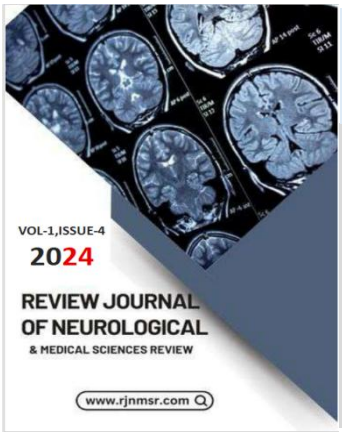

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Comparative Analysis of Open vs Percutaneous Transpedicular Fixation in Thoracolumbar Fractures Including its Ssi Rate and Associated Causes

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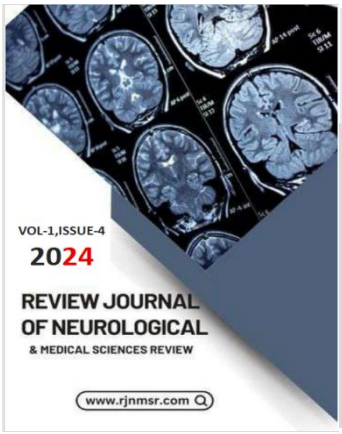
Abstract

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.



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Results: Percutaneous fixation technique has a significant value with the duration of the procedure, blood loss, implant failure, time to return to the normal routine, and SSI. Post-operative pain and nerve injury have no significant effect in both surgeries. Usage of improper sterilization techniques, hypothermia, and comorbidity are the most common causes of SSI. Operative time and blood loss have no statistically significant correlation with. Conclusion: Percutaneous fixation technique has favorable outcomes as compared to open fixation and has better outcomes on the quality of life of the patient.

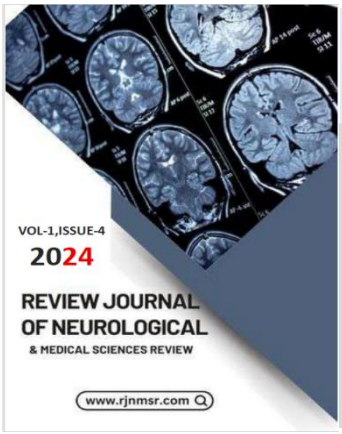
Key Words

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

Introduction

The spine is a wonderful thing that God has created in the human and animal body. It provides balance 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- 30 m in length(1). In the 20th century spine fractures were treated with immobilization, bed rest, and by applying a splint, traction, and the help of bracing (2). Eduard Hadra was the first surgeon how successfully perform spine fixation surgery in 1981(3). 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. The thoracic region of the spine is attached to the ribs making it more mobile than any other spinal region (4). Due to its mobility, this region is more susceptible to trauma. The most common causes of thoracolumbar fractures are roadside traffic accidents and fall from height (5). Some other causes of spinal fractures are chest trauma(6), 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(7). Thoracolumbar fractures has four types compression fractures, burst fractures, flexion distraction fractures, and dislocating fractures. Spine Xrays, CT scans, and MRI are diagnostic tests that are performed to assess the level of fractures and severity of fractures.

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 (8, 9). Thoracolumbar



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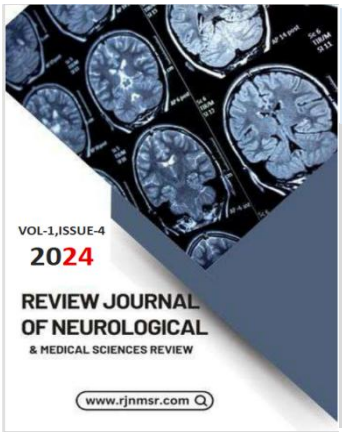
fractures of the spine can lead to different levels of disability if it is treated improperly (10). In percutaneous transpedicular screw fixation, a small 2-3cm incision is made for each screw through this, a screw and rods are placed to correct the deformity. This percutaneous technique has many advantages over the conventional open method for spine fixation (11). Such as percutaneous doesn't require excessive stripping, long long-term spinal muscle contractions. This technique also reduced lumbar stiffness, very less intra and post-operative bleeding, post operative 4 pain (12)and short hospital stays(13), 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 (14), screw loosening decompression of neural elements and due to dural puncture CSF leakage.

In open transpedicular fixation, there is a chance of a large incision, heavy bleeding, or excessive amount of blood loss, need for drain placement in the wound cavity for drainage of blood and serious fluid. Longer hospital stays and recovery time with more pain (15, 16). Surgical site infection of the spine causes a wide variety of pathology including minor infections to different life-threatening infections or permanent or short-term disability (17). Surgical site infection is divided into three types superficial incisional surgical site infection, deep incisional surgical site infection, and organ or organ cavity surgical site infection. All superficial SSI can easily be treated with oral or in some cases with IV antibiotics. Deep incisional SSI requires debridement of pus contents with the administration of IV antibiotics. Organ or organ cavity SSI requires debridement, with removal of implants and administration of IV antibiotics. Major causes of SSI are longer hospital stays, high blood loss, smoking, immunocompromised patients, and underlying comorbidities are the common causes of infection (18). There are many false beliefs present among doctors, health professionals, and patients regarding these techniques. Some surgeons felt the 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, 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 is very few research 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 surgical site infection rate.



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Materials and Method

A comparative cohort study design is conducted at the neurosurgery department of Punjab Institute of Neurosciences (PINS) Lahore. 160 patients are selected on a simple random sampling technique for the study from which 90 patients are added in group A (open transpedicular screw fixation) and 70 patients are added in group B (percutaneous transpedicular screw fixation) . Sampling technique A random sampling technique is used to collect the data. Our Inclusion criteria is all patients of both genders' males and females with thoracic and lumbar fractures who needed fixation are 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 and B. Our Exclusion criteria is all 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. Ethical consideration is taken from the ethical review board committee of the hospital. Informed consent is given to the patients in both Urdu and English language and briefly describes the purpose of the study. Data is collected on a developed Performa after explaining the consent form to the patients. Patient personal information is noted such as age, gender, home address, contact number, and 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 marked intraoperatively marked in the operation theatre and the information that needs to be marked postoperatively marked on data collection form in the ward. Monitor the duration of the procedure with help of stopwatch. Check blood loss with the help of the gravimetric method and volumetric method. Check nerve injury with the help of TLICS score. Monitor the body temperature with the help of a thermometer. Check the sterilization indicators to monitor the status of the sterilization of instruments. Check underlying comorbidities by asking from the patient and by checking the laboratory results. Ruled out the SSI with help of pussy discharge from the wound and implant failure by the help of spinal x-ray and local examination. Take a two 2-months long follow-up period to check the outcomes.

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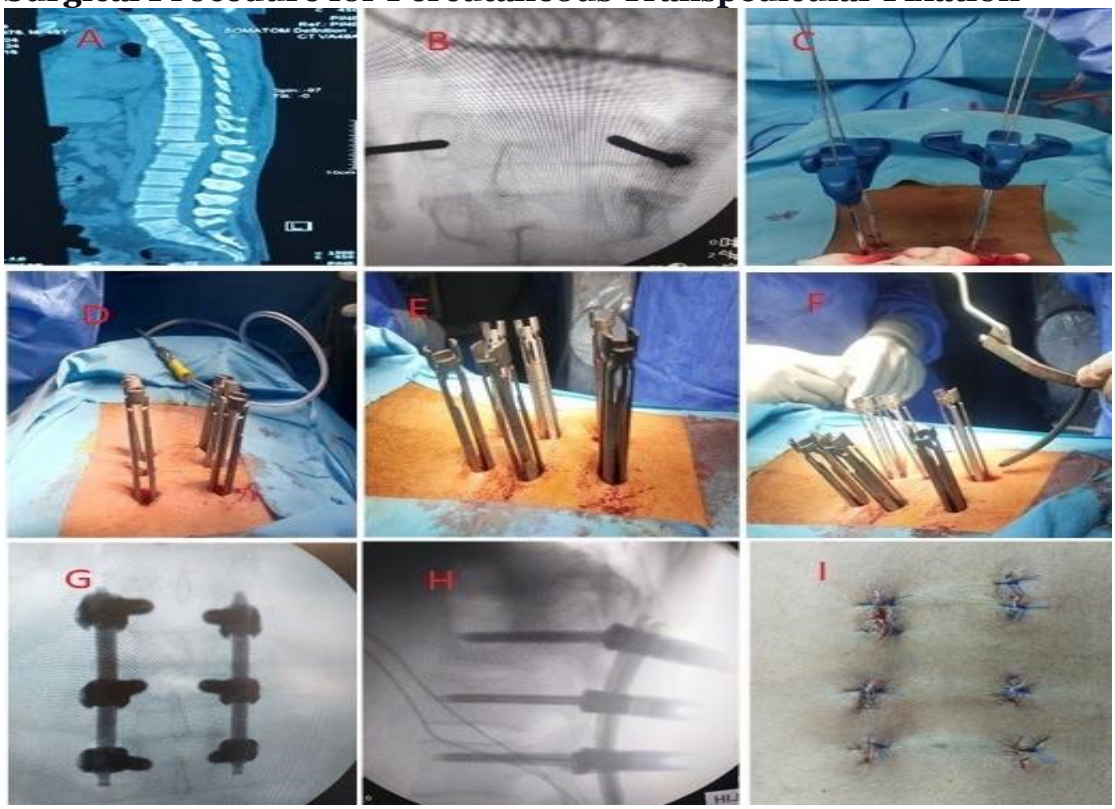
Surgical Procedure for Percutaneous Transpedicular Fixation



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.

The patient is placed in a prone position on the operating room table and a Wilson frame is used for positioning. A gel pad is placed under the arms, elbow, knee, and foot. With the help of a C-arm machine in anteroposterior dimension fractured vertebra is identified and a stab wound of 1-2 cm is given on the desired vertebra skin, subcutaneous fat, tissues, and muscle is separated. The pedicle is marked under fluoroscopy and a Jamshidi needle is inserted into the pedicles. Styles of jamshidi needle is removed and guide wire is inserted. According to the length of the body and pedicle desired screw size is selected. A tap of the desired screw is ruled on the guide wire and performed tap in the vertebral body. Removed tap and ruled the desired screw on the guide wire and under fluoroscopy screw is placed in the vertebra through the pedicle. This procedure is repeated on all vertebras. To give stabilization to screws rod size is verified under fluoroscopy and inserted. Inners are placed above the rod to hold the rods in her position. Again, under fluoroscopy screws and rods positioning is verified. The suture material is then used to close the skin.

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Surgical procedure for open transpedicular fixation

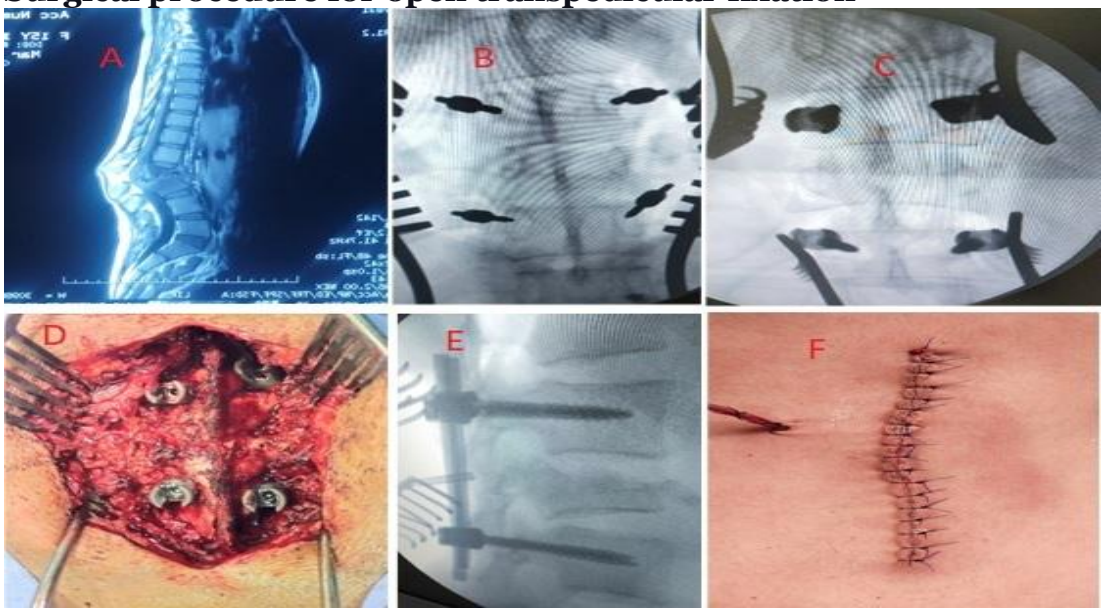


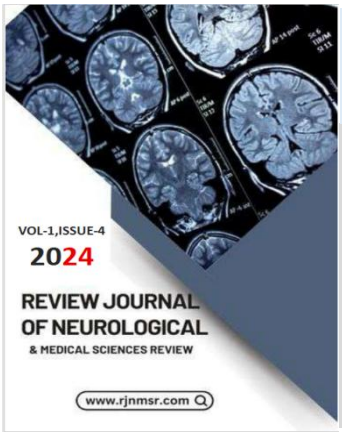
Image **A** shows MRI of fractured vertebra **B** Steinmann pin inserted into the pedicle **C** shows anteroposterior view of the screw that are placed into the body **D** real image of the screw E lateral view of rods and screws **F** shows image of skin after closure.

In open fixation midline incision is made subcutaneous tissue and spinal muscle are dissected pedicle is exposed and stemin pins are inserted under fluoroscopy inside the desired pedicles. Pedicle sicker is guided through the pedicle into the vertebral body. Tap is selected according to the length of the body and diameter of the pedicle and guide into the body. The tap is removed and the screw is placed into the body under fluoroscopy. Rod is inserted inside the screws and placed inners on it to give support and stabilization to the bone and implants. Again, through fluoroscopy screws and rods position is verified if reduction and distraction are required give distraction and reduction. A drain is placed to reduce the chance of internal bleeding. Sutures are used to close the paraspinal muscles, fascia, and skin.

Results

Table 1.1: 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	1	**97**	**60.6%**	1.48	±0.692



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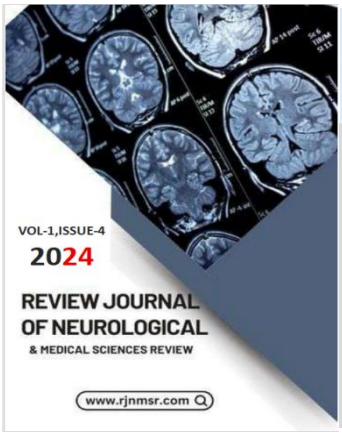
fractured levels	2	**49**	**30.6%**		
	3	**12**	**7.5%**		
	4	**1**	**0.6%**		
Injury type	Traumatic injury	**126**	**78.8%**	0.21	±0.410
	Non-traumatic injury	**34**	**21.3%**		
Surgery type	Open fixation	**90**	**56.3%**	0.44	±0.498
	Percutaneous fixation	**70**	**43.8%**		

We selected four demographic variables age, gender, no of fractured levels, injury type, and surgery type. Table 1.1 shows 72 patients belonging to the age group 35-75 years old and 23 patients belonging to the age group 1-18 years old. Age has 34.48 mean and ±14.226. 102 patients are male and 58 patients are female. While gender has 0.36 mean and ± 0.482 97 patients have single-level fracture and only one patient has 4 levels of severe fracture. The number of fractured levels has a 1.48 mean and ±0.692. Out of 160 patients, 126 patients have traumatic injuries and 34 have non-traumatic injuries with 0.21 mean and ±0.410. 90 patients are operated on with the open fixation technique and 70 with the Percutaneous fixation technique. Surgery type has 0.44 mean and ±0.498.

Table 1.2: 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	3.289 ± 2.94		2.72 ±4.742		**<0.001**
Post operative 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**



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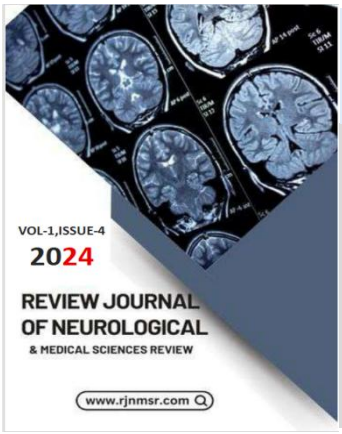
Nerve injury	Yes	**37**	Yes	**37**	**0.139**
	No	**53**	No	**33**	
Surgical site infection	Yes	**45**	Yes	**18**	**0.002**
	No	**45**	No	**52**	
Type of surgical site infection	Superficial SSI	**19**	Superficial SSI	**10**	**0.631**
	Deep incisional SSI	**20**	Deep incisional SSI	**06**	
	Organ or organ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

Table 1.2 upon correlating the Duration of the procedure with open and Percutaneous fixation techniques shows a significant p-value <0.001. The mean duration of the procedure in minutes in the open fixation technique is 280.64 and ±96.387 and 185.14 ±51.548 in the percutaneous technique. Blood loss has a significant p-value <0.001 with open and Percutaneous fixation techniques both. In the open fixation technique, the mean and standard deviation of blood loss is 293.00 ±111.319 and in percutaneous fixation is 150.71 ±60.704. The average mean 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 technique. Post-operative pain has no significant value with both techniques P= 0.095. Of the patients who are operated on with an open 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. Implant failure in open fixation is present in 37 patients and in 53 patients there is no implant failure is present in Percutaneous fixation 42 patients complained of implant failure and 28 patients said there is no implant failure present. Its P value is 0.018. Nerve injury has no good correlation with both techniques. In open fixation, 37 patients complained of nerve injury, and 53 patients did not face any nerve injury.

In percutaneous 37 patients nerve injury is present and in 33 patients nerve injury is not present. Incisional Surgical site infection has a strong association with open and Percutaneous fixation techniques with a P value of 0.002. Out of 90 patients, 45 have surgical site infection 45 have no surgical site infection. 70 patients were operated on with Percutaneous fixation 18 had incisional Surgical site infection and 52 had no infection. Further types of surgical site infection have no strong association it has a P value of P = 0.631. In open fixation 19 have superficial surgical site infection, 20 have deep incisional



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Surgical site infection and 06 have organ or organ cavity surgical site infection. In Percutaneous 10 had superficial 06 has Deep and 02 patients developed organ or organ cavity Surgical site infection.

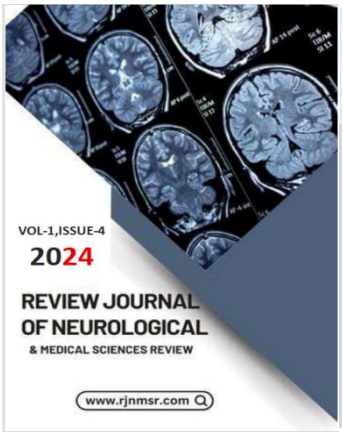
Table 1.3: Comparison of Surgical Site Infection (SSI) with its Causes and its P Values

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**	

Table 1.3 shows operative time in minutes and blood has no significant correlation with surgical site infection with their respective mean and standard deviation. 236.49, ±90.69 234.99, ±117.610. Operative time in minutes has a P value of P = 0.188 and blood loss in ml has P= 0.192 with surgical site infection. Out of 160 patients in 50 patient's improper sterilization technique was used and in 110 patients there was no improper sterilization technique used and it has a significant P value P = < 0.001. In 45 patients' comorbidities are present and in 115 patients there is no comorbidity present Comorbidity has a statical value of P= 0.003 with Surgical site infection. 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 surgical site infection.

Discussion

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. Out of 160,90 patients were treated with the open fixation method and 70 with the percutaneous fixation method. 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 surgical site infection have



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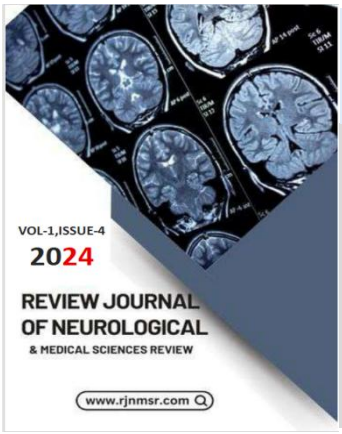
significant statical values 0.018 and 0.002 respectively. Further types of surgical site infection have no significance with open and percutaneous fixation technique and its P value is 0.631.

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). 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 (19). 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)(20). 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 (20). 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 (21). 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 (22) 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 (23). A study conducted in China and their stats show relevancy to our results in percutaneous surgery the operation time is 153.955 to 160.24 minutes which is consistent with our findings (24). A related study conducted in China that shows operative duration and blood loss have a significant relation with a P value of <0.001 (25). 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 (26). 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) (27). A parallel study stat shows operative time has no significant effect in both surgeries with a p-value P= 0.4485 (28). These results are not consistent with our study. This study was conducted in developed country 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 percutaneous surgery.

Postoperative pain has no statistically significant association in both open and percutaneous surgeries (19). A corroborating study gives support to our results that show post-operatively pain has no association with open and



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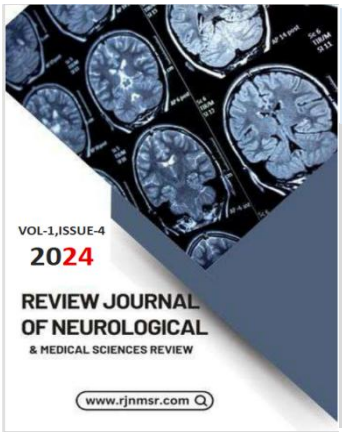
percutaneous surgeries and its statical Value is P= 0.419 (29). A study conducted in Turkey and her stats show less post-operative pain and less time to return to normal routine work in the percutaneous fixation technique as compared to the open fixation technique (21). A parallel study that was conducted 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 significant with a P value of ($P < 0.05$). 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 (22). An analogous study shows post-operatively pain has no statically robust effect in both surgeries with a P value of 0.84 (23). A study was conducted in China that showed there is no statistical significance present between both techniques related to postoperative pain. 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 (25).

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 technique and 5.2± 0.84 months in open technique (15). 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. (26). 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 the 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 (19). Another study stated that screw malpositioning 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 (9). 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 showed nerve injury has no relatively comparative effect their chances are similar in both surgeries (27). 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 (28). A study conducted in Pakistan Karachi



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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 (30). Another study that was carried out in Pakistan shows implant failure was higher in percutaneous surgeries as compared to open surgeries (15). All these 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 (31). A cognate study shows implant failure is not statically significant in both surgeries (19). 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 (32). A study conducted in Turkey shows Nerve injury has a statistically significant effect in both surgeries with a P value 0.002 (33).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 Surgical site infection has a statical association in both surgeries with a p-value of 0.031, and a higher number of patients in the open fixation technique as compared to the percutaneous fixation technique (29). A study conducted in Egypt that shows the percutaneous fixation technique has a lower infectious rate (21).

A parallel study shows percutaneous fixation technique has a lower infection rate as compared to the open fixation technique (32). Another analog study shows that the post-operative infection rate is higher in the open fixation technique as compared to the percutaneous technique (23). 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 (31). Incisional surgical site infection has a p-value of 0.36 and is insignificant in both surgeries (9). 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 surgical site infection. 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 (34). A

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comparable study shows that operation time has no statically good association with SSI and its statical value is 0.13 (35). 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.

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 (34). A study conducted in the United States that shows comorbidity is a significant cause of SSI post operatively (36). 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 (35). A comparative study stat says Hypothermia is a significant cause of surgical site infection (37). An identical study shows Improper sterilization techniques can cause a higher rate of surgical site infection (38). An analog study shows that hypothermia can cause a significant increase in surgical site infection (39). 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 (40). A study conducted by Atesok et al that Hypothermia, comorbidity, and improper sterilization techniques have a positive association with surgical site infection. These can increase the risk of surgical site infection. If we follow the standard practices of sterilization then we can significantly decrease the SSI rate (41).

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.

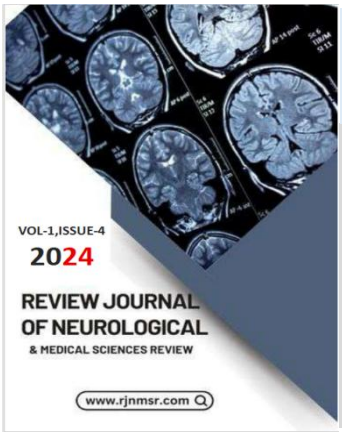
Recommendations

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.

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 surgical site infection. In terms of post-operative pain and nerve injury and type of surgical site infection, both techniques are similar in results.

The infection rate of open surgery is high as compared to percutaneous surgery and operative time and blood loss are not a significant cause of



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infection. The most common causes of SSI are the usage of improper sterilization techniques, comorbidity, and hypothermia. So percutaneous transpedicular fixation technique is good as compared to the open transpedicular fixation technique.

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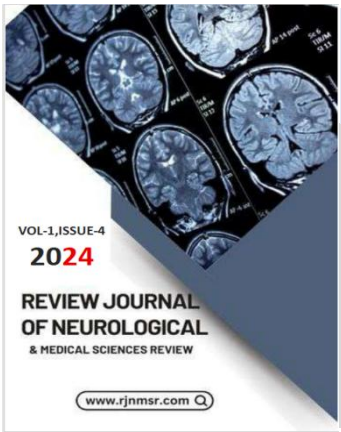

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