderful thing that God has created in the human and animal body. It provides balance, body alignment, different range of motion, and gives support to the body. The smallest spine measured in the frog is 7.7 mm in length and the largest spine is found in blue whales measuring 20-30m in length [2]. In the 20th century spine fractures were treated with immobilization, bed rest, and by applying a cast, splint, traction, and the help of bracing [3]. Eduard Hadra was the first surgeon how successfully perform spine fixation surgery in 1981[4). The first percutaneous pedicle screw fixation was done by Mageral in 1982. The first percutaneous pedicle screw fixation system was developed in 1995 by Mathews and Long [5]. Over the past 20 years interest has been growing in the treatment of spinal fractures due to advanced surgical techniques and new inventions [6]. Many billion dollars are spent every year on the management of spinal and limbs pain [7]. Every year 5 million vertebral fractures occur. Thoracolumbar fractures are two-thirds of all the traumatic fractures of the spine skeleton. These injuries can have more significant effects on patient as well as their families' well-being, social and financial burdens than any other injuries [8]. Thoracolumbar region fractures are 76-91.5 % of all the fractures of spinal cord injuries in Pakistan [9]. The incidence of spinal cord injuries are 10,000 per year [10]**.** The thoracolumbar region of the spine is the most common region that is fractured during spinal trauma. Trauma that is caused by fractures causes different spinal cord injuries such as compressions altered posture alignment, permanent or temporary damage to the cord or spinal canal. The thoracolumbar is the most mobile region of the spine. Thoracic region of the spine is attached to the ribs making it more mobile than any other spinal region [11]. Due to

its mobility, this region is more susceptible to trauma during RTA or fall from height[12]. Fractured occurred when pressure on the lumber spine and semirigid thoracic spine increased due to tension and stress. During trauma fractured vertebra dislocated at the point of the facet joint. Outcomes of these fractures range from paraplegia to quadriplegia, numbness, weakness of the limbs, pain, and deformity of the spine. Roadside accidents and falls from high altitudes are the two most frequent causes of thoracolumbar fractures [13]. Some other causes of spinal fractures are TB, scoliosis chest trauma [14], abdominal trauma, gunshot injuries, and perforating injuries but these are less common. Thoracolumbar fractures mostly occurs between T11 to L2 levels and are mostly males affected at younger ages as compared to females [15]. While some studies showed T10 - L2 are the most common fractures of the spine [14]. The compressed fractures, burst fractures, flexion distraction fractures, and displacing fractures are the four primary categories of thoracolumbar fractures according to their level of severity. Spine X-rays in the anterior to posterior and lateral to medial view, CT scans, and MRI are diagnostic tests that are performed to assess the level of fractures and severity of fractures. If findings are confirmed on a CT scan, then MRI is not needed because it causes unnecessary delay in the treatment. If decompression is not performed within time, it causes necrotizing of the spinal canal and spinal cord due to low or impaired blood supply that ultimately leads to disability [16]. Choosing surgical techniques is a challenge for spinal surgeons because they have to fulfill many goals. To restore the normal support and function of the spine is one of the main goals of fixation [17]. The primary goals of treating these fractures are the protection of neural tissue from damage, restore the normal nervous system, early return to normal routine, and correction of the deformity that is formed by fracture. Some surgeons said that when vertebral fractures cause neurological damage then surgical treatment is decompression with fixation while some surgeons said that there is no decompression required when fractures don’t cause neurological damage while this ambiguity is not clear [18]. Thoracolumbar fractures of the spine can leads to different levels of disability if it is not treated improperly [19]. The decision of the surgery type depends upon the fracture type, its location, neurological status, kyphosis of the patient, condition of the patient, muscles and bone condition of the patient, bone shape, ligament injury, surgeon skills, and associated injuries are some common

factors according to these surgeon decided surgery type for the patient [8] . Due to trauma different osteoligamentus changes of the spine are occurred that also affect the surgical treatment choices. Thoracolumbar fractures can affect the central nervous system by creating compression on the spinal canal that leads to the neurological impairment as well as the lungs by compromising the respiratory function. Compressed thoracic vertebra create pressure on the pleural space and lungs. That's effect the lungs capacity and ability of the patient to breath actively. So, these fractures have a drastic effect. Currently in the world anterior approach, posterior approach, combined anterior and posterior approach, and minimally invasive surgery are mostly used for the treatment of thoracolumbar fractures. Posterior open pedicular screw fixation and minimally invasive percutaneous pedicular screw fixation techniques are widely used percutaneous pedicular screw fixation system has decreased chances of posterior lumbar structures [20].

Since 1970 different screws and plates are used to treat thoracolumbar fracture are reported. The percutaneous technique is invented less than a decade later. Fluoroscopic guided percutaneous transpedicular screw fixation, computer-assisted guided, neuro navigated and robot-assisted percutaneous transpedicular fixation techniques are widely used. In Pakistan fluoroscopic guided percutaneous transpedicular screw fixation system is widely used. There is no need for a single large incision in MIS [21]. In percutaneous transpedicular screw fixation, a small 2-3cm incision is made for each screw through this, a screw and rods are placed to correct the deformity. Inners are used to hold rods on its place. This percutaneous technique has many advantages over the conventional open method for spine fixation [22]. Such as percutaneous doesn't require excessive stripping, large incision, long long-term spinal muscle contractions and less chance of SSI. This technique also reduced lumbar stiffness, very less intra and post-operative bleeding, post-operative pain [23], short hospital stays [24] and post-operative analgesia [8]**,** but there are many issues that surgeons can face during this method such as fracture of the pedicle, the accuracy of screw fixation due to limited access for screw and rods placement[25], screw loosening decompression of neural elements and due to dural puncture CSF leakage. Puncture of the pleura, traumatic injury to lungs and vertebral artery is a significant complication if it is not treated with precautions [26]. Surgeon experience can also affect screw placement in

MIS. An experienced surgeon how has done many surgeries previously can better understand MIS techniques and can performed surgery with better outcomes as compared to this surgeon how has recently gained expertise in this technique. The major disadvantage of MIS is bone fusion through bone grafting. Due to limited access surgeon cannot placed bone fragments adjacent to the implant for fusion for fusion of the screws with its adjacent bone. It is more expensive than open fixation because its implant has higher cost its surgical instruments are expensive, and surgeon charged extra fee for this surgical procedure. These challenges were resolved from time to time as the surgeon gained more expertise and become more familiar with different techniques which can be used during operation to get better results. In open transpedicular screw fixation, there is a large midline incision is made to access the pedicle, posterior ligamentous complex injury [27], heavy bleeding, or excessive amount of blood loss, need for drain placement in the wound cavity for drainage of blood and serious fluid from the wound cavity. Longer hospital stays and recovery time with more pain [28, 29]. Muscular atrophy is another problem with the open fixation technique. Open surgery has some benefits including good satisfactory outcomes with fracture reduction, good access to the fracture site and better deformity correction. An open transpedicular screw fixation system provides strong stability to the spine as comparative to MIS [30]. As the long screws are used for fixation the tension between vertebral bodies is reduced [31]. The spinal deformity is corrected with a good satisfactory outcome.

SSI of the spine causes a wide variety of pathology including spondylodiscitis ,minor infections to different life-threatening infections or permanent or short-term disability [32] .The annual cost of preventable SSI in the United States is 345 million dollars [33]. Every 3-5% of surgical patient faced infection due to the transmission of Staphylococcus aureus. 50 % of Staphylococcus aureus sites are directly linked with Staphylococcus aureus transmission which is found in 39 % of surgical cases [34] . It is a major cause of morbidity and mortality of the patient in neurosurgical ward and ICUs. Age, comorbidity, higher CCI scores are the common complications that are associated with readmission of the patient after presenting with infection [35]. The most major complication that causes readmissions of the patient or increased stay of the patient for 9.7 days in the hospital is spinal infections. Proper screening of the

patient's normal flora and optimization of preoperative and post operative risk factors may prevent more than 156000 spine infections. Diabetes can halt the process of wound healing by causing local ischemia and microangiopathic changes. The infection rate in diabetic patients is higher as compared to non-diabetic patients after spinal surgery. In normal mechanisms, proangiogenic and antiangiogenic factors are balanced during normal healing processes. When injury occurred these proangiogenic and antiangiogenic factors distributed. Inflammation alters the proliferative and remodeling stage of wound healing and causes infection. These infections convert into chronic wounds then tissue necrosis, and distribution of infection into the other parts of the body, which leads to sepsis and ultimately causes death. Incisional hernia and failure to anastomosis the wound edges are associated with increased wound infection [36]. Smoking is an another cause of SSI after spinal surgery. Smoking interferes with the normal mechanism of wound healing by vasoconstriction and tissue hypoxemia, and by impairing the normal mechanism of action of neutrophils against microorganisms. The incidence of SSI is 50 percent higher in those patients who smoke as compared to those who don't smoke. Albumin level less than 3.5g/dL is a major cause of SSI. After spine surgery obesity is an important risk factor for the development of infection. Obese patients have fat that after surgical procedure produce seroma that cause infection. Hypothermia is anticipated in those patients whose surgery is longer than 6 hours and where blood loss is high. Hypothermia can cause delays in wound healing and surgical site infection [37). Warming blankets and forced warming air are important measures to reduce the chances of hypothermia and ultimately leads to reduced the chances of infection.

Treatment of these SSI becomes difficult due to wound location, size, mechanism of spreading infection, patient age, and those infectious agents that are difficult to diagnose. Implementation of preoperative, intraoperative, and postoperative clinical practice, preparation of the skin flora before surgical procedure can decrease the incidence of infection postoperatively. The three main categories of SSI are organ or whole organ cavity SSI, deep incisional SSI, and superficial SSI. All superficial SSIs are mainly treated with oral antibiotics, or in certain situations, intravenous antibiotics are used. Deep incisional SSI requires removal of pus contents with the administration of IV antibiotics. After spinal surgery incidence of deep tissue SSI is 1-4 %. Organ or

organ cavity SSI requires removal of pus with removal of implants if it is also infected and administration of IV antibiotics. Staphylococci, Streptococci, and Enterococcus species are the most common gram-positive bacteria that are present in spinal infections [37]. Gram-negative is also present but they are less common than gram-positive. Administration of antibiotics 30 minutes before skin incision is an important factor in reducing the incidence of SSI. Administration of antibiotics every 4 hours and when blood loss of more than 1500 is suspected is essential to reduce the chances of infection. Preoperative skin preparation with the help of iodine, chlorhexidine, and alcohol-based compounds is essential to decrease the chances of infection. Used of Vancomycin powder inside the wound cavity is another prevention that has recently used to control the infection rate. Vancomycin powder has covered from gram-positive microorganisms. Betadine is an antiseptic solution that is used inside the wound cavity to remove debris and microorganisms from the wound. 0.5- 4% concentration is effective against microorganisms but more than 5% concentration causes cytotoxicity. The usage of a closed suction drain is also an effective measure to control infection. A drain in the wound cavity reduces the chances of blood accumulation inside the wound. That prevents from the hematoma formation wound site infection and other complications related to wound healing. Major causes of SSI are longer hospital stays, high blood loss, smoking, immunocompromised patients, and underlying comorbidities are the common causes of infection [38]. Reducing the transmission of Staphylococcus aureus, good hand hygiene, environmental cleaning, decolonization of the patient's own body, and intravenous IV-line care are some important strategies to decrease the chances of SSI.

There are many false beliefs present among doctors, health professionals, and patients regarding these techniques. Many surgeons prefer open technique over percutaneous technique. Some surgeons felt percutaneous technique is not good because there is a higher chance of dural tear, screw misplacement, and any other Spinal injury due to the limited visibility. Some surgeons are not comfortable with the open technique because they thoughts there is a higher chance of blood loss, complications, longer operating time as well as anesthesia time, and chances of higher SSI rate. This research allows surgeons and patient to make evidence-based decisions by reviewing the results of this research article. In Pakistan there are very few researches has been done

regarding this topic. Which one is the best technique for treating thoracolumbar fractures regarding the quality of life of the patient after a surgical procedure? To ruled out which technique has better outcomes for the patient by comparing time to return to work, operative duration, blood loss, chances of implant failure, chances of nerve root injuries, and SSI rate. To find what is the most common cause of SSI rate.

AIM AND OBJECTIVES

Aim

The aim of this research is to compare the two surgical options that are currently used for the treatment of thoracolumbar region fractures. Our main focus of this research is comparing the post-operative outcomes to find which one is the best technique in which terms. I also find the SSI rate in both surgeries and check the most common cause of SSI. The results of this research give practical recommendations to doctors, patients and health care organizations.

OBJECTIVES

1. To rule out which technique has the better outcomes for the patient by comparing time to return to work, operative duration, blood loss, chances of implant failure, nerve root injuries, and SSI rate.
2. To find what is the effect of blood loss, operative duration, hypothermia, usage of unsterilized instruments, and underlying comorbidities on surgical site infection rate.

Chapter 2

LITERATURE REVIEW

A recent meta-analysis of studies about open vs percutaneous transpedicular spinal fixation shows that there are only four prospective and nine other studies were published in the last fifteen years in different journals. In Pakistan, percutaneous transpedicular fixation at the Punjab Institute of Neurosciences was started in 2018. That shows very few publications are present regarding this topic.

A retrospective cohort study was conducted in the orthopedic department of Odense University Hospital of Denmark her stats showed that two groups are made up of 112 patients 34 were operated with percutaneous and 78 with the open transpedicular fixation technique. There follow up time period is taken after 56 months. Percutaneous group was ten years older than open group. The study results showed that patients who operated with the percutaneous technique had better ODI scores with a p-value of 0.046, while the second group had no significant value. while in terms of time taken to return to normal work and any disability such as dural puncture, paraplegia was similar in both groups. Post operative pain is less in percutaneous group and has a significant value <0.001. Number of analgesic doses required more in open fixation group with a significant value of 0.002. Patient satisfaction was similar in both groups with a significant value 0.261[39]. This study shows that MIS surgery has better outcomes on the quality of life of the patient after surgery.

A prospective cohort study was conducted in the orthopedic surgery department of Al-Azhar University Hospital Damietta on percutaneous transpedicular fixation. Twenty patients are selected for the study from which 6 patients were female and 16 were male. The results show that two patients developed incomplete paraplegia from 20 patients and one patient completely recovered postoperatively. Post operative pain score was 7.8±1.5 and there range was 6 to 9 points. Post operative pain has a significant association with a value of 0.003. One patient developed superficial infection out of 20 that are resolved with medication. 90 screws are used in fixation from which 6 screws are misplaced while all other screws are correctly positioned within pedicle and body of the vertebra. Surgical time duration was 54-130 minutes

and its average was 71± 12 minutes. Post-operative hospital stay is 1-4 days or 2.0±0.5 days [40].

A prospective observational study was conducted in the neurosurgery department of Jinnah Postgraduate Medical Centre Karachi. A six-months long follow-up time period is used in this study to check the outcomes of the surgery. 55 patients were selected for the study. From which 40 were male and 15 were female. All preoperative post-operative and demographic character is noted. The results shows that out of 100 patients, 30.9 % of patients developed complications that are treated with spinal injuries. SSI has the highest ratio of complications with 10.9%. 1.8 % patient complained for wound opening after surgical procedure. The chi-square test is used for data analysis in the study [41].

A retrospective comparative observational study was published in the European Journal of Orthopedic Surgery and Traumatology in 2023 this study shows that a total of 134 patients operated for supine surgery of which 79 patients operated with percutaneous technique and 55 patients operated with conventional open technique. The stats of this research show 176 ml blood loss in percutaneous and 220 ml in open technique with a P value of 0.02. Postoperative hospital stay is shorter after percutaneous surgery a mean of 3.6 days and 5.5 days after open technique with a P value of <0.001. 24 % of patients operated with percutaneous surgery required implant removal while 36% of patients required implant to be removed due to discomfort and infection after open surgery. 163 screws out of 186 are properly placed in the body of the vertebra by passing through pedicles in percutaneous surgery, while 164 out of 243 screws are placed in the vertebral body through pedicles with the help of the open technique with a P value of < 0.001[24].

A comparative retrospective cohort study was published in the Journal of Robotic Surgery in 2023, the results of this study show, that 48 patients were selected from which 24 patients were added to the open fixation technique and 24 patients were selected for the PCBT technique. Compare the results of blood loss, hospital stay, surgical procedure time VAS score, disability index SSI rate. Screw loosened and percentage of pedicle screw misplacement and fracture. PCBT has less blood loss as compared to the conventional open technique in the range of (65.45± 19.68ml) as compared to (222.73± 81.74ml) with a p-value of P =0.001. In PCBT the hospital stay

time is (10.00±2.93 days) while in open technique the hospital staying time is 14.75±7.09 days) with a P value of 0.009. In PCBT the surgery time is longer than the open fixation technique. In PCBT the surgery duration time is (124.55±19.68min) and in open technique, the time is (116.36±14.33 min). While comparing on VAS score after 5 days of operation the VAS score is lower in the PCBT technique as compared to open. VAS score in open is 3.64±0.92 and in PCBT the score is 2.32 ±0.81. Disability index shows no comparable significance difference. In both techniques. In the open technique, 5 patients developed SSI out of 24 patients while in PCBT no SSI was noted. One 1 patient complained of screw loosening out of 24 and 1 one patient complained of pedicle screw breakage out of 24. One patient observed a neurological defect while the PCBT patient don't receive any complaints. 60% of all the screws that are implanted with percutaneous techniques are loosened. The percentage of pedicle screws misplacement and fracture of the pedicle ranged from 21-40% which can cause root injury, dural tear, and in severe cases rupture of abdominal artery or vertebral artery [42].

A two-centered study was conducted in France on the percutaneous transpedicular fixation technique and its outcomes for the treatment of thoracolumbar fractures. 31 patients are selected for the study. Their maximum time for follow-up is 35.6 months and the minimum time is 12 months after the operation. The results of the study showed that three patients died during follow-up. The average hospital stay was 6 days after the surgery. The visual analogue score for the pain is 1.8 and it has a significance value P= 0.02. Implant failure was noted in one patient out of 31 patients. 228 screws are implanted with the Percutaneous technique and 6 (2.6%) screws are improperly positioned during surgery which was confirmed on the plain x-ray and CT scan. However, no patient develops any nerve injury postoperatively. The percutaneous transpedicular fixation technique has good outcomes such as early wound healing, early patient returns to normal work, and lower complication rates [22].

A retrospective cohort study was conducted in the Department of Neurosurgery, Odense University Denmark. 173 patients are included in the study that was operated in 2014- 2018. Out of 173 sixty-one patients refused to participate in the study and 112 patients were selected. 34 patients are treated with the percutaneous transpedicular

screw fixation technique and 78 with the open transpedicular screw fixation technique. The mean follow-up time for both surgeries is 56 months. The mean of age in both groups shows patients in Percutaneous group are 10 years older than open fixation group. Oswestry disability index score shows a positive association with the MIS group and has a statistical significance value of P= 0.046. The time taken to return to normal routine is not significant in both groups. Postoperative analgesic medications are not used in the percutaneous group if they are necessary then their ratio is very low as compared to open fixation. Overall percutaneous group has favorable outcomes related to the quality of life of the patient, post-operative pain, surgeon, and patient satisfaction with outcomes [43].

A study was conducted at the Punjab Institute of Neuroscience in Lahore Pakistan. 157 patients were selected for the study how has thoracolumbar fractures. Plan X-ray, CT scan, and MRI are used as a diagnostic tool to check the intensity severity, and levels of the fracture. Preoperatively neurology of the patient is checked. After surgery duration of the procedure, blood loss, and pain are noted, and at the time of discharge hospital stay days are marked in the data collection form. Statistical analysis shows that 69.4% of patients are male, 30.6% are females. Out of 157, 141 patients have traumatic injuries and 16 patients have non-traumatic injuries. 128 (81%) patients were discharged after one day of the surgery 23 patients were discharged after 2 days and 6 patients were discharged on the third Day. 79% of patients had single-level fractures and 21% had two levels fractured. The operative duration for the surgery was 55 minutes. Post-operative pain is markedly reduced in the percutaneous group as compared to the open fixation group. Nerve injury is not present in any patient. Overall the study concluded that the percutaneous transpedicular screw fixation system is the best choice for the treatment of thoracolumbar fractures [11].

A retrospective single center study was carried out at the university school of medicine in Washington district of Columbia from January 2013 to January 2016. 1442 spine cases are included in the study. 961 cases are added to the group of percutaneous fixations. 481 cases were included in the open fixation group. Out of 1442 21 (1.5%) cases showed infection. Overall SSI rate of the percutaneous fixation technique was 0.5 % and in open fixation technique was 3.3 %. That shows SSI rate of percutaneous

wasis lower than the open fixation technique. Its significance value is P=0.0003. Decompression of only spinal canal shows infection rate of percutaneous surgery is less than open fixation technique and its significance value is P=0.04. In this percutaneous group shows 0.4% infection rate and open group technique 3.9% infection rate. Those spinal surgeries when decompression with fusion is done their infection rate is also lower in percutaneous group as comparative to open fixation. Its percentage for percutaneous was 0.7% and 2.6% in open fixation. Its statistical significance value was 0.68 in both groups. Overall 7-fold reduction in SSI is noted in the percutaneous group as compared to the open fixation technique[38].

A retrospective study was carried out to rule out the outcomes of the open and percutaneous transpedicular fixation technique. 45 patients are selected for the study from which 20 patients are selected in the percutaneous group and 25 patients are selected in the open fixation technique. Preoperative, intraoperative, and postoperative findings are recorded to compare the outcomes. Chi-square and Fisher exact tests are used for statistical analysis of the data. The average operative duration for percutaneous surgery is 102.5 minutes and in open transpedicular screw fixation operative duration is 129 minutes. Blood loss shown in the percutaneous group is 89ml and in open fixation large blood loss is anticipated 344.8ml. Post-operative pain in the percutaneous group is relatively low as compared to the open group and there is no or less amount of analgesia required after the percutaneous fixation technique. A two-year long follow-up period is used to check the infection rate of the open and percutaneous transpedicular fixation technique. There is no patient report of SSI in both groups. Implant failure is also not present in the percutaneous group. Nerve injury shows no statistically desirable significance value in the open and MIS group [44].

A systematic review of open and percutaneous transpedicular screw fixation was carried out in the orthopedic department of Mount Sinai Medical Centre, New York. 44 studies are selected for the study. Two independent observers reviewed all the studies 38 studies were removed because they didn't meet our inclusion criteria and 6 studies were selected for review. The confidence interval is selected at 95%. Heterogeneity is accessed with the help of statistics and L2. The review shows percutaneous screw fixation group shows good outcomes as compared to the open

fixation group in terms of blood loss and operative duration for surgical procedure and its significance value between both groups is P= <0.05. The patient reported operative pain has no effect in open and MIS that is the same in both surgeries [23].

A systematic review and meta-analysis were published in 2022 in the Journal of Clinical Spine Surgery. The author analyzed 7 articles and described their results an analysis of 7 articles authors gave favor to the percutaneous technique over the open fixation method. The mean difference between open fixation and percutaneous fixation methods is 29.75 minutes. With a P value of < 0.0001. Blood loss measurement is noted in 4 studies and all 4 studies give favor to the percutaneous fixation method as compared to the open. The mean difference is -390.18 ml with a P value of <0.00001. When comparing wound infection SSI infection is noted in 6 out of 7 articles. 5 studies give results in favor of the percutaneous technique and 1 research gives results with no significant difference between these two techniques with a p-value 0.003. The rate of screw misplacement or implant failure is noted in 4 studies out of 7 studies. From these 4 studies, 2 studies give results in favor of the percutaneous technique over the open technique, and 2 articles give results in favor of open fixation techniques as compared to the percutaneous fixation. Hence the difference between these two techniques is non-significant with a P value of 0.94. Screw loosening and implant failure is noted in 4 studies out of 7 studies 3 authors give results in favor of the percutaneous technique as compared to open fixation and 1 study gives results in favor of the conventional open fixation method as compared to the percutaneous fixation method. The difference between these techniques is non-significant and its P value is P=0.56 [45].

A randomized controlled study was carried out in Lahore General Hospital Lahore and this study was published in the Pakistan Journal of Neurological Surgery in 2022. The results of this study show that percutaneous transpedicular screw fixation has better outcomes as compared to the open screw fixation system in terms of duration of procedure and time taken to return to work. 60 patients are selected for the study 30 patients are selected for the percutaneous fixation technique and 30 patients are selected for the open fixation technique. The time taken to return to normal work was 2.9 days with the percutaneous technique and 5 days with the open technique. The results between these two techniques are significant and its p value is p= 0.001. In the

percutaneous technique, the difference between males and females regarding the time taken to return to work is significant with a P value of 0.032. Male to female no significant difference is noted in open conventional technique. Duration of the procedure regarding completion of the surgical procedure has a significant impact on the time taken to return to work. With a p-value of P= 0.001 [13].

A systematic review and meta-analysis were published in clinical spine surgery in 2023 on the topic of comparative analysis of open vs percutaneous transpedicular fixation and its outcomes. Initially, 215 articles were selected for the study out of 215, 7 retrospective articles were selected and reviewed. Overall 722 patients were recorded of which 405 patients are male and its percentage is 56.1% and 317 patients are female and its percentage is 43.9%. Totally 342 patients are operated with the percutaneous fixation technique and 380 patients are selected for percutaneous fixation technique. In the percutaneous fixation technique operative duration has a significant statical value P<0.0001 between both groups. Blood loss in open and percutaneous fixation techniques also has statistical significance P<0.00001. Pain shows 1.54 points in the Percutaneous fixation technique and has significance with the open fixation technique P<0.00001. The postoperative duration of the hospital stay is 4.49 days and is significant in the Percutaneous fixation technique with a P value (P=0.001). 7.2% of patients who have surgery with the percutaneous fixation approach have a SSI. Its Statistical value is (P=0.003). In the percutaneous fixation technique, implant failure chances are relatively low as compared to open fixation techniques but its statistical value is unsignificant in both surgeries. Overall MIS technique has less blood loss, short operative time, postoperative pain, hospital stay, and SSI. It is the best techNique for the treatment of thoracolumbar fractures [45].

A systematic review was conducted in department of Neurosciences Policlinico University Hospital, Catania, Italy. This study shows that blood loss during surgical procedure has a significant association with type of surgery with a p value of 0.001and 0.017. blood loss in MIS group is low than open fixation group. Operative duration was also low in MIS technique than open. Operative duration in MIS technique was 97.1±15.3 and in open group was 161.0±72.5. In terms of postoperative hospital stay MIS technique is better because it has short duration with 11.1±3.8. In open fixation the duration was 22.9±14.1. which is higher than MIS technique. SSI was not present

in both surgical techniques. Its ratio was 0.0 %. Chances of screw malposition was more in number than percutaneous group. In MIS technique chances of screw mispositioning was 0.0% and in open technique was 2.0%. Chances of nerve injury or neurological symptoms was 0.0% in both MIS and open group [46]. Results of the percutaneous method are marginally better than open fixation method but there is not any significant difference was noted.

Chapter 3

METHODOLOGY

3.1. Research design

A comparative cohort study design is adopted for the study.

3.2. Clinical setting

A study was conducted at the neurosurgery department of Punjab Institute of Neurosciences Lahore General hospital (PINS/LGH) Lahore.

3.3. Sample size

For calculation of sample size, we used Cochran's formula

n=$z2P(1-P)/e2$

Z=Expected level of significance

95%= 1.96

P=Expected proportion of study variable =0.10

e=Expected error

5%= 0.05

n=Sample size

=3.84(0.09)/0.0025

=0.3456/0.0025

n=139

160 patients are selected for the study from which 90 patients are added in group A and 70 patients are added in group B.

3.4. Sampling technique

A random sampling technique is used to collect the data.

3.5. Duration of study

A study was conducted in six months after the approval of the synopsis.

3.6. Selection criteria

3.6.1Inclusion criteria

All patients of both genders' males and females with thoracic and lumbar fractures who needed fixation were added to the study. Surgeons decides on TLICS score which surgical technique is used to correct the deformity and then according to technique

added patient into the group A (percutaneous transpedicular fixation technique and B (open transpedicular fixation technique).

3.6.2. Exclusion criteria

Patients who have different spinal injuries, complete cord injuries, patients with multiple traumas, and those patients who refused to fill out consent forms are removed from the research. Those patients who decided to skip the research process during data collection due to personal reasons were also removed from the study.

3.7. Ethical consideration

Ethical approval was granted after the defense of the synopsis from the hospital ethical review board committee. The consent form was given to the patients or their attendants in both Urdu and English language and briefly described the purpose of the study.

3.8. Data collection procedure

For data collection firstly make a well-developed data collection form. Select the desired patients for the study. Before the day of the operation explain to the patient if he is conscious otherwise explain to her close relatives about the research. Give the data collection form to the patient and ask him if you can read this consent form if he is illiterate read the consent form and ask the patient to listen to the details about the consent form. Tell them we want to add you as a patient in our research. Give them details about the surgical procedure as well as more information about your research topic. Tell them we wanted to measure these things before, during, and after the surgery. Take permission from the patient can we add you? If the patient said yes then take a signature on the consent form. Patient personal information, such as age, gender, home address, and contact number, is noted on the data collection performa. Preoperatively age, gender, injury type number of fractured levels, and comorbidities are noted. Age and gender are confirmed by asking from the patient and by matching with medical record history. Injury type is identified by asking about the mechanism of the injury if the patient has a history of falls or RTA it is considered a traumatic injury. If the patient has multilevel protrude discs and the surgeon decides discectomy with fixation, sypondylesthesis, or spinal tumor or spinal TB that required fixation after surgery is considered as non-traumatic injury. Numbers of fractured levels are noted by the help of an X-ray, CT scan, or if it is required confirmed with

the help of an MRI. Check the incisional site for any swelling, redness, or bruise. Check underlying comorbidities by asking the patient if he has any serious medical issues such as diabetes, hypertension, hepatitis, cancer, TB, or any other specific disease and by checking the previous and new laboratory results if any. Intraoperative measurements are surgery type, blood loss, duration of the procedure implant failure, hypothermia, and usage of improper sterilization techniques. On the operating room table if the surgeon performs open surgery check the box of open surgery in the data collection form if he selected to perform percutaneous check the box in the percutaneous fixation group. Monitor the duration of the procedure with the help of a stopwatch. The stopwatch is started at the time of skin incision and stopped after the last skin stitch. Note down the time on the data collection form. Check blood loss with the help of the gravimetric method and volumetric method. In the volumetric method, we measured the blood volume in the suction bottles. In the volumetric method, we also note down the saline that is used during surgery. For this, we subtract the volume of used saline from the total fluid in the suction bottle. That gives us the total blood loss in the bottle. In the gravimetric method, we count the surgical sponge, gauze, and surgical patties that are wet with blood during the surgical procedure. And note down the estimated blood loss during surgical procedure. Implant failure was measured intraoperatively and post-operatively. During surgery if the screw is inserted on the wrong side and that requires the removal of the screw and again insertion. After insertion the implant is not placed correctly in the pedicle or its purchase with the pedicle is not good enough that considered implant failure. Postoperatively if the implant starts loosening or the breakage of screws or rods is noted on an X-ray or CT scan that's considered as implant failure. Check intraoperative hypothermia by measuring the body temperature with the help of a thermometer. A body temperature of less than 36°C is considered as hypothermia. Usage of improper sterilization techniques is noted by reviewing the sterilization indicator of surgical instruments. If any indicator is lacking or the instrument is wet that is considered as usage of improper sterilization technique. The instrument is dipped in an Acidex solution and used during surgical procedures is also considered as improper sterilization technique usage. During the paint drape of the surgical site if any sterilization barrier is crossed such as touching outside the patient's surface except for the painted area . Staff nurse is

touching with trolleys. Hanging hands below or above the waist level is considered as usage of Improper sterilization technique during surgical procedures. Nerve injury can be measured by comparing the power and pain preoperatively and postoperatively. Normal power is 5/5 of patients develop power 4/5 after surgery that is considered a nerve injury. The patient complained of severe pain that radiated from the back of the pain to the foot and heal which is also considered a nerve injury. Post-operative MRI findings suggest nerve injury that is also considered in the nerve injury category. Postoperatively pain is noted according to VAS and by asking the patient about pain. If the patient said I have no pain then fill the box pain if a patient said I have some pain at the incision site and I can walk easily. Filled the box with moderate pain. If a patient said I have severe pain and I can't walk then fill the box with severe pain and if the patient said I have unbearable pain and I can't walk filled the box with unbearable pain. Postoperatively if discharge occurred from the incisional site that's considered a SSI. The Minor discharge that only involves the skin is marked as a superficial SSI. Also comparing this normal discharge with this discharge that is present preoperatively if any infection involves the skin, subcutaneous tissues, and muscles is considered as deep tissue SSI. If infection involves the deep tissues, implants, and bone of the spine that's considered as organ or organ cavity SSI. The time taken to return to normal routine is measured as the time required after surgery for the patient to its normal routine when he starts walking and doing some normal work by himself. If fractured levels are on a data collection form. And the mechanism of injury. Check the level of fracture with the help of an X-ray, CT scan, and MRI if it is required, and note down information on performa. Performed local examination to check for any incision site infection, swelling, redness, or deformity. Note down the information that needs to be checked intraoperatively marked in the operation theatre and the information that needs to be checked postoperatively marked on the data collection form in the ward. Take a two-month-long follow-up period to check the outcomes.

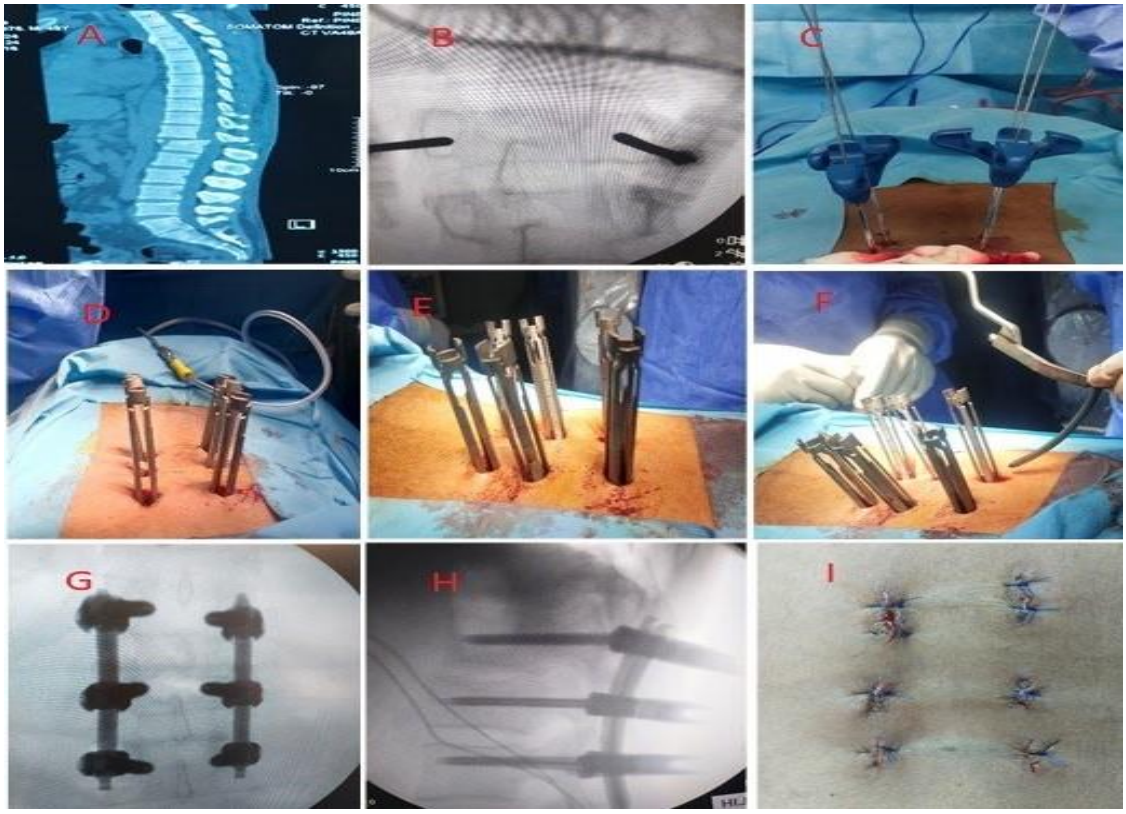

Figure 3.1 Surgical procedure for percutaneous transpedicular fixation (A) CT-scan image of vertebral fractured (B) jamshidi needle inserted into the pedicle. (C) shows guide wire is inserted through jamshidi needle into the body (D) view of screws inserted into the body (E) lateral view of screws inserted into the body. (F) rod is inserted through the fascia (G) anteroposterior view of screws (H) lateral view of screws (I) incision picture after skin closure.

Based on the patient's physical and neurological state as well as their best interests, the surgeon chooses the surgical technique. Surgeons take a consent form from the patient if he is conscious or in a good state of mind otherwise, they take consent forms from his blood relation or close relatives. The surgeon explained the surgical procedure to the patient and their close relatives including the benefits of the surgery, risk factors associated with the operation, and post-operative outcomes of the desired surgical procedure. Before the surgical procedure, the anesthetist also takes the consent form from the patient or their attendants for the anesthesia. On the day of the surgery, the patient moved from the neurosurgery ward to the operation theatre. The anesthetist again reviews the blood group type, blood reports, ECG, and chest X-ray and checks physical fitness for the Anesthesia. After reviewing all the reports anesthetist gives General Anesthesia to the patient.

Operating room runners, surgeons, and anesthetists make a desired position for the surgery according to the surgeon's feasibility. After the patient is placed in a prone position on the operation theater surgical table a Wilson frame is used for positioning. Wilson Frame is a specially designed frame that is used in spinal surgery for making the prone position of the patient. A gel pad is placed under the arms, elbow, knee, and foot and secured the padding. Earth plate is placed under the fatty part of the body so that during cautery usage no current passes through the patient body and chances of patient burning should minimized. With the help of a C-arm machine in the anteroposterior dimension and lateral to medial dimensions fractured vertebra is identified and the level is marked. The skin incision is marked with the help of a marker. The patient's surgical incisional site is painted with the help of a pyodine solution. Seven times incisional site is painted so no germs remain on the surface of the incision. The patient is draped with the help of disposable drape sheets or reusable sterilized sheets in a sterilized fashion. The surgeon assistant checks the monopolar, bipolar, and sucker machines for irrigating the fluid from the surgical Field. Time out is noted and a stab wound of 1-2 cm is given on the desired vertebral level. Skin is incised with the help of 15 Blade. Subcutaneous fat, tissues, and muscle are separated layer by layer. Hemostasis with the help of bipolar is secured. Take a jamshidi needle and the pedicle is marked under fluoroscopy. With the help of a hemmer insert the Jamshidi needle into the pedicle. Stylet is removed from the Jamshid needle with caution so that the jamshidi needle should not be displaced from its main point. Take a guide wire and insert it into the pedicle. Take the image with the help of a C- Arm machine that guide wire not cross the vertebral body and enter into the pleural space or peritoneum. According to the diameter of the pedicle and Length of the Vertebral body, screw size is selected. A tap of the desired screw is selected. Tap is ruled over the guide wire. Jamshidi needle is removed from the pedicle by rotatory motion so the guide should not displace from the pedicle. Again, with the help of C-Arm position of the guide wire is confirmed. A tap is inserted into the body through the pedicle so screws can be placed easily. By the help of the C-Arm machine again confirmed that the tap was done successfully. The tap is removed from the vertebral body desired screw is ruled over the guide wire and inserted into the body. As the screw is entered into the pedicle guide wire is removed and screw is entered into the body in rotatory

motion. Take an image with the help of C-Arm and check the position of the screw in the body. Is he not crossing the pedicle or it is exactly through the pedicle or he is not compressing the canal? Also, note down the CSF leakage or any other complications. If the screwed is directed laterally or medially removed the screw and adjust the position. After that check purchase of the screw. This procedure is repeated with all screws. With the help of the C-Arm machine in anteroposterior and lateral to medial direction check the position of the screws. Take a desired rod and verified it by taking an image are he covered the all screws or not. If the length of the rod is short change it and select the rod according to the desired length. Rod is passed through the fascia and ruled over the all screws. Placed inners on the rods and tightened the rod. Inners support the rod on its place so rods cannot be displaced from its position. Firstly, tighten the left-sided rod and then the right-sided rod. With the help of the C-Arm machine take a final image in anteroposterior and lateral to medial image and check the position of the screws and rods. Add Gentamycin sulphate injection in the irrigation fluid and wash thoroughly the wound so any residual blood and other materials are removed from the wound cavity. Take Vicryl 2-0 suture and close subcutaneous tissues one by one. After that used proline 2-0 and closed the skin. After the closing of the skin again clean the wound and place antiseptic dressing on the wound.

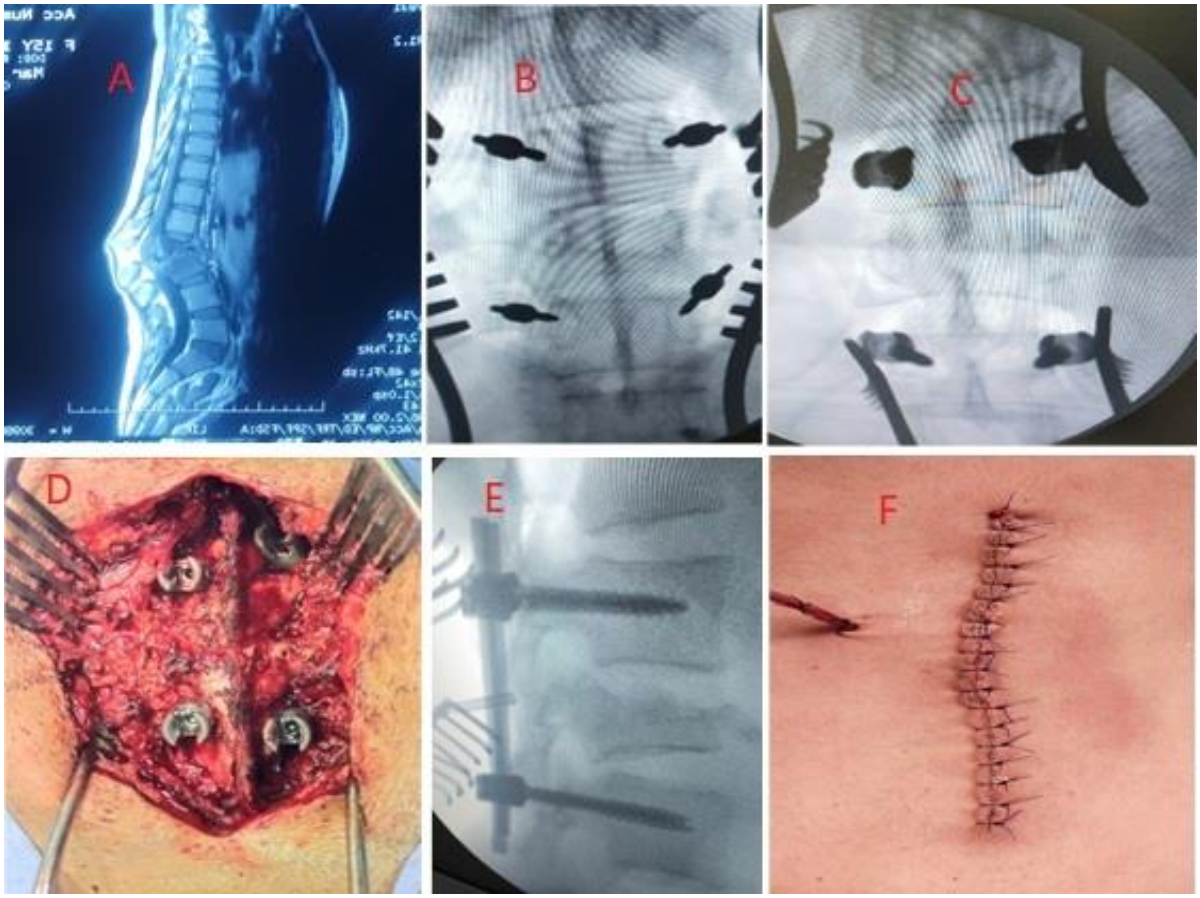

Figure 3.2 Surgical procedure for open transpedicular fixation Image (A) shows MRI of fractured vertebra (B) Steinmann pin inserted into the pedicle (C) shows anteroposterior view of the screw that are placed into the body (D) real image of the screw (E) lateral view of rods and screws (F) shows image of skin after closure.

Based on the patient's physical and neurological state and their best interests, the surgeon chooses the surgical technique. Surgeons take a consent form from the patient if he is conscious or in a good state of mind otherwise, they take consent forms from his blood relation or close relatives. The surgeon explained the surgical procedure to the patient and their close relatives including the benefits of the surgery, risk factors associated with the operation, and post-operative outcomes of the desired surgical procedure. Before the surgical procedure, the anesthetist also takes the consent form from the patient or their attendants for the anesthesia. On the day of the surgery, the patient moved from the neurosurgery ward to the operation theatre. The anesthetist again reviews the blood group type, blood reports, ECG, and chest X-ray and checks physical fitness for the anesthesia. After reviewing all the reports anesthetist gives

General Anesthesia to the patient. Operating room runners, surgeons, and anesthetists make the necessary preparations for the desired position of the surgery according to the surgeon's feasibility. For open transpedicular fixation, the patient is placed in a prone position. For the positioning a specially designed Wilson frame is used for making a prone position on the operating room table. A gel pad is placed under the face, arms, elbow, knee, and foot and secured the padding. So, that pressure cannot directly applied on the body parts. Vision loss is a significant complication if head rest is not placed under mouth without proper padding. Pressure creates corneal edema that cause vision loss. Earth plate is placed under the fatty part of the body so that during cautery usage no current passes through the patient body and chances of patient burning should minimized. With the help of a C-arm machine in the anteroposterior dimension and lateral to medial dimensions fractured vertebra is identified and the level is marked. The rough skin incision is marked with the help of a marker. The patient's surgical incisional site is painted with the help of a pyodine solution. Seven times incisional site is painted so no germs remain on the surface of the incision. The patient is draped with the help of disposable drape sheets or reusable sterilized sheets in a sterilized fashion. The surgeon assistant checks the monopolar, Bipolar, and sucker machines for irrigating the fluid from the surgical field. Time out is noted and a long midline skin incision is given with the help of a scalpal. The length of the skin incision varies according to the fractured level. Skin Subcutaneous fat, tissues, or cut with the help of monopolar cautery. Fascia and muscles are dissected with the help of a cautery. Spinous processes, lamina, and facet joints are exposed. Hemostasis with the help of bipolar is secured. In some cases, monopolar is used to secure bleeding on bony parts where bipolar cannot works. With the help of fine fine neebler make a place for the entrance of the stemin pins. Without nibbling the bone Steinmann pain cannot placed at a point because a tuberosity is present. So, to minimize the chances of pin misplacement nibble the facet joint site. Take a steinmann pin and the pedicle is marked under Fluoroscopy. With the help of a hemmer insert the steinmann pin into the pedicle. Hold round lumber pedicle probe and insertes into the pedicle. After that, this round lumbar pedicle probe and the pointed thoracic pedicle probe moved this probe into the body by giving force by a hammer. Take the image with the help of a C- Arm machine that probe does not cross the vertebral body and enter into the pleural

space or peritoneum. Removed this probe from the pedicle took a bent round spine probe and checked the wall of pedicles that the probe was in the pedicle or not. According to the diameter of the pedicle and length of the vertebral body, screw size is selected. A tap of the desired screw is selected. Tap is entered into the body through the pedicle a caution is given that the tap does not breach the pedicle. Again, with the help of C-Arm position of the tap is confirmed. A tap is inserted into the body through the pedicle so that screws can be placed easily. The help of the C-Arm machine again confirmed that the tap was done successfully The tap is removed from the vertebral body desired a screw is inserted into the body. Take an image with the help of C-Arm and check the position of the screw in the body. Is he not crossing the pedicle or it is exactly through the pedicle or he is not compressing the canal? Also, note down the CSF leakage or any other complications. If the screwed is directed laterally or medially remove the screw and adjust the position. After that check purchase of the screw. This procedure is repeated with all screws. With the help of the C-Arm machine in anteroposterior and lateral to medial direction check the position of the screws. Take a desired rod and verified it by taking an image are he covered the all screws or not. If the length of the rod is short change it and select the rod according to the desired length. Rod is passed through the fascia and ruled over the all screws.

Placed inners on the rods and tightened the rod. Inners support the rod in its place so this cannot displaced from its position. Firstly, tighten the left-sided rod and then the right-sided rod. With the help of the C-Arm machine take a final image in anteroposterior and lateral to medial image and check the position of the screws and rods. Add Gentamycin sulphate injection in the irrigation fluid and wash thoroughly the wound so any residual blood and other materials are removed from the wound cavity. Take a drain of 14Fr and place it beneath the muscles to remove blood and fluids from the wound cavity. Take Vicryl 2-0 suture and close the paraspinals muscles. Tightly close the fascia with the help of Vicryl 1-0. subcutaneous tissues closed one by one with the help of Vicryl 2-0. After that used proline 2-0 and closed the skin. After the closing of the skin again clean the wound and place antiseptic dressing on the wound to minimize the chances of infection.

3.9. Data analysis

Data is analysed with the help of SPSS version 29. Analysis gives basic information about patient data and their results. Our analysis shows frequency, percentage, mean, and standard deviation are measured for socio-demographic variables. Numerical variables are expressed as frequency, mean, and standard deviation. The significance value is calculated with the help of the Pearson chi-square test. Comparison the causes of SSI is expressed as mean and standard deviation. The significance value is calculated by the Pearson chi-square test. A P value of less than <0.05 is considered as significant.

Chapter 4

RESULTS

Table 4.1 Socio demographic Variables with their percentage, mean and S.D

Variables	Frequency		Percentage	Mean	Standard deviation
Age	**1-18**	**23**	**14.37%**	34.84	±14.226
	18-35	**65**	**40.62%**		
	35-75	**72**	**45%**		
Gender	**Male**	**102**	**63.7%**	0.36	±0.482
	Female	**58**	**36.3%**		
No of fractured levels	**1**	**97**	**60.6%**	1.48	±0.692
	2	**49**	**30.6%**		
	3	**12**	**7.5%**		
	4	**1**	**0.6%**		
Injury type	**Traumatic injury**	**126**	**78.8%**	0.21	±0.410
	Non-traumatic injury	**34**	**21.3%**		
Surgery type	**Open fixation**	**90**	**56.3%**	0.44	±0.498
	Percutaneous fixation	**70**	**43.8%**		

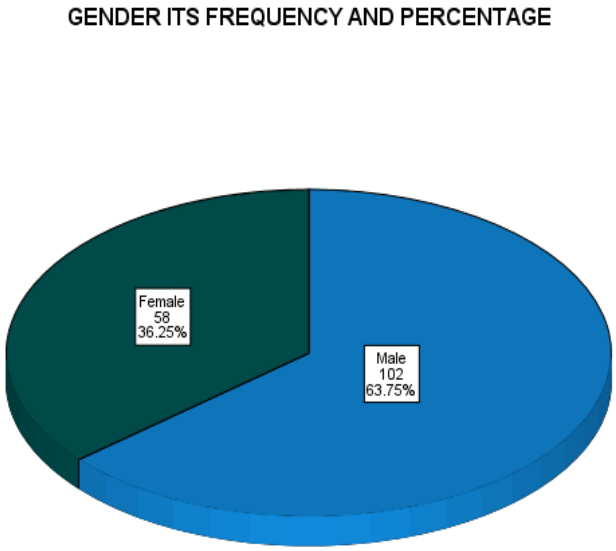

Figure 4.1 Graphical view of gender its frequency and percentage

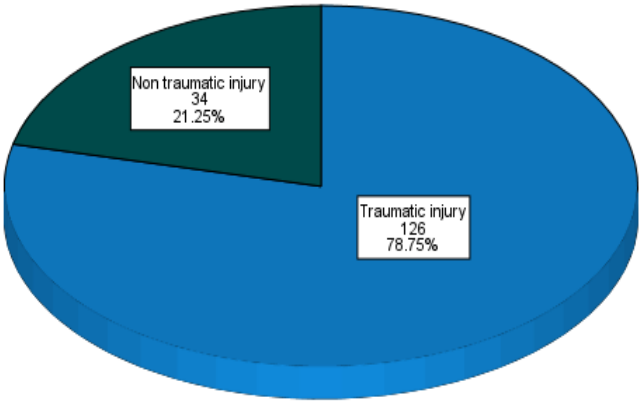

Figure 4.2 Graphical representation of injury types its frequency and percentage

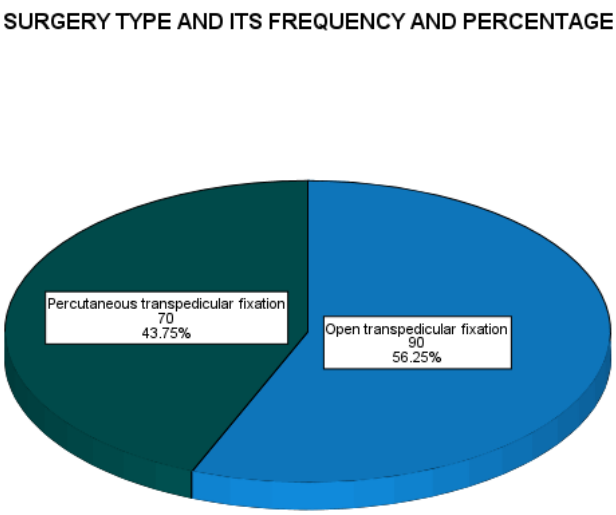

Figure 4.3 Graphical representation of surgery types its frequency and percentage

In our study, four demographic variables age, gender, no of fractured levels, injury type, and surgery type are Included. Age is divided into three categories 1-18, 18-35, and 35-75 years. Table 1.1 indicates that 72 patients, or 45.0% of the total, were in the 35–75 age range. Twenty-three patients, or 14.37% of the total, are between the ages of 1 and 18.

65 patients belong to the age group 18-35 years and their overall percentage is 40.62%. Age has 34.48 mean and standard deviation ±14.226. These results show that most patients in our research belong to the age group 35-75 years old. 102 patients are male and 58 patients are female. While gender has a 0.36 mean and standard deviation ± 0.482. These numbers show that males are more in numbers than females in our study. 97 patients have single-level thoracolumbar fracture and their percentage is 60.6%. 49 patients have two levels of fracture and their percentage is 30.6 % out of 100. Only twelve patients have triple levels of thoracolumbar fractures. Their percentage is 7.5 % and only one patient has 4 levels of severe fracture and its overall percentage is 0.6%. Our research variable number of fractured levels has a 1.48 mean and standard deviation of ±0.692. These resultant stats show that most patients have single-level injuries or fractures. Overall, 160 patients are included in the study. Out of 160

patients, 126 patients have traumatic thoracolumbar injuries and their percentage is 78.8% and 34 patients have non-traumatic injuries and their percentage is 21.3%. Variable injury type has 0.21 mean and standard deviation ±0.410. This shows that most patients have traumatic injuries as compared to non-traumatic injuries. Of 160 patients 90 patients are operated on with the open transpedicular fixation technique and their percentage is 56.3% and 70 patients are operated on with minimal invasive percutaneous transpedicular fixation techniques. Overall variable surgery type has 0.44 mean and ±0.498 standard deviation. This result shows that patient who are operated on with open fixation are more in numbers than percutaneous but their difference is not too much high. See Table 1.1.

Table 4.2 Comparison of intraoperative and post-operative variables for open vs percutaneous transpedicular fixation

Complications	**Open fixation group**		**Percutaneous fixation group**		**P value**
Duration of the procedure in minutes	280.64 ±96.387		185.14 ± 51.548		**<0.001**
Blood loss in ml	293.00 ±111.319		150.71 ±60.704		**<0.001**
Time taken to return to normal routine works	3.289 ± 2.94		2.72 ±4.742		**<0.001**
Post operatively pain	**No pain**	**1**	**No pain**	**2**	**0.095**
	Moderate pain	**41**	**Moderate pain**	**36**	
	Severe pain	**41**	**Severe pain**	**32**	
	Unbearable pain	**7**	**Unbearable pain**	**0**	
Implant failure	**Yes**	**37**	**Yes**	**42**	

	No	53	No	28	0.018
Nerve injury	Yes	37	Yes	37	0.139
	No	53	No	33	
Surgical site infection	Yes	45	Yes	18	0.002
	No	45	No	52	
Type of Surgical Site Infection	Superficial SSI	19	Superficial SSI	10	0.631
	Deep incisional SSI	20	Deep incisional SSI	06	
	Organ or organ cavity SSI	06	Organ or organ cavity SSI	02	

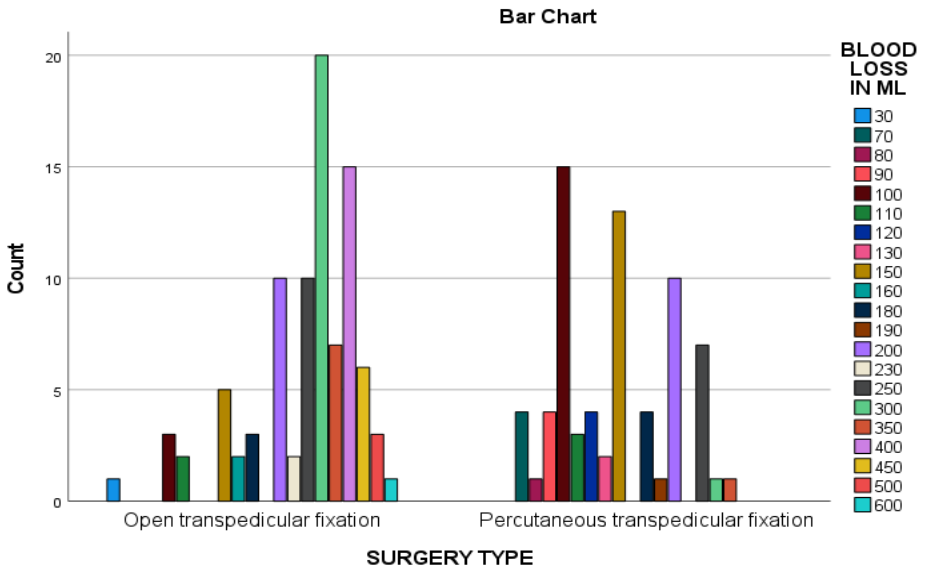

Figure 4.4 Graphical representation of Blood loss in open and percutaneous fixation technique

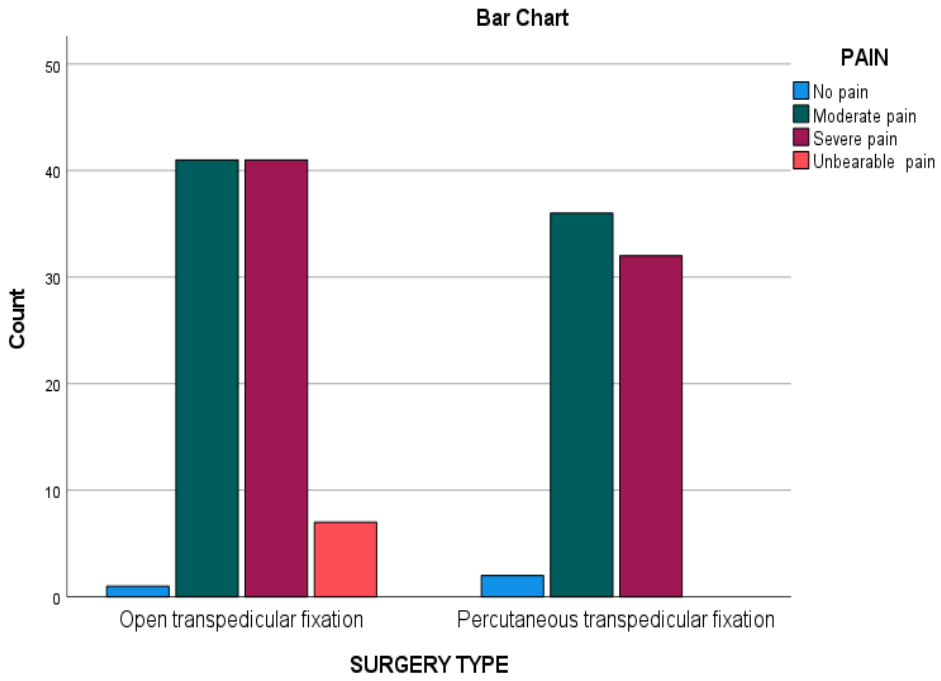

Figure 4.5 Graphical representation of post-operative pain in open and percutaneous fixation technique

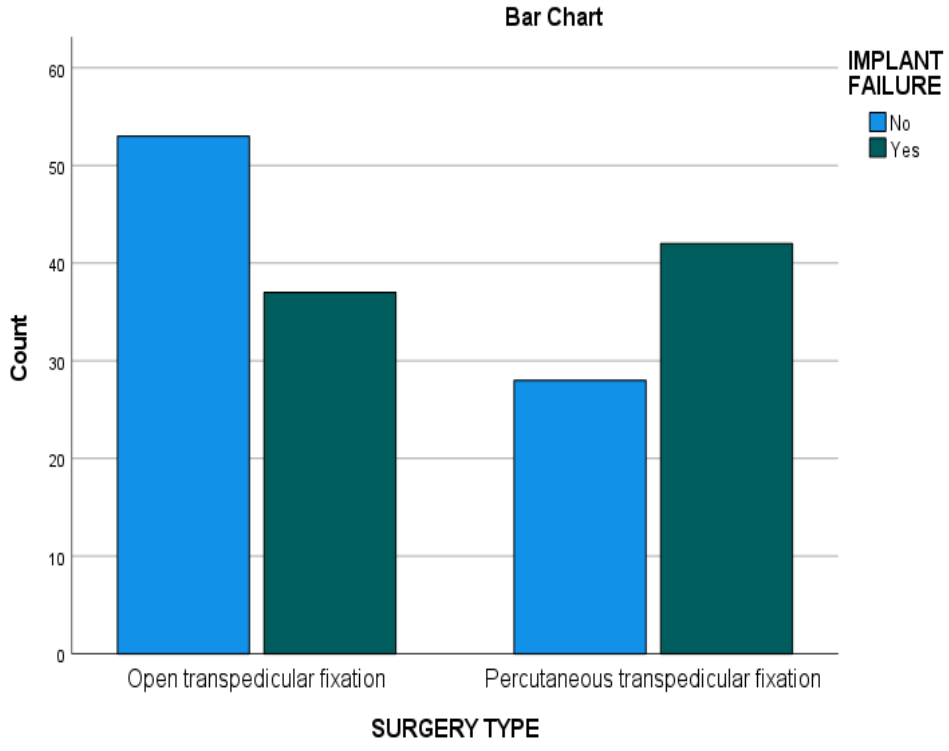

Figure 4.6 Graphical representation of implant failure in open and percutaneous fixation technique

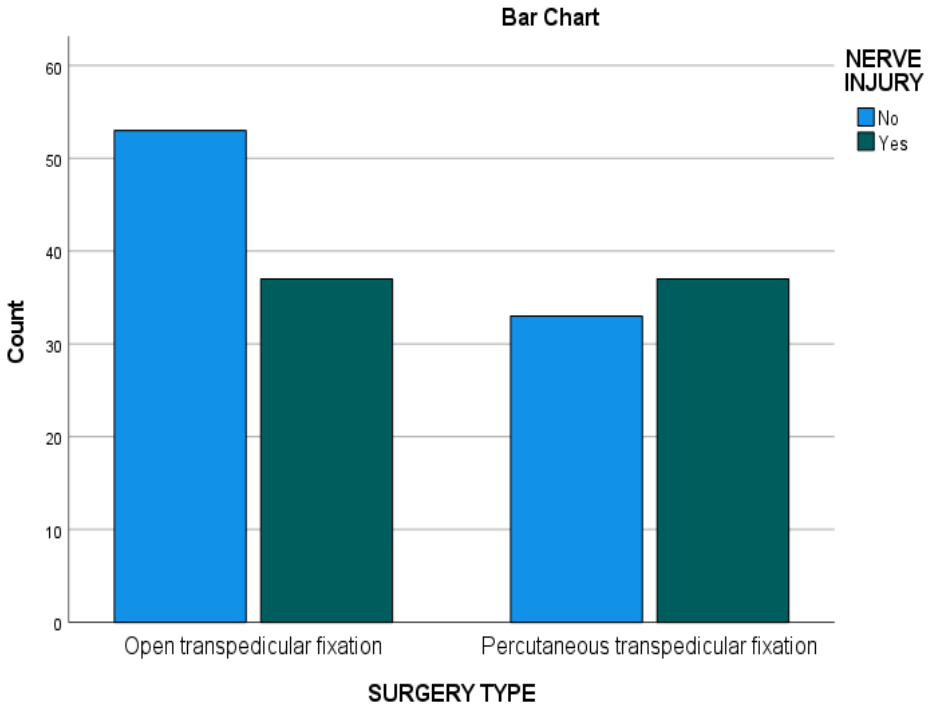

Figure 4.7 Graphical representation of Nerve injury in open and percutaneous fixation technique

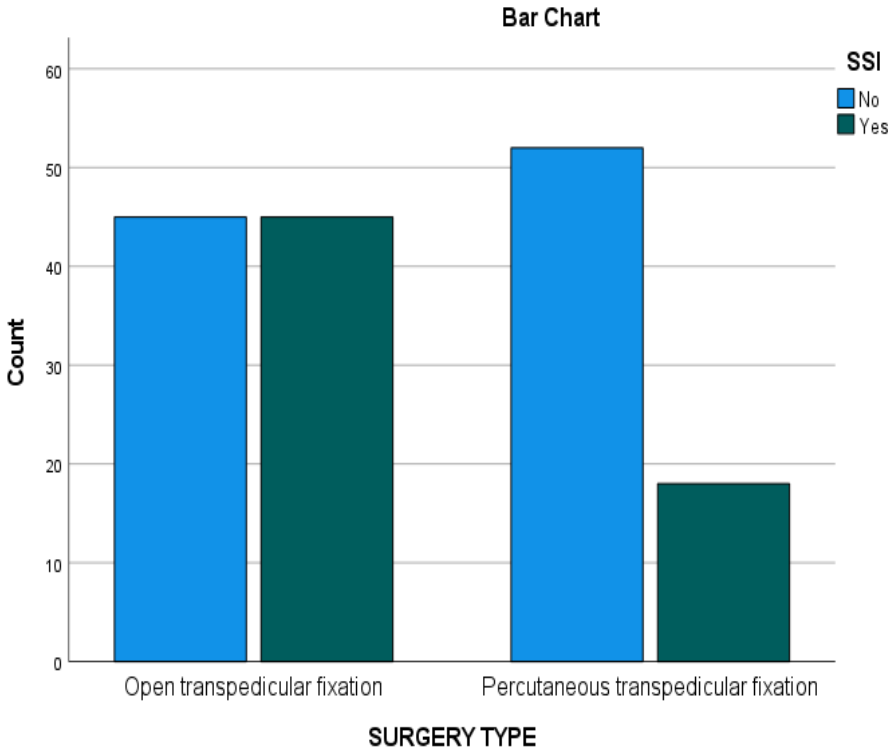

Figure 4.8 Graphical representation of SSI in open and percutaneous fixation technique

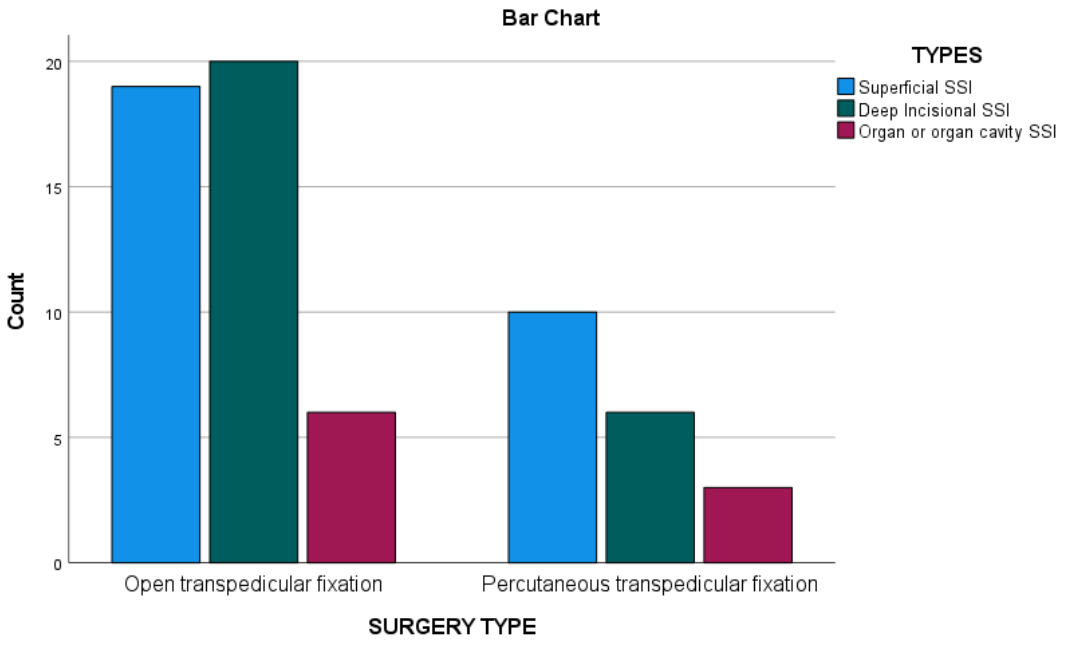

Figure 4.9 Graphical representation of types SSI in open and percutaneous fixation technique

Upon analysis of our research data, we analyze that the duration of the procedure with open and percutaneous fixation techniques shows a significant P-value <0.001. The operative time in the open fixation technique group was 280.64 minutes and its standard deviation is ±96.37. The duration of the procedure in the percutaneous fixation technique is 185.14 and its standard deviation is ±51.548. These results show that the percutaneous fixation technique is better because it has a short operative time as compared to the open fixation technique. Blood loss has a significant P-value <0.001 with open and percutaneous fixation techniques. In the open fixation technique, the mean blood loss is 293.00 ml and the standard deviation is ±111.319 in the percutaneous fixation technique the mean blood loss is 150.7 ml and its standard deviation is ±60.704. This statistical analysis shows that blood loss in the percutaneous fixation group is relatively low as compared to open fixation. Chances of blood loss are higher in open technique. The average time taken to return to normal routine has statistical significance in both groups with a value (P<0.001). The average mean and standard deviation of time taken to return to normal routine is 3.289 ±2.94 in the open fixation technique and 2.72 ±4.742 in the percutaneous fixation technique. In terms of time taken to normal routine percutaneous technique is better. It's time for a return to normal routine is low. Post-operative pain has no significant value with both open and

percutaneous fixation techniques and its statical value is P= 0.095. Of those patients who are operated on with open transpedicular fixation technique, one patient has no pain 41 have moderate pain 41 have severe pain and 7 patients have unbearable pain. In the percutaneous fixation group, 2 patients have no pain 36 patient develops moderate pain and 32 have severe pain while no patient complains of unbearable pain postoperatively. Implant failure in the open fixation technique is present in 37 patients and 53 patients there is no implant failure is present in the percutaneous fixation group 42 patients complained of implant failure and 28 patients said there is no implant failure present. Its P value is 0.018. Our results show that the chances of implant failure are higher in the percutaneous group as compared to the open fixation technique. So open fixation technique is good if we want to remove or minimize the chances of implant failure of our surgery. Nerve injury has no good correlation with both open and percutaneous fixation techniques. In the open fixation technique, 37 patients complained of nerve injury, and 53 patients did not face any nerve injury. In the percutaneous fixation group, 37 patients complained of nerve injury and in 33 patients nerve injury is not present. If we want to remove or minimize the chances of nerve injury open fixation technique is better because the chances of nerve injury in the open fixation technique are less than percutaneous. Incisional SSI has a strong association with open and percutaneous fixation techniques with a P value of 0.002. in terms of infection, the percutaneous fixation technique is better than the open fixation technique. Number of cases that are infected after surgery was less in percutaneous fixation group. In the open fixation technique out of 90 patients, 45 patients have infection and 45 have no infection. Out of 160 patients 70 patients were operated on with the percutaneous fixation technique 18 had incisional SSI and 52 had no infection. Further, when we compared types of infection with both techniques there is no strong association was present and it has a P value of P = 0.631. Six patients in the open fixation group have an organ or organ cavity SSI, twenty have a deep SSI, and nineteen have a superficial SSI.

These results show that in the open fixation technique, the chances of deep incisional SSI were higher than superficial and organ cavity SSI. The most prevalent type of infection is deep incisional SSI. In percutaneous 10 patients had superficial SSI. 06 had Deep incisional SSI and 02 patients developed organ or organ cavity SSI. In the

percutaneous fixation technique, the most prevalent infection type is superficial SSI then deep incisional and organ or organ cavity SSI. These stats also show that in terms of infection, the percutaneous fixation technique has better outcomes as compared to open transpedicular fixation technique. See table 1.2.

Table No. 4.3 Comparison of SSI with its causes and its P values

Causes of SSI	**Total no of patients with SSI (n=63)**		**P value**
Operative time in minutes	236.49 ±90.69		**0.188**
Blood loss in ml	234.99 ±117.610		**0.192**
Usage of improper sterilization technique	**Yes**	50	**<0.001**
	No	110	
Comorbidities	**Yes**	45	**0.003**
	No	115	
Hypothermia	**Yes**	85	**0.002**
	No	75	

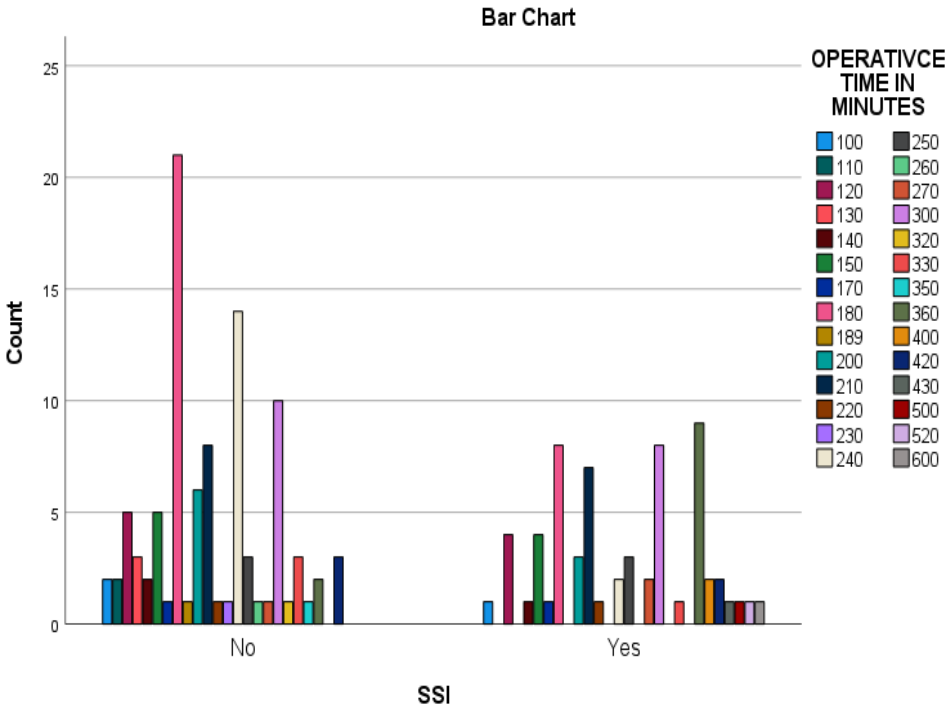

Figure 4.10 Graphical representation of SSI with operative time in minutes

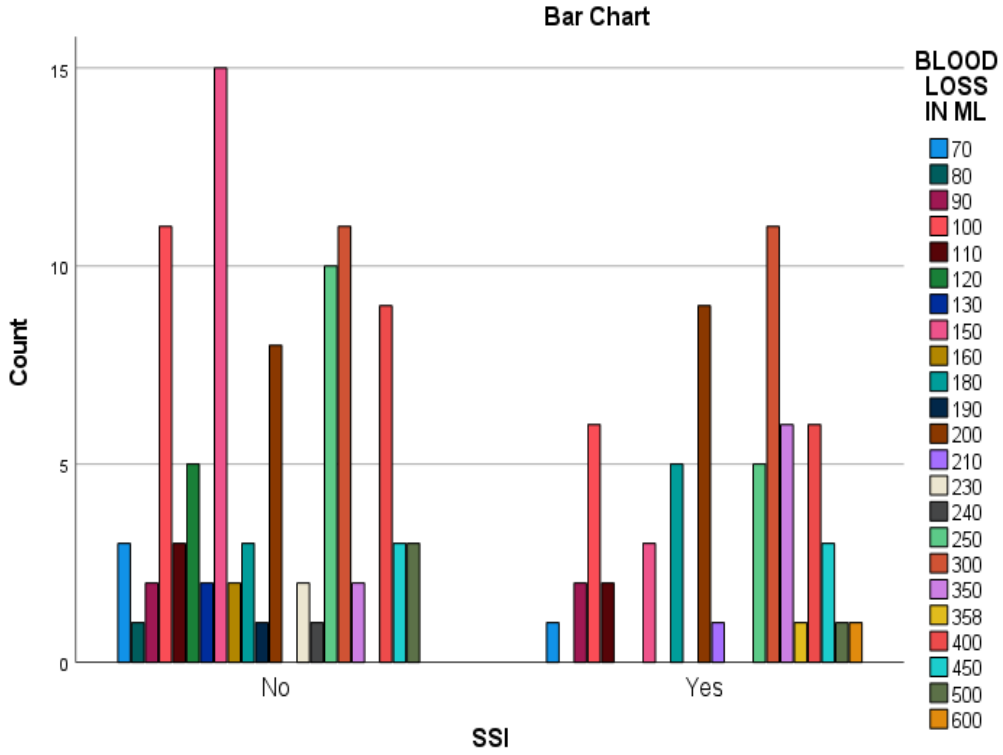

Figure 4.11 Graphical representation of SSI with blood loss

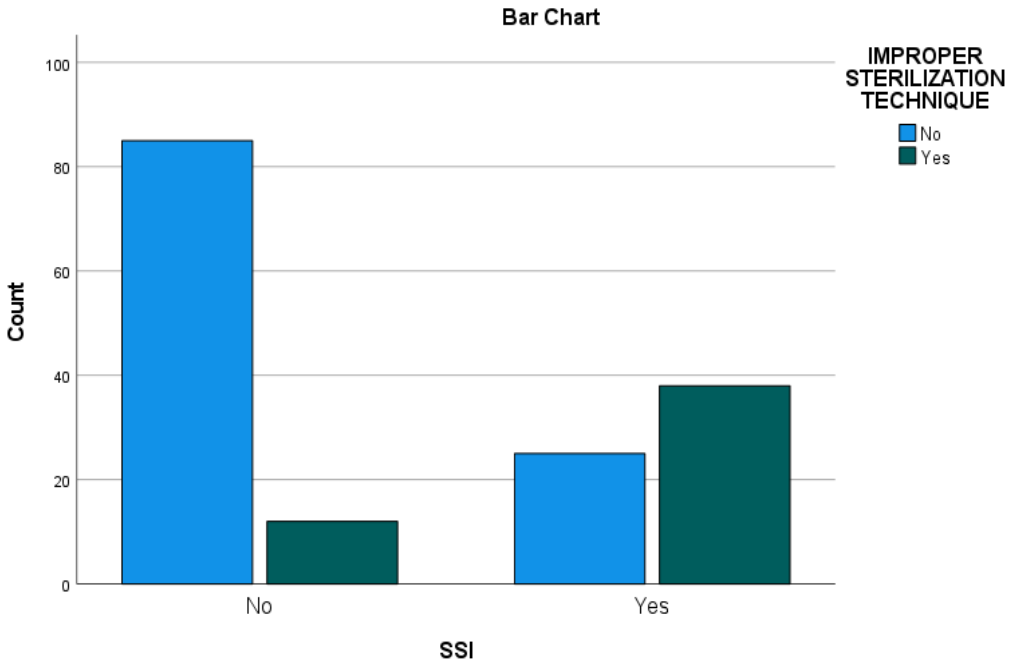

Figure 4.12 Graphical representation of SSI with usage of improper sterilization technique

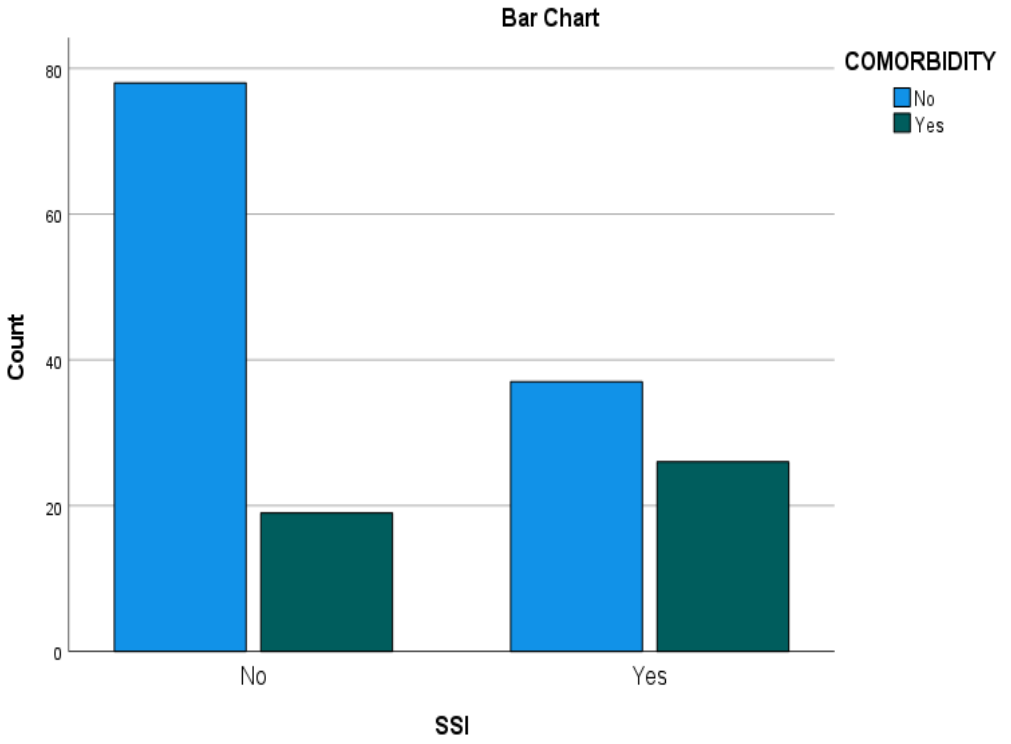

Figure 4.13 Graphical representation of SSI with comorbidities

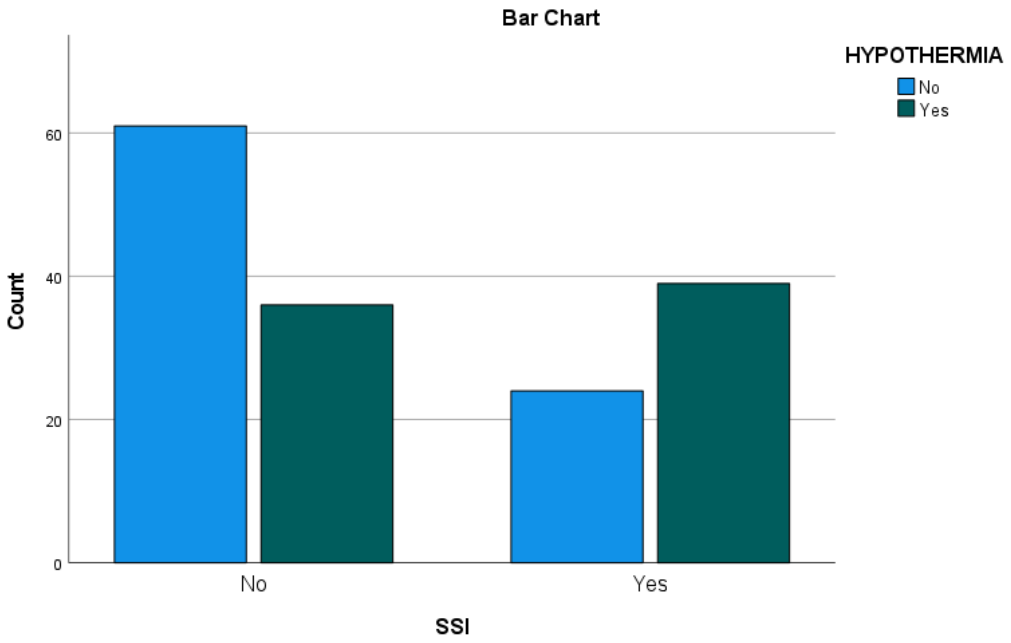

Figure 4.14 Graphical representation of SSI with Hypothermia

Table 1.3 shows a comparison of different causes of infection and its impact on infection. Operative time in minutes has no significant correlation with SSI. Its mean and standard deviation values are 236.49, ±90.69. Operative time in minutes has a P value of P = 0.188 blood loss in ml has 234.99 mean and standard deviation ±117.610. Blood loss in ml has a statistical value of P= 0.192 with infection. Out of 160 patients, 50 patient's improper sterilization technique was used and in 110 patients there were no improper sterilization techniques used and it has a significant P value P = < 0.001 with SSI. In 45 patients' comorbidities were present and in 115 patients there were no comorbidities are present. Comorbidity has a statical value of P= 0.003 with SSI. Hypothermia during surgery develops in 85 patients and in 75 patients there is no hypothermia is present. Hypothermia has a significant statistical value of P = 0.002 with infection. That shows it is a major cause of SSI. If any patient faced hypothermia during surgical procedure their chances of infection is more as compared to those patients how don't faced hypothermia. All results of the table show that operative time blood loss has no comparative effect on SSI these are not the major causes of SSI. Usage of improper sterilization techniques, comorbidity, and hypothermia are the major causes of infection. If a patient has any of these illnesses during surgery, their risk of developing an infection should be elevated.

Chapter 5

DISCUSSION

Thoracolumbar fractures are the most commonly occurring fractures during spinal trauma. The most major cause of these fractures is road traffic accidents. It has a significant impact on patient health as well as the well-being of the patient. These spinal fractures can cause instability of vertebral Colum, cord injuries, bone marrow injuries, and in some cases cauda equina syndrome or paralysis. It has a significant impact on patient health as well as the well-being of the patient. To solve these issues and stabilize the spine we performed transpedicular fixation. These two methods are currently practiced in Pakistan one is open transpedicular fixation and the other one is percutaneous transpedicular fixation. In this study, we compared these two methods to evaluate which technique has better outcomes on the quality of life of the patient. In our study one sixty patients are selected from which 45% are between the age of 35-75 years old and 14.37% are 1-18 years old. 60.6% of patients have single-level fracture and only one patient has 4-level severe fractures. 78.8% of patients suffered from traumatic injury and 21.3% from non-traumatic injury as shown in Table 1.1. The open fixation method was used to treat 90 of the 160 patients, while the percutaneous fixation method was used to treat 70 patients.

Duration of the procedure, blood loss operative time, and time taken to return to normal routine have significant associations with both open and percutaneous fixation techniques with a p-value <0.001. Post-operative pain and nerve injury have no statical significance in both techniques with their P values respectively 0.095, and 0.139. Implant failure and SSI have significant statical values 0.018 and 0.002 respectively. Further types of surgical site infection have no significance with open and percutaneous fixation technique and its P value is 0.631.

Our study shows that operative time and blood loss have a significant association with open and percutaneous techniques with a P value P >0.001. A similar study showed that operative time and blood loss have a significant association with open and percutaneous fixation techniques and have a P value P < 0.01[47]. Another study showed percutaneous fixation technique has a shorter operative time a mean of 45 minutes as compared to open fixation. The mean blood loss in the percutaneous

fixation technique is 136.5 ml and in open fixation is 602 ml [48]. Another in-line study to our results showed the operative time for percutaneous surgery is 123±24 and for open surgery is 156±12 minutes which shows a strong correlation with a p-value P = < 0.001[49]. Blood loss in the percutaneous fixation technique is 142±37 ml and in the open fixation, technique is 330±97 ml and shows a significant correlation with a p-value of P= <0.001 [49]. Our findings are also supported by this study that describes operative time has statical significance with both techniques and its significance value is P= 0.003 [50]. A study conducted in Egypt shows percutaneous fixation technique has lower blood loss and, a short operative time as compared to the open fixation technique that are same as our results [51]. A corroborating study shows that percutaneous fixation surgery has less operative time as compared to conventional open fixation technique with a statical value P < 0.0001. A parallel study shows that the percutaneous fixation technique has less blood loss as compared to the open fixation technique [52]. A study conducted in China that showed surgical time and blood loss for percutaneous surgery is less than open surgery with a statically supported value P<0.05 [53]. Another comparable study tells us percutaneous pedicular screw fixation technique has less operative time as compared to open fixation with a significant p-value of 0.01. Blood loss in percutaneous is 190.66±74.39 and in open fixation technique is 444.33±127.90 that shows in percutaneous surgery less blood loss is anticipated with a statical value of 0.001 [54]. According to statistics from a study conducted in China, the duration of percutaneous surgery ranges from 153.955 to 160.24 minutes, which is in line with our findings [55]. A study conducted in Egypt that shows operative time and blood loss have a statically strong relation with both surgeries and its significance value is <0.001 [56]. A related study conducted in China on open vs percutaneous transpedicular fixation that shows operative duration and blood loss have a reliable relation with a statistical value of <0.001 [57]. A similar study shows blood loss and operative duration have a significant relation with the percutaneous fixation technique and its statical value is P < 0.001 [58]. Consistency in these results strengthens our results with evidence-based results from previous literature that operative time and blood loss have significant associations in open and percutaneous techniques. Our results are aligned with the study that was conducted in Nepal that showed operative time and blood loss has a significant correlation with

open and percutaneous transpedicular screw fixation with a statical value P <0.001 [59]. These results are similar to our study that shows the validity of our results and give support to our research results. A study conducted in Thailand that shows operative time has no significant effect in both surgeries and it has a significance value P = 0.719 [60]**.** A parallel study stat shows operative time has no significant effect in both surgeries with a p-value P= 0.4485 [61]. These results are not consistent with our study. These studies are conducted in developed countries where surgeons have good surgical skills. Their operating room infrastructure is high quality as compared to ours. So, these factors may influence these parameters. Thus, it's confirmed that blood loss and operative time of open fixation technique is longer than MIS surgery.

Postoperative pain has no statistically significant association in both open and percutaneous surgeries [48]. A corroborating study gives support to our results that show post-operatively pain has no association with open and percutaneous surgeries and its statical Value is P= 0.419 [50]**.** A study conducted in Turkey and her stats show less post-operative pain and less time to return to normal routine work in the percutaneous fixation technique as compared to the open fixation technique [51]**.** Another study that is consistent with our results shows MIS fixation technique has lower pain postoperatively as compared to open fixation technique [52]. A parallel study that was conducted in China shows post-operative pain is significantly lower in percutaneous surgery as compared to open surgery after 2 weeks of the operation and after 3 months of analysis, the results were not statistically reliable results P < 0.05. This research also shows Time taken to return to normal routine has a significant association with surgical techniques used to correct deformity with Lower time in percutaneous technique as compared to open fixation technique [53]. An analogous study shows post-operatively pain has no statically robust effect in both surgeries with a P value of 0.84 [54]. A statically supported study shows post-operatively pain has no significant effect in open and percutaneous techniques [60]. A study was conducted in China that showed there is no statistical significance present between both techniques related to postoperative pain [61]. A similar study shows post-operative pain has no significant effect in both surgeries [56]. A study was conducted in China on the open and percutaneous fixation technique that shows pain in the percutaneous fixation technique is lower than the open fixation technique [57]. A study was conducted in

Turkey and their results showed post-operative pain has no statically strong association with percutaneous transpedicular fixation surgery [58]. An affirmed study conducted in Pakistan that also shows Time to return to normal routine has a statistically supported association with both surgical techniques and has a significant value P <0.005. The average time taken to return to normal routine is 3.1± 0.61 months in percutaneous transpedicular screw fixation technique and 5.2 ± 0.84 in open technique [28]. A cognate study shows the same results time taken to normal routine is statically validated P value 0.03 and shorter time in percutaneous fixation technique then open fixation technique. [59]. These resultant statistical analyses of parent articles are similar to our results and give support to our results. Only one similar study conducted in Nepal shows pain after surgery has a significance P value <0.001 that is against our results that may be due to health status, physical fatigue of the patients, and due to sample size and sampling technique that are used in this research. In line with these previous researches, we state that in terms of post-operative pain, both surgeries have equal benefits and in terms of time taken to return to normal routine is less in the percutaneous technique and higher in the open fixation technique.

Our results corroborate with this research that shows nerve injury does not have any significant robust value with open and percutaneous fixation technique [48]**.** Another study stated that screw misplacement has a P value P = 0.82 in both groups and that is not significant in nature and nerve injury also shows the same results [62]. Our research is supported by this study that stats nerve injury has no statistically discernible effect in open and percutaneous fixation surgeries [63]. A comparative study shows nerve injury has no significant association with both surgical techniques [53]. An analog study showed significant value of nerve injury is not statically validated in both surgical techniques [54]. A study conducted in Thailand shows chances of implant failure in the percutaneous technique is 3.76% and in the open fixation technique is 2.22%. Our findings are supported by this study that nerve injury has no relatively comparative effect their chances are similar in both surgeries [60]. A retrospective study conducted in China that shows nerve injury has no statically validated effect in both surgical techniques with a p-value>0.05 [61]**.** A study conducted in Pakistan Karachi and their stats show implant failure is significant in open and percutaneous surgeries with a P value of P>0.05. These results are consistent with our study [64].

Another study that was carried out in Pakistan shows implant failure is higher in percutaneous surgeries as compared to open surgeries [28]. All the previous studies' results are in line with our results which shows the generalizability of our data and gives strength to our results.

An analogous study shows screw mispositioning has no significant effect in both open and percutaneous surgeries with a p-value of P = 0.664 [47]. A cognate study shows implant failure is not statically significant in both surgeries [48]. A parallel study shows implant failure has a significant effect in both surgeries with less no of cases in percutaneous surgery as compared to open fixation surgery [52]. A study conducted in Turkey shows Nerve injury has a statistically significant effect in both surgeries with a P value 0.002 [56].These results are not in favour of our research findings that might be influenced due to surgeons' skills, and operative machines that are required to carry out surgery. Some countries are using O-arm machines, navigation, and high-quality implants that are not available in Pakistan. In Pakistan there is only a C-arm machine is used to carry out these spinal surgeries. So, these factors have a significant impact on nerve injury and implant failure. Our findings are supported by this research that shows SSI has a statical association in both surgeries with a p-value of 0.031, and a higher number of patients in the open fixation group as compared to the percutaneous fixation group [50]. Another study conducted in Egypt that shows the percutaneous fixation technique has a lower infectious rate [51]. A parallel study shows percutaneous fixation technique has a lower infection rate as compared to the open fixation technique [52]. According to a comparable study, the open fixation technique has a much higher post-operative infection rate than the percutaneous technique [54]. These in-line findings are consistent with our results and show validity to our research. A comparable but different result with our study tells us wound infection postoperatively has no statistical association with open and percutaneous surgery with a p-value of 0.733. A study conducted in Egypt shows a 5.5 % post-operatively infection rate is present in open fixation technique [47]. Incisional SSI has a p-value of 0.36 and is insignificant in both surgeries [62]. Infection has no strong association with both techniques and has a significance value of 0.386 [57]. These studies results are not consistent with our findings but these might be due to sample size or sampling technique. A good hygienic environment, proper sterilization techniques, and

following sterilization protocols can also alter these results. Pre-operative and intraoperative antibiotics cover, patient hand hygiene might also influence these factors. Our study shows that operative time and blood loss have no significant association with SSI. Comorbidity, hypothermia, and improper sterilization technique have strong statical associations with SSI. A similar study supports our results and shows blood loss and operative time have no significant effect on SSI with a P value of 0.334 and 0.208 respectively [65]. The same study shows operative time has no significant effect on SSI [35]. A comparable study shows that operation time has no statically good association with Operative time and its statical value is 0.13 [66]. These previous research findings support our research findings and give evidence-based support to our results. One study conducted in Iran that shows operative time is a common cause of higher SSI rates these results are against our findings. That might be due to wound site not good sterilization techniques and some patient characteristics effect infection rate. Patient data and sampling technique can also affect the results of the data.

A prospective cohort study conducted in a hospital of China that showed comorbidity has a positive relation with SSI and its p-value is <0.001 [65]. A similar study conducted in the United States that shows comorbidity is a significant cause of SSI post operatively[67]. A related study was conducted in patras that shows comorbidities have a positive association with SSI and the most common cause is diabetes with a p-value of 0.021 [66]. A study conducted in Iran that shows comorbidities are a common cause of higher SSI rates [68]. A comparative study stat says hypothermia is a significant cause of SSI [33]. An identical study shows Improper sterilization techniques can cause a higher rate of infection [69]. An analog study shows that hypothermia can cause a significant increase in SSI [70]. A study conducted by Kim SH et al. shows comorbidity has a statically desirable significant value that shows comorbidity is a major cause of SSI [71]. A study showed that hypothermia, comorbidity, and improper sterilization techniques have a positive association with infection. These can increase the risk of SSI. If we follow the standard practices of sterilization then we can significantly decrease the SSI rate [72]. In our study we find that comorbidity, hypothermia and improper sterilization technique has great effect on SSI. These all-study findings are similar with these familiar studies that gives

evidence-based proof from previous data and add support to our results that our results are good enough that they can used for a clinical decision.

CONCLUSION

This study revealed that the percutaneous technique has better outcomes in terms of duration of the procedure, blood loss time for a return to normal routine, implant failure, nerve injury, and SSI. In terms of post-operative pain and nerve injury and type of SSI, both techniques are similar in results. The duration of the procedure in the percutaneous fixation technique is 185.14 minutes and in the open fixation technique is 280.64 minutes. That's shows percutaneous fixation technique is best in terms of duration of the procedure. In the open fixation technique, the mean blood loss is 293.00 ml and in percutaneous fixation technique the mean blood loss is 150.7 ml these results show that blood loss in open fixation technique is higher than percutaneous that's why percutaneous fixation is better. The average mean of time taken to return to normal routine is 3.289 and in the open fixation technique is 2.72 in the percutaneous fixation technique. That's why percutaneous fixation technique is better in terms of time taken to return to normal routine. Those patients who are operated on with open transpedicular fixation technique, postoperatively one patient has no pain 41 patients have moderate pain 41 have severe pain and 7 patients have unbearable pain after surgery. In the percutaneous fixation technique group, 2 patients have no pain 36 patients develops moderate pain and 32 patients have severe pain while no any patient complains of unbearable pain postoperatively. According to these results post-operative pain has no any significance towards surgery type. Implant failure in the open fixation technique is present in 37 patients and 53 patients there is no implant failure is present in the percutaneous fixation group 42 patients complained of implant failure and 28 patients said there is no implant failure present. In terms of implant failure open fixation technique is better. In the open fixation technique, 37 patients complained of nerve injury, and 53 patients did not face any nerve injury during operation. In the percutaneous fixation group, 37 patients complained of nerve injury and in 33 patients nerve injury is not present. According to these results both techniques have similar results. In the open fixation technique 45 patients have infection and 45 have no infection. Out of 160 patients 70 patients were operated on with the percutaneous fixation technique 18 had SSI and 52 had no infection reported postoperatively. In open fixation 19 patients have superficial SSI, 20 have deep

incisional SSI and 06 have organ or organ cavity SSI. In percutaneous 10 patients had superficial SSI, 06 has deep incisional SSI, and 02 patients developed organ or organ cavity SSI. Our results showed that in terms of infection open fixation technique is not a better choice as comparative to percutaneous because its infection rate is high. In the open fixation technique, the deep incisional SSI is most prevalent and in the percutaneous fixation technique, the most prevalent infection is superficial SSI. To treat superficial SSI is easy as comparative to deep incisional SSI. That's also showed percutaneous fixation technique is better.

Operative time has no significant effect on infection and spinal fixation surgery is safe in terms of infection. In terms of blood loss fixation is also safe because it has no any significant effect. Hypothermia and comorbidity have significant effect on infection if patient has any comorbidity and faced intra operative hypothermia the chances of SSI should increase. Usage of improper sterilization technique is also statistically significant with SSI that's our study shows. So, if during surgical procedure improper sterilization technique is used chances become increased. According to our all statistical analysis percutaneous transpedicular fixation technique is good and safe technique as compared to the open transpedicular fixation technique related to its outcomes and infection rate.

Limitations

It is a single-center study that cannot be generalized to all populations. Every surgeon has a different level of competency in surgical skills so there is a chance of bias. Reporting does not mean that the patient actually tells the right thing so biasness in the data may be occured.

Recommendations

- Conduct a broader study by engaging different patients from multiple hospitals and check the results.
- Data collected from different hospitals needs to be correlated to get a better understanding of which technique has better outcomes and in which terms has better results.

- Further enhanced this research by identifying the most common microorganisms that caused SSI.
- Cost effectiveness can be measured for open and percutaneous transpedicular screw fixation system.
- Grade the implant failure and conduct a deeper study to check how implant failure effect the quality of life of the patient after surgery.

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APPENDICES

ENGLISH CONSENT FORM

The study you are about to participate is a comparative cohort study titled as;

"COMPARATIVE ANALYSIS OF OPEN VS PERCUTANEOUS TRANSPEDICULAR FIXATION IN THORACOLUMBAR FRACTURES INCLUDING ITS SSI RATE AND ASSOCIATED CAUSES"

The study has no potential harm to participants. All data collected from you will be coded in order to protect your identity, and should not be disclosed to anyone. Following the study there will be no way to connect your name with your data. Your answers to the questions will not affect the quality of education given to you. Any additional information about the study results will be provided to you at its conclusion, upon your request.

You are free to withdraw from the study at any time. You agree to participate, indicating that you have read and understood the nature of the study, and that all your inquiries concerning the activities have been answered to your satisfaction.

NAME _____

SIGNATUR_____

DATE_____

URDU CONSENT FORM

میں_____ تصدیق کرتا/ کرتی ہوں کہ **محترمہ (عبدالواجد)**نے اپنی اس تحقیق

تھوراکولمبر فریکچر میں اوپن بمقابلہ پرکیوٹینیئس ٹرانسپیڈیکولر فکسیشن کا تقابلی تجزیہ جس"
"میں اس کی ایس ایس آئی کی شرح اور اس سے وابستہ وجوہات شامل ہیں۔

.زیرنگرانی **(ڈاکٹر تسرہ بی بی)** کے متعلق بتا دیا ہے۔ مجھے اس تحقیق کی نوعیت، مقاصد، احداف، توقعات، فوائد اور خطرات کے متعلق ، ۔ساری معلومات فراہم کر دی گئی ہیں
اس تحقیق کے دوران ساری معلومات صیغۃ راز میں رہیں گی اور مریض کا نام اور دیگر معلومات صرف تحقیق کے لیے استعمال ہوں گی۔مجھے یہ بھی بتا دیا گیا ہے کہ میں اس تحقیق سے متعلقہ ہر قسم کے سوال پوچھنے کا مجاز ہوں اور یہ تحقیق صرف ایک شخص ک مفاد میں نہیں ہے بلکہ بحسثیت مجموعی انسانیت کا مفاد اس سے وابسطہ ہے۔ تمام تفصیلات جاننے کے بعد یس تحقیق میں شامل ہونے یا نہ ہونے پر کسی کا قائل نہیں ہوں۔ اس تحقیق سے کسی بھی وقت علیحدہ ہونے پر مجھ پر کوئی پابندی نہیں ہو گی۔ میں بذاتِ خود بقائمی حوش و حواس
۔اور رضا مندی سے اس تحقیقاتی عمل میں شامل ہوتی/ ہوتا ہوں

---------- دستخط محقق
---------- دستخط شرکت کار
---------- تاریخ

DEMOGRAPHICS FORM & QUESTIONNAIRES

DATA COLLECTION FORM:

Patient Name: _____

MR No: _____

Contact No: _____

Address: _____

Surgery Type:

Open Transpedicular Fixation	Percutaneous Transpedicular Fixation

Demographic variables

1. Age: _____

2. Gender:

Male	Female

3.Injury type:

Traumatic injury	Non traumatic injury

4.No of Fractured levels: _____

Intra operative measurements

Duration of the procedure in minutes: _____

1. Blood loss in ml: _____

Post operative measurements

1. Implant failure

Yes	No

2. Nerve injury

Yes	No

3.Post operative pain

No pain	Moderate pain	Severe pain	Unbearable pain

4.Surgical site infection

Yes	No

Type of surgical site infection

Superficial SSI	
Deep incisional SSI	
Organ or organ cavity SSI	

5.Time taken to return to normal work: _____

Surgical site infection rate causes

1. Blood loss in ml: _____
2. Operative time in minutes: _____

3. Hypothermia:

Yes	No

4.Usage of improper sterilization technique:

Yes	No

5.Comorbidities:

Yes	No

ETHICS COMMITTEE LETTER

No. 1926 /IRB/PINS/Approval/2024 Dated: - 09/10/2024

INSTITUTIONAL REVIEW BOARD – PUNJAB INSTITUTE OF NEUROSCIENCES
APPROVAL LETTER

Study Title COMPARATIVE ANALYSIS OF OPEN VS PERCUTANEOUS TRANSPEDICULAR FIXATION IN THORACOLUMBAR FRACURES INCLUDING ITS SSI RATE AND ASSOCIATED CAUSES

Position	Author Names	Department
1.	Dr Abdul Wajid	Surgical Tech NOT 6th floor, PINS, Lahore

Dear,

Dr Abdul Wajid
ORCID # 0000-0003-0675-9934

Thank you for submitting the above-mentioned study proposal. I am pleased inform you that the IRB- PINS has reviewed this proposal in its 13th meeting on 08-10-2024 and the board members are satisfied with the design and ethical aspects of your study.

The IRB-PINS has given approval for a period of\ one year to conduct this study. Any change in the protocol or extension in the period of study should be notified to the board for approval. Interim report on progress of study be submitted to IRB from time to time.

Professor Dr. Mohsin Zaheer
Head of Neurology Department
Chairman Institutional Review Board,
Punjab Institute of Neurosciences, Lahore

PLAGIARISM REPORT

February 18, 2025

PLAGIARISM CERTIFICATE

For MPhil and PhD

This is certified that the thesis entitled: **Comparative Analysis Of Open Vs Percutaneous Transpedicular Fixation In Thoracolumbar Fractures Including Its SSI Rate And Associated Causes.**

Student Name: Abdul Wajid

Reg /Roll No: SU91-MSAHW-S23-047

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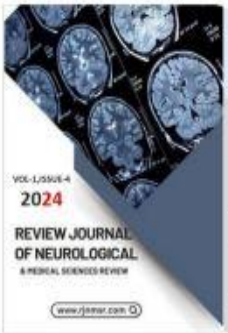

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Comparative Analysis of Open vs Percutaneous Transpedicular Fixation in Thoracolumbar Fractures Including its Ssi Rate and Associated Causes

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Abstract

Background: Thoracolumbar fractures are the most common fractures that occur due to high-energy trauma. There are two main methods for transpedicular fixation: open and percutaneous each of which has different advantages as well as disadvantages. Objective: To rule out which technique has the better outcomes for the patient and what are the common causes of surgical site infection rate. Methodology: A comparative cohort study is conducted at PINS and a total of 160 patients are selected 90 patients are added in group A and 70 in group B. Our inclusion criteria are both males and females of all ages. Patients who have different spinal injuries, complete cord injuries, and those patients who refused to fill out consent forms are excluded from the study.