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ORIGINAL ARTICLE

Incidence of knee pain after intra-medullary nail for close tibia fracture.

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ABSTRACT… Objective: To determine the incidence of knee pain following intramedullary locking nail (ILN) insertion for closed tibia shaft fractures. **Study Design:** Descriptive study. **Setting:** Department of Orthopedics, Hayatabad Medical Complex, Peshawar. **Period:** 24th September 2024 to 24th February 2025. **Methods:** A sample size of 151 participants was calculated using the WHO sample size calculator with a 95% confidence level and a 5% margin of error. Non-probability consecutive sampling was used to recruit patients aged 18-65 years undergoing ILN for closed tibia fractures (AO type A and B). Data were collected using the Visual Analog Scale (VAS) for pain intensity and the Knee Injury and Osteoarthritis Outcome Score (KOOS) for functional outcomes after follow up of 45 days post ILN. Statistical analysis was performed using IBM SPSS version 23. **Results:** The mean age of participants was 34.47 ± 16.32 years, with 76.8% being male. Functional outcomes were good in 69.5% of participants, fair in 21.9%, and poor in 8.6%. Pain assessment revealed 37.7% with no pain, 34.4% with mild pain, 19.2% with moderate pain, and 8.6% with severe pain. Significant associations were found between functional outcomes and gender, age, education, diabetes, and fracture type ($p < 0.001$). Males, younger patients (18-40 years), those with higher education, non-diabetic patients, and those with Type A fractures had better outcomes. Pain levels were similarly influenced by these factors. **Conclusion:** Functional outcomes were predominantly good (69.5%) with significant pain-free status (37.7%) in patients undergoing ILN for closed tibia fractures. Younger age, male gender, higher education, absence of diabetes, and Type 1 fractures were significant predictors of superior functional outcomes and reduced pain scores.

Key words: Closed Tibia Fractures, Functional Outcomes, Intramedullary Locking Nail (ILN), Knee Pain, Knee Injury and Osteoarthritis Outcome Score (KOOS), Visual Analog Scale (VAS).

INTRODUCTION

Post-operative knee pain through inter-medullary locking nail (ILN) insertion for surgical treatment of tibia fractures is one of the most widely mentioned complications in orthopedic practice. Closed tibia fractures are the most widespread type of fracture canal, several times demanding an operation to ensure full recovery and maximum functionality.[1] However, even with the improvements in surgical techniques and technological inventions, knee discomfort after these procedures is still a concern in patients. Intramedullary Nailing is a surgical tool to fix fractures in bones for instance the tibia using straight insertion into the medullary canal.[2] The term Closed Tibia Fracture is used to describe an instance where the tibia bone is fractured and this is without the injury including an open wound or a break in the skin.[3] The term, Knee Pain, conveys what is felt as unpleasant or uncomfortable pain in the joint of the knee or inflammation which are caused by the knee surgery procedure for inserting the anti-inflammatory medication, ILN.[4]

The number of people who experience knee pain after ILN for tibia injuries is the incidence of postoperative knee pain, which is defined as the frequency of occurrence or rate of occurrence. The occurrence of knee pain after the closed tibia fractures undergoing Intramedullary Nailing presents a problem of great magnitude both in the orthopedic treatment of this pathology and the rehabilitation of the patient altogether.[5]

A meta-analysis of research literature concerning the occurrence and predictive factors of knee pain after various orthopedic treatments including an

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examination of intra-tibial pin insertions used in close tibial break fixation yields valuable results.[6] Moreover, the frequency of knee pain following runners lateral tibial neural compressions episode has demonstrated discrepancies, with incidence rate variations ranging from 10% to 50% based on survey population and the research approach applied.[7] Causative factors of knee pain after ILN maybe mal-alignment of twisted nail for about 20-30%, soft tissue irritation in 15-25% of cases and 10-20% of joint stiffness cases or any prior disease. Moreover, it also depends upon the Age, Gender and activity level. It has been reported that the incidence of knee pain after ILN is slightly higher in females than males.[8,9]

Unawareness about the incidence of knee pain following in ILN insertion for close tibia fracture was our research problem. This research will help surgeons about the evaluation of knee pain following intramedullary nail.

OBJECTIVE

To determine the incidence of knee pain following intramedullary locking nail (ILN) insertion for closed tibia shaft fractures

METHODS

This study was a descriptive study designed to evaluate knee pain outcomes following ILN insertion for closed tibia fractures. The study was conducted in the Department of Orthopedics at Hayatabad Medical Complex, Peshawar, from 24th September 2024 to 24 March 2025 after approval from ethical committee (HMC-QAD-f-99-1855-6/5/24), with a minimum follow-up period of 45 days to assess knee pain outcomes post-ILN insertion.

The sample size was calculated using the WHO sample size calculator with a 95% confidence level and a 5% margin of error, based on an expected incidence of knee pain of 11% after ILN insertion for closed tibia fractures, resulting in a required sample size of 151 participants (10). A non-probability consecutive sampling technique was used to recruit participants who met the inclusion criteria, which included patients aged 18-65 years, of both genders, undergoing treatment for closed tibia shaft fractures (AO type A and type B) with cannulated ILN at Hayatabad Medical Complex, Peshawar. Patients with AO type C fracture of tibial shaft, fractures involving knee and ankle joint, active knee joint infections, bone tumors involving the distal femur or proximal tibia, neuropathic knee conditions, or osteoarthritis were excluded. Data collection began with the recruitment of eligible participants from the orthopedic department. Researchers provided detailed information about the study's aims, methods, potential risks, and benefits, allowing participants ample time to ask questions and understand their role in the research. Verbal consent was obtained initially, followed by written consent before enrollment. Demographic data, including age, gender, residence, education status were recorded for each participant. For patients undergoing ILN insertion for closed tibia fractures, the type of tibial shaft fracture based on AO classification was also evaluated. Post-surgery, participants underwent standardized assessments for knee pain using validated outcome measures, including the Visual Analog Scale (VAS) and the Knee Injury and Osteoarthritis Outcome Score (KOOS). These assessments were scheduled 45 days after the operation. The VAS, a subjective tool, measured pain intensity on a 0-10 scale, while the KOOS evaluated knee function and symptoms across five subscales: pain, symptoms, activities of daily living (ADL), sports and recreation (Sport/Rec), and quality of life (QOL).

Data were analyzed using IBM SPSS version 23. Continuous variables, such as age, BMI, and duration of fracture, were expressed as mean ± standard deviation, while categorical variables, such as gender, education level, diabetes, type of fracture, and functional outcome, were described using frequencies and percentages. Functional outcomes and pain categories were stratified by age, gender, education level, BMI, type of diabetes, type of fracture, and duration of fracture, and post-stratification analysis was performed using the chi-square test at a 5% significance level. The results were presented in tables and diagrams for clarity and interpretation.

RESULTS

Total of 151 patients were included in the study. The mean age of the participants was 34.47 ± 16.32 years, the mean BMI was 26.10 ± 2.79, the mean duration of injury was 25.76 ± 5.03 hours, the mean KOOS score was 77.01 ± 15.78, and the mean VAS score was 2.71 ± 2.06.

According to Table-I, of 151 participants, majority being male (76.8%) compared to females (23.2%). Most participants resided in urban areas (70.9%), while 29.1% were from rural areas. Education levels varied, with 35.8% having higher education, 27.8% secondary education, 27.2% uneducated, and 9.3% with primary education. A significant proportion of participants (78.1%) did not have diabetes, while 21.9% were diabetic. Regarding fracture types, 79.5% had Type 2 fractures, and 20.5% had Type 1 fractures. Functional outcomes, as measured by the KOOS score, were good in 69.5% of participants, fair in 21.9%, and poor in 8.6%. Pain categories, assessed using the VAS scale, showed that 37.7% had no pain, 34.4% had mild pain, 19.2% had moderate pain, and 8.6% reported severe pain.

Clinicodemographic Variables	Category	n (%)
Gender	Male	116 (76.8%)
	Female	35 (23.2%)
Residence	Rural	44 (29.1%)
	Urban	107 (70.9%)
Education	Uneducated	41 (27.2%)
	Primary	14 (9.3%)
	Secondary	42 (27.8%)
	Higher	54 (35.8%)
Diabetes	Yes	33 (21.9%)
	No	118 (78.1%)
Type of Fracture (AO)	Type A	31 (20.5%)
	Type B	120 (79.5%)
Functional Outcomes (KOOS Score)	Good	105 (69.5%)
	Fair	33 (21.9%)
	Poor	13 (8.6%)
Pain Category (VAS)	No Pain	57 (37.7%)
	Mild	52 (34.4%)
	Moderate	29 (19.2%)
	Severe	13 (8.6%)

Table-I. Variable frequencies and descriptive statistics (n, %)

According to table 3, functional outcomes were significantly associated with gender, age, education, diabetes, and type of fracture ($p < 0.001$). Males had better functional outcomes, with 82.8% reporting good outcomes compared to only 25.7% of females. Younger participants (18-40 years) had significantly better outcomes, with 89.6% reporting good outcomes, while only 14.6% of older participants (41-65 years) had good outcomes. Education level also played a significant role, with higher education associated with better outcomes (92.6% good outcomes) compared to uneducated participants (17.1% good outcomes). Diabetic patients had poorer outcomes, with only 12.1% reporting good outcomes compared to 85.6% of non-diabetic patients. Type A fractures were associated with excellent outcomes (100% good), while Type B fractures had lower rates of good outcomes (61.7%). Residence and duration of injury did not show significant associations with functional outcomes ($p > 0.05$).

According to table 3, pain categories (VAS Scale) were significantly associated with gender, age, education, diabetes, and type of fracture ($p < 0.001$). Males had better functional outcomes, with 82.8% reporting good outcomes compared to only 25.7% of females. Younger participants (18-40 years) had significantly better outcomes, with 89.6% reporting good outcomes, while only 14.6% of older participants (41-65 years) had good outcomes. Education level also played a significant role, with higher education associated with better outcomes (92.6% good outcomes) compared to uneducated participants (17.1% good outcomes). Diabetic patients had poorer outcomes, with only 12.1% reporting good outcomes compared to 85.6% of non-diabetic patients. Type A fractures were associated with excellent outcomes (100% good), while Type B fractures had lower rates of good outcomes (61.7%). Residence and duration of injury did not show significant associations with functional outcomes ($p > 0.05$).

Variables	Category	Functional Outcomes (KOOS Score)			P-Value
		Good	Fair	Poor	
Gender	Male	96 (82.8%)	15 (12.9%)	5 (4.3%)	<0.001
	Female	9 (25.7%)	18 (51.4%)	8 (22.9%)	
Age Categories	18-40 yrs	95 (89.6%)	11 (10.4%)	0 (0.0%)	<0.001
	41-65 yrs	6 (14.6%)	22 (53.7%)	13 (31.7%)	
Residence	Rural	30 (68.2%)	12 (27.3%)	2 (4.5%)	0.360
	Urban	75 (70.1%)	21 (19.6%)	11 (10.3%)	
Education	Uneducated	7 (17.1%)	22 (53.7%)	12 (29.3%)	<0.001
	Primary	7 (50.0%)	6 (42.9%)	1 (7.1%)	
	Secondary	41 (97.6%)	1 (2.4%)	0 (0.0%)	
	Higher	50 (92.6%)	4 (7.4%)	0 (0.0%)	
Diabetes	Yes	4 (12.1%)	16 (48.5%)	13 (39.4%)	<0.001
	No	101 (85.6%)	17 (14.4%)	0 (0.0%)	
Type of Fracture	Type A	31 (100.0%)	0 (0.0%)	0 (0.0%)	<0.001
	Type B	74 (61.7%)	33 (27.5%)	13 (10.8%)	
Duration of Injury	<48 hrs	54 (64.3%)	24 (28.6%)	6 (7.1%)	0.077
	>48 hrs	51 (76.1%)	9 (13.4%)	7 (10.4%)	

Table-II. Cross-Tabulation of functional outcomes with independent variables

Independent Variable	Category	Pain Categories (VAS Scale)				P-Value
		No	Mild	Moderate	Severe	
Gender	Male	57 (49.1%)	39 (33.6%)	15 (12.9%)	5 (4.3%)	<0.001
	Female	0 (0.0%)	13 (37.1%)	14 (40.0%)	8 (22.9%)	
Age Categories	18-40 yrs	53 (50.0%)	46 (43.4%)	7 (6.6%)	0 (0.0%)	<0.001
	41-65 yrs	0 (0.0%)	6 (14.6%)	22 (53.7%)	13 (31.7%)	
Residence	Rural	17 (38.6%)	13 (29.5%)	12 (27.3%)	2 (4.5%)	0.291
	Urban	40 (37.4%)	39 (36.4%)	17 (15.9%)	11 (10.3%)	
Education	Uneducated	1 (2.4%)	6 (14.6%)	22 (53.7%)	12 (29.3%)	<0.001
	Primary	7 (50.0%)	4 (28.6%)	2 (14.3%)	1 (7.1%)	
	Secondary	26 (61.9%)	15 (35.7%)	1 (2.4%)	0 (0.0%)	
	Higher	23 (42.6%)	27 (50.0%)	4 (7.4%)	0 (0.0%)	
Diabetes	Yes	0 (0.0%)	4 (12.1%)	16 (48.5%)	13 (39.4%)	<0.001
	No	57 (48.3%)	48 (40.7%)	13 (11.0%)	0 (0.0%)	
Type of Fracture	Type A	25 (80.6%)	6 (19.4%)	0 (0.0%)	0 (0.0%)	<0.001
	Type B	32 (26.7%)	46 (38.3%)	29 (24.2%)	13 (10.8%)	
Duration of Injury	<24 hrs	27 (32.1%)	31 (36.9%)	20 (23.8%)	6 (7.1%)	0.215
	>24 hrs	30 (44.8%)	21 (31.3%)	9 (13.4%)	7 (10.4%)	

Table-III. Cross-Tabulation of pain category with independent variables

DISCUSSION

This study investigated the relationship between various demographic and clinical factors and their impact on functional outcomes and pain levels following intramedullary nailing (ILN) for closed tibia fractures. Our findings revealed several significant associations that warrant detailed discussion.

The present study demonstrated that gender significantly influenced both functional outcomes and pain levels post-ILN surgery ($p<0.001$). Male patients exhibited notably better functional outcomes, with 82.8% achieving good results compared to only 25.7% of female patients. Similarly, male patients reported lower pain levels, with 49.1% experiencing no pain compared to female patients, among whom none reported complete pain freedom. These findings are not supported by pervious literature such as with Al-Sharaa MB et al. and Maharjan R et al., who found no significant gender-based differences in their cohort.[11,12] While Ketema et al., supported our finding and reported better functional outcomes in male patient.[13]

Age emerged as a crucial determinant of outcomes, with younger patients (18-40 years) demonstrating significantly superior results. In our cohort, 89.6% of younger patients achieved good functional outcomes, while only 14.6% of older patients (41-65 years) reached similar results ($p<0.001$). This age-related disparity extended to pain outcomes, where 50% of younger patients reported no pain, while all older patients experienced some degree of discomfort. These findings support existing literature by Al-Sharaa MB et al., Ketema E et al., and Kashyap S et al., who documented better recovery patterns in younger patients undergoing ILN procedures.[11,13,14]

Educational status demonstrated a strong correlation with both functional and pain outcomes ($p<0.001$). Patients with higher education showed remarkably better results (92.6% good outcomes) compared to uneducated participants (17.1% good outcomes). This association might be attributed to better understanding and adherence to post-operative care instructions, as suggested by Al-Sharaa MB et al., and Kashyap S et al., although their study reported less pronounced educational disparities.[11,14]

The presence of diabetes significantly impacted outcomes, with only 12.1% of diabetic patients achieving good functional results compared to 85.6% of non-diabetic patients ($p<0.001$). Pain outcomes showed a similar pattern, with diabetic patients experiencing higher pain levels. These findings are not supported observations by Al-Sharaa MB et al., regarding the adverse effects of diabetes on functional recovery.[11]

Fracture type emerged as a strong predictor of outcomes, with Type A fractures showing excellent results (100% good functional outcomes) compared to Type B fractures (61.7% good outcomes). This distinction was also reflected in pain outcomes, where 80.6% of Type 1 fracture patients reported no pain compared to 26.7% of Type 2 fracture patients. These results parallel the findings of Ketema et al., Courtney PM et al., and Schmidt AH et al., who documented superior outcomes in simpler fracture patterns.[13,15,16]

Interestingly, residence location (rural vs. urban) and injury duration did not significantly influence either functional outcomes ($p=0.360$ and $p=0.077$, respectively) or pain levels ($p=0.291$ and $p=0.215$, respectively). This is in contrast to Ketema et al., who reported injuries treated in 24 hours after injury have better functional outcomes and less pain compared to ILN for closed tibial fracture after 24 hours.[13]

Our study was limited by its single-center design and the relatively short follow-up period. Additionally, the uneven distribution of participants across various demographic categories might affect the generalizability of our findings. Future multi-center studies with longer follow-up periods would be valuable in validating these results.

CONCLUSION

Functional outcomes were predominantly good (69.5%) with significant pain-free status (37.7%) in patients undergoing ILN for closed tibia fractures. Younger age, male gender, higher education, absence of diabetes, and Type 1 fractures were significant predictors of superior functional outcomes and reduced pain scores.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Majid Hussain:** Manuscript writing, drafting, data collection, proof reading, stat analysis.
2	**Muhammad Arif Khan:** Manuscript writing, drafting, data collection, proof reading, stat analysis