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Evaluating Pain Relief Using Total Pain Relief (Totpar) In Operative Orthopedic Patients

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ABSTRACT

Background: Postoperative pain is a major concern for orthopedic patients, as it can delay recovery and prolong rehabilitation. This study aimed to evaluate the efficacy of pain relief using the Total Pain Relief (TOTPAR) score in postoperative orthopedic patients. Additionally, it aimed to analyze the role of multimodal analgesia in improving pain management and enhancing recovery outcomes.

Methods: A prospective observational study was conducted involving 148 patients who underwent various orthopedic surgeries. Pain levels were assessed using the Numerical Rating Scale (NRS) and the TOTPAR score over a 48-hour period following surgery. Standardized analgesic regimens, including nonsteroidal anti-inflammatory drugs (NSAIDs), opioids (e.g., tramadol), and adjunctive therapies, were administered to manage postoperative pain. The effectiveness of these analgesic treatments was measured by changes in NRS and TOTPAR scores.

Results: The study found a significant reduction in postoperative pain intensity. NRS scores decreased from a mean of 7.77±0.72 before treatment to 6.66±0.71 after treatment, indicating notable pain relief. The TOTPAR scores showed consistent improvement, rising from a baseline of 0.24±1.71 to 32.14±6.13 at 48 hours, further demonstrating the effectiveness of pain management. NSAIDs were the most commonly used analgesics, followed by tramadol and other adjuncts, supporting the role of multimodal analgesia in postoperative pain relief. However, no significant correlation was found between the TOTPAR score and the length of hospital stay, suggesting that factors other than pain relief may influence recovery duration.

Conclusion: The study concluded that the TOTPAR score is a reliable and comprehensive tool for evaluating postoperative pain relief in orthopedic patients. The findings underscore the importance of individualized pain management strategies and the effectiveness of multimodal analgesia in optimizing pain control and improving recovery outcomes. By utilizing a combination of analgesic approaches, healthcare providers can better address postoperative pain and enhance the patient experience during recovery.

***Keywords:** TOTPAR, Postoperative pain, Orthopedic surgery, Multimodal analgesia, NRS*

1. INTRODUCTION

Postoperative pain is a prevalent challenge in orthopedic surgery, significantly influencing patient recovery and rehabilitation. Historically, opioids have been the mainstay of postoperative pain management due to their potent analgesic effects. However, their adverse effects, such as respiratory depression, dependency, and gastrointestinal disturbances, have prompted the adoption of alternative strategies. [1-3] The limitations of opioids paved the way for multimodal analgesia, a comprehensive approach that targets different pain pathways using a combination of pharmacological and non-pharmacological methods. [4,5]

Multimodal analgesia involves using agents like NSAIDs, acetaminophen, magnesium sulfate, and ketamine, alongside techniques like regional anesthesia and patient-controlled analgesia. [6-8] This approach has been shown to reduce opioid consumption, enhance pain relief, and improve recovery outcomes. [9-11] Innovations in regional anesthesia, such as nerve blocks and local anesthetic infusions, have further contributed to improved postoperative care. [12-14]

Assessing the effectiveness of pain management is equally crucial. The Numerical Rating Scale (NRS) is commonly employed to quantify pain intensity but offers limited insights into the cumulative effects of analgesic interventions. In contrast, the Total Pain Relief (TOTPAR) score provides a more comprehensive assessment by evaluating cumulative pain relief percentages over time. [15-17] Studies using TOTPAR have consistently demonstrated its value in evaluating multimodal analgesic protocols, especially in orthopedic surgery. [18-20]

Despite these advancements, challenges remain. Variability in patient responses, inconsistent use of standardized pain metrics, and the risks of opioid-related complications emphasize the need for continued research and individualized pain management. [21-23] This study aims to evaluate 50% pain relief within 48 hours using TOTPAR in postoperative orthopedic patients and to assess the efficacy of multimodal analgesia in enhancing recovery and patient outcomes. [24, 25]

2. MATERIALS AND METHODS

Study Design

A prospective, observational study was conducted on 148 patients undergoing elective orthopaedic surgeries in the Department of Orthopaedics at the Owaisi Group of Hospitals. The study was approved by the Institutional Ethics Committee (2024/59/081) and carried out over a period of six months.

Study Criteria

Inclusion Criteria

Patients aged 18 years and above undergoing elective orthopedic surgery on upper or lower limbs.

Patients who provided informed consent.

Exclusion Criteria

Patients below the age of 18 years.

Pregnant or lactating women.

Patients experiencing chronic pain unrelated to surgery.

Patients with bone tumors.

Data Collection

Pre-Operative Assessment

Patient socio-demographic details such as age, gender, past medical history, personal habits, chief complaints, and history of present illness were collected from case sheets, surgical reports, and interviews. Pain intensity was recorded using two tools: The Numerical Rating Scale (NRS) and the Total Pain Relief (TOTPAR) score.

NRS scores were documented on a scale ranging from 0 (no pain) to 10 (severe pain).

TOTPAR scores were calculated using a 5-point categorical pain relief scale: none (0), slight (1), moderate (2), good (3), or complete pain relief (4).

Intra-Operative Assessment

Patients experiencing severe or unbearable pain were administered **Inj. Dynapar (Diclofenac)** once daily before surgery, along with antibiotics. The surgical procedures included Nailing, Plating, K-wire fixation, Joint Replacement, Arthroscopy and Arthrodesis. These procedures were performed under various types of anaesthesia, such as general, spinal, epidural, nerve blocks, and sedation.

Post-Operative Assessment

After surgery, patients were kept on a NBM (Nothing by mouth) protocol for six hours. Pain relief management was initiated thereafter, and TOTPAR values were documented at specific time intervals of 0, 12, 24, 36, and 48 hours. Corrected TOTPAR scores were calculated using a time factor (t_2-t_1), which was multiplied by the respective pain relief scores, as illustrated in Table 1.

Time (hours)	Initial Pain	Current Pain Relief	Corrected Time Factor (t_2-t_1)	Corrected Score (Current Pain Relief × Corrected Time Factor)
0	3	0	0	0
12	3	2	12	24
24	3	2	12	24
36	3	1	12	12
48	3	3	12	36
TOTPAR Score				96
Maximum TOTPAR (48 hours)				144
Percentage of Maximum TOTPAR				66.67%

Table 1: Calculation of TOTPAR for a Single Patient[26]

Assessment of Pain Relief Using TOTPAR

The following formula was used to calculate TOTPAR:

Maximum TOTPAR = maximum relief score × time (hours).

Percentage of maximum TOTPAR was determined to assess the effectiveness of pain relief. For instance, a TOTPAR score of 96 out of a possible maximum score of 144 indicated 66.67% pain relief.

Data Documentation and Analysis

The scores of all 148 patients were documented and analysed. TOTPAR provided a complete percentage-based picture of pain relief, while NRS offered numerical pain intensity scores.

Statistical Analysis

The statistical analysis for the study was conducted using SPSS software, version 23. Various tests were performed to analyse the data, including the dependent t-test, repeated measures ANOVA, and Pearson correlation. A confidence interval of 95% was employed, and results were deemed statistically significant if the p-value was less than 0.05.

3. RESULTS

Sociodemographic Details

The majority of patients were aged between 18-38 years, with a higher number of males. Hypertension, along with hypertension and diabetes, were the most common comorbidities. Pain was reported by all patients, with swelling and immobility also prevalent (Table 2).

Factor	Frequency	Percentage
Age		
18 - 38	63	42.56
39 - 59	50	33.78
60 – 80	29	19.59
81 & above	6	4.05
Gender		
Male	90	60.81
Female	58	39.19
Comorbidities		

Hypertension	11	7.43
Hypertension and Diabetes Mellitus	33	22.30
Hypertension, Diabetes Mellitus and Chronic Kidney Disease	3	2.03
Diabetes Mellitus	22	14.86
Diabetes Mellitus and Chronic Kidney Disease	1	0.68
Hypothyroid	4	2.70
Epilepsy	2	1.35
Coronary Artery Disease	5	3.38
Renal Calculus	1	0.68
Gall Stones	1	0.68
Pulmonary Tuberculosis	2	1.35
Others	11	7.43
Personal history		
Smoker	28	18.92
Alcoholic	9	6.08
Tobacco chewer	4	2.70
Other	5	3.38
Complaints		
Pain	148	100
Swelling	98	66.21
Immobility	51	34.45
History of Present Illness		
Skid & fall	65	43.91
Road Traffic Accident (RTA)	60	40.54
Trauma	35	23.64
Massage by Quack (Chiropractor)	10	6.75

Table 2: Sociodemographic details

Pre, Intra and Post-Operative Factors

All patients received surgery education, with a significant portion experiencing preoperative anxiety. Nailing and plating were the most common surgeries (Figure 1), with spinal anesthesia being the most widely used (Figure 2). The majority of surgeries were on the lower limb, with a smaller number on the hip and upper limb (Figure 3). Postoperative pain was moderate, and NSAIDs were the primary pain management (Table 3).

Factor	**Frequency**	**Percentage**
Education on surgery		
Yes	148	100
No	0	0

History of pre-operative anxiety		
Yes	88	59.45
No	60	40.54
History of pre-operative pain (Pre NRS-scores)		
None (0)	0	0
Mild (1-3)	0	0
Moderate (4-7)	51	34.4
Severe (8-10)	97	65.5
Type of surgery		
Nailing	64	43.24
Plating	41	27.7
Replacement		
Total Knee Replacement	1	0.67
Total Hip Replacement	2	1.35
Hemiarthroplasty	7	4.72
K-wire fixation	22	14.86
Arthrodesis	1	0.67
Arthroscopy	10	6.75
Type of Anesthesia		
General	3	2.02
Spinal	58	39.18
Epidural	48	32.43
Blocks Ankle Brachial Ring	 7 12 3	 4.72 8.10 2.02
Sedation Local Sub Arachnoid	 5 12	 3.37 8.10
Duration of Anaesthesia		
1-2 hr	75	50.67
3-4 hr	70	47.29
>5 hr	3	2.02
Site of Surgery		
Hip	30	20.27
Upper limb	18	12.16

Lower limb	100	67.57
Post-operative pain (post NRS scores)		
None (0)	0	0
Mild (1-3)	0	0
Moderate (4-7)	132	89.18
Severe (8-10)	16	10.81
History of any surgery		
Yes	12	8.10
No	136	91.89
Other sites of tissue injury		
Yes	9	6.08
No	139	93.91
Multiple site fracture		
Yes	63	42.56
No	85	57.43
Surgical duration		
1-2 hr	86	58.10
3-4 hr	62	41.89
>5 hr	0	0
Post-operative pain management		
Non-Steroidal Anti-Inflammatory Drugs (NSAIDS)	134	90.54
Opioid Analgesics	53	35.81
Others	27	18.24

Table 3: Pre, Intra, Post- Operative factors

Figure 1: Percentages of duration and different types of surgeries using clustered bar graph.

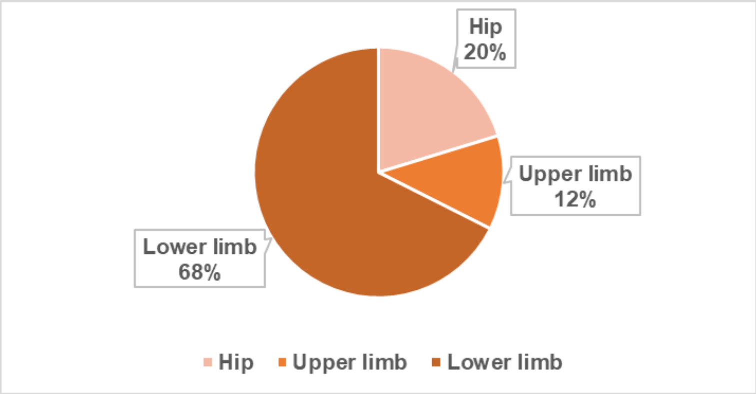

Figure 2: Pie chart illustrating various surgical sites.

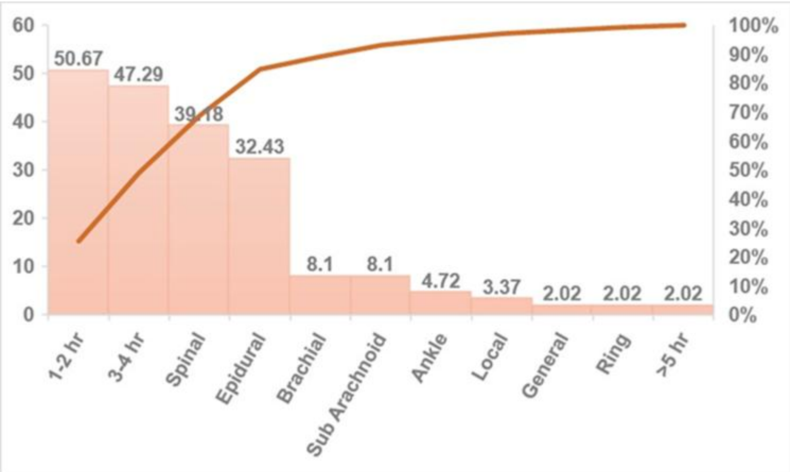

Figure 3: Percentages of duration and types of anesthesia in operative orthopaedic patients.

Postoperative Outcomes

The postoperative outcomes, including pain levels and complications, were primarily determined through the NRS pain scores as illustrated in Figure 4. As noted, the majority of patients experienced moderate pain (89.18%), with 10.81% suffering from severe pain. Postoperative complications, including infections and other site injuries, were minimal, with only 6.08% of patients reporting additional tissue injuries.

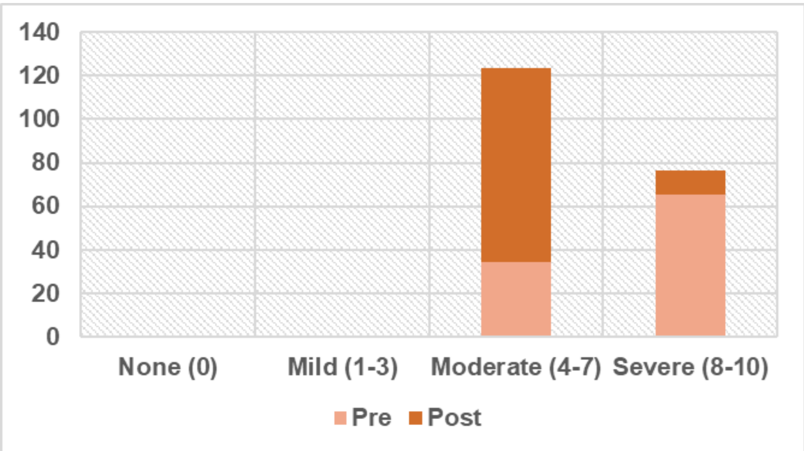

Figure 4: The stacked column graph illustrates pre and post-operative pain levels using the Numeric Rating Scale (NRS), where the highest frequency of pre-operative pain scores falls within the severe range (8-10), whereas post-operative results shows majority of scores in the moderate pain category (4-7).

Medication and Treatment

Cefuroxime and Amikacin were commonly used antibiotics, along with Paracetamol and Diclofenac for pain management. Supportive treatments included Rabeprazole, Ondansetron, and Metronidazole. Calcium, Vitamin D3 and methyl cobalamin with multivitamins were regularly administered (Table 4).

Sl. No.	Drug	Generic Name	Frequency (No. of patients)
1.	Inj. Piptaz	Piperacillin and Tazobactam	2
2.	Inj. Amikacin	Amikacin Sulphate	51
3.	Inj. Stafcure	Cefuroxime	85
4.	Inj. Monocef	Ceftriaxone	49
5.	Inj. Razo	Rabeprazole Sodium	130
6.	Inj. Zofer	Ondansetron	50
7.	Inj. Dynapar 75mg	Diclofenac Sodium	95
8.	Inj. Tramadol	Tramadol Hydrochloride	53
9.	Inj. PCM	Paracetamol (Acetaminophen)	134
10.	Inj. Metrogyl	Metronidazole	92
11.	Inj. Meaxon Gold (weekly for 6 weeks)	Methylcobalamin, Multivitamins and Minerals	97
12.	Inj. Clexane (on Day 2)	Enoxaparin Sodium	72
13.	Tab. BioD3	Cholecalciferol (Vitamin D3)	113
14.	Tab. A to Z	Multivitamins and Minerals	91
15.	Tab. Chymoral Forte	Trypsin and Chymotrypsin	39
16.	Tab. Limcee	Vitamin C (Ascorbic Acid)	102
17.	Tab. Enzitra	Trypsin, Bromelain, and Rutoside	54
18.	Tab. Nerve Plus	Methylcobalamin, Alpha-Lipoic Acid, Pyridoxine, and Folic Acid	53
19.	Tab. Ultracet	Tramadol and Acetaminophen (Paracetamol)	27
20.	Anti-depressants		24
21.	Other medications		30

Table 4: Treatment

Comparison of NRS before and after treatment

The Table 5 and Figure 5 present a comparison of Numeric Rating Scale (NRS) scores before and after treatment. Before treatment, the NRS scores ranged from a minimum of 6 to a maximum of 9, with a mean score of 7.77 ± 0.72. After treatment, the scores ranged from a minimum of 5 to a maximum of 8, with a mean score of 6.66 ± 0.71. The reduction in mean NRS scores was statistically significant, as indicated by the P-value of less than 0.0001.

Review	NRS			P value
	Minimum	Maximum	Mean± SD	
Before	06	09	7.77±0.72	<0.0001
After	05	08	6.66±0.71	

Table 5: Comparison of NRS before and after treatment

The box plot (Figure 5) visually demonstrates this reduction, with the distribution of scores after treatment being lower than those before treatment. The figure highlights a noticeable shift in the median and interquartile range, further supporting the effectiveness of the treatment.

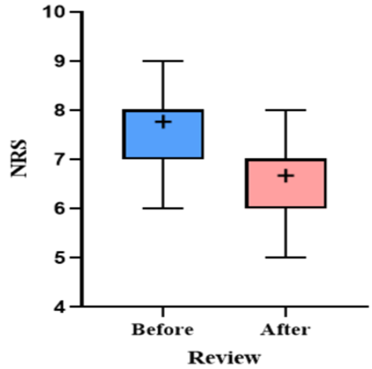

Figure 5: Numeric Rating Scale (NRS) scores before the treatment, ranged from a minimum of 6 to a maximum of 9, with a mean score of 7.77 ± 0.72 and after treatment, the scores ranged from a minimum of 5 to a maximum of 8, with a mean score of 6.66 ± 0.71(p<0.0001) using repeated measures ANOVA.

Comparison of TOTPAR before and after treatment

The Table 6 shows that the mean TOTPAR values increased significantly over time, starting from 0.24 ± 1.71 at baseline (0 hours) to 33.29 ± 5.03 at 12 hours. This improvement continued, with values stabilizing between 24 hours (28.65 ± 2.00) and 36 hours (27.86 ± 5.96), before slightly increasing again to 32.14 ± 6.13 at 48 hours. The p-value (<0.0001) indicates that these changes are statistically significant, confirming the treatment's effectiveness.

Time Interval (Hrs)	TOTPAR			P value
	Minimum	Maximum	Mean± SD	
0	0	12	0.24±1.71	<0.0001
12	24	36	33.29±5.03	
24	12	36	28.68±6.20	
36	12	36	27.86±5.96	
48	12	36	32.14±6.13	

Table 6: Comparison of TOTPAR before and after treatment

The box plot (Figure 6) visually illustrates these changes, showing an upward trend in TOTPAR values over time. The median TOTPAR increases notably after 12 hours, indicating significant pain relief, and remains consistent with slight variability between 24 and 48 hours. The variability in TOTPAR values, reflected in the standard deviation, suggests some differences in individual responses to the treatment.

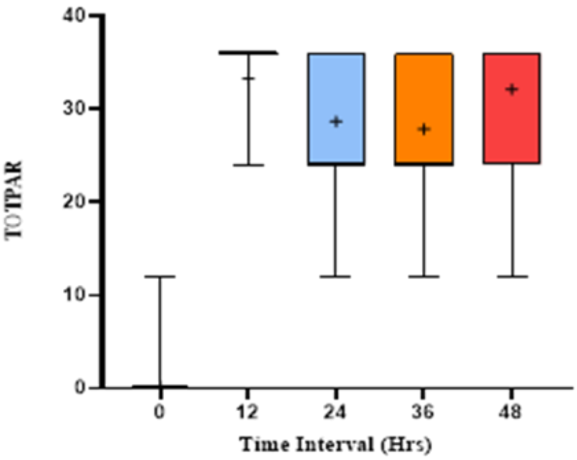

Figure 6: Mean TOTPAR analysed using repeated measured ANOVA, values starting from 0.24 ± 1.71 at baseline (0 hours) to 33.29 ± 5.03 at 12 hours. This improvement continued, with values stabilizing between 24 hours (28.65 ± 2.00) and 36 hours (27.86 ± 5.96), before slightly increasing again to 32.14 ± 6.13 at 48 hours. The p-value (<0.0001).

Correlation of TOTPAR versus length of hospital stay

The scatter plot (Figure 7) depicts the relationship between TOTPAR (Total Pain Relief) and the length of hospital stay. The correlation coefficient (r) is -0.068, indicating a very weak negative correlation. This implies that as TOTPAR increases, the length of hospital stay slightly decreases; however, the relationship is negligible.

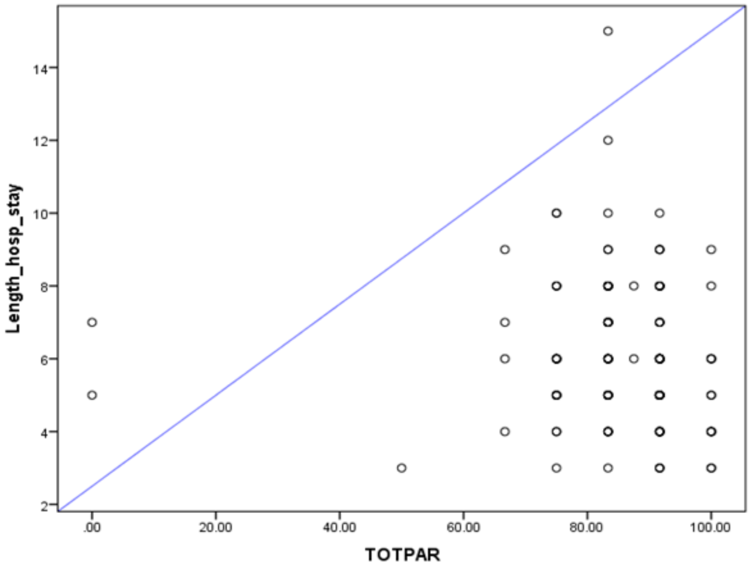

Figure 7: Scatter plot drawn using Pearson correlation depicts the relationship between TOTPAR and the length of hospital stay where the correlation coefficient (r) is -0.068, indicating a very weak negative correlation and the p-value for this analysis is 0.416, which is greater than the standard significance threshold of 0.05.

The p-value for this analysis is 0.416, which is greater than the standard significance threshold of 0.05. Therefore, the result is not statistically significant. This means that there is no evidence to suggest a meaningful inverse relationship between TOTPAR and the length of hospital stay based on the data analysed.

4. DISCUSSION

Postoperative pain management is a critical component of orthopaedic surgery, as inadequate pain relief can delay rehabilitation, prolong hospital stays, and lead to chronic pain syndromes.[1,2] Historically, opioids were the cornerstone of pain management; however, their adverse effects, including dependency and respiratory depression, necessitated the shift toward multimodal analgesia.[4,6] This study evaluated the effectiveness of multimodal analgesia using the Total Pain Relief (TOTPAR) score in 148 postoperative orthopaedic patients, comparing findings to existing literature.

The significant reduction in pain intensity observed in this study, with NRS scores decreasing from 7.77±0.72 to 6.66±0.71 ($p < 0.0001$), is consistent with prior findings emphasizing the efficacy of multimodal approaches.[5,15] Studies by Joshi et al. (2019) and Gan et al. (2019) similarly demonstrated the advantages of combining NSAIDs, opioids, and adjunct therapies in improving pain control and reducing opioid reliance.[16,19] The consistent improvement in TOTPAR scores over 48 hours (from 0.24±1.71 to 32.14±6.13) corroborates research by Moore et al. (2015) and Derry et al. (2017), which validated TOTPAR as a robust metric for cumulative pain relief.[12,17]

NSAIDs were the most commonly used analgesics in this study, followed by tramadol and adjunctive therapies. This aligns with Gonzalez et al. (2018), who highlighted NSAIDs' role in reducing inflammation and enhancing pain relief.[7] Similar findings by Ryu et al. (2020) and Aminoshariae et al. (2020) have underscored the importance of combining NSAIDs with other agents for optimal analgesic efficacy.[8,20] However, unlike Albrecht et al. (2017), who found regional anaesthesia to be superior to systemic analgesics, the limited use of nerve blocks in the present study may have influenced outcomes.[10]

One notable divergence from existing literature is the absence of a significant correlation between TOTPAR and hospital stay length ($r = -0.068$, $p = 0.416$). While Vaughan et al. (2021) and Loeser et al. (2020) reported associations between effective pain control and reduced recovery times, the present findings suggest that factors like surgical complexity or comorbidities may play a more substantial role. [3,14]

The findings of this study echo earlier research emphasizing the value of multimodal analgesia in improving pain outcomes. Studies by Hayek et al. (2019) and Turner et al. (2020) have similarly highlighted the role of adjunctive therapies like ketamine and magnesium sulfate in enhancing pain relief. [11,13] The integration of TOTPAR as a primary assessment tool aligns with recommendations by Kim et al. (2023) and Zhai et al. (2021), who emphasized the importance of comprehensive pain metrics for evaluating cumulative relief. [23,25]

Despite this alignment, the limited implementation of regional blocks in the current study contrasts with findings by Kaye et al. (2017) and Joshi et al. (2019), who demonstrated superior outcomes with nerve blocks in orthopaedic patients. [21,18] Moreover, patient variability in pain perception, as noted by O'Connor et al. (2017), may have contributed to the differences observed between TOTPAR scores and hospital stay durations. [27]

5. CONCLUSION

TOTPAR emerges as a vital tool in evaluating postoperative pain relief, particularly in orthopaedic patients where effective analgesia significantly impacts recovery trajectories. By providing a cumulative measure of pain relief, TOTPAR addresses the limitations of traditional scales like VAS and NRS, offering nuanced insights into treatment efficacy.

The integration of TOTPAR within multimodal analgesia protocols demonstrates enhanced outcomes, underscoring its relevance in modern pain management paradigms. However, addressing implementation challenges through technological innovations and standardized protocols is essential to maximize its utility.

Future research should focus on longitudinal studies that integrate TOTPAR with emerging pain assessment tools, fostering a comprehensive, patient-centric approach to postoperative care. By bridging gaps in existing methodologies, TOTPAR holds the potential to revolutionize pain management, ensuring optimal outcomes for orthopaedic patients.

6. LIMITATIONS:

Future research should address these limitations by including larger, multi-center cohorts and exploring the integration of innovative technologies such as real-time pain monitoring systems. [28,29] Additionally, examining the long-term benefits of multimodal analgesia in preventing chronic pain could provide valuable insights. Comparing TOTPAR with emerging metrics like the Quality of Recovery (QoR) score could refine postoperative protocols further. [22,24]

The present findings reinforce the utility of multimodal analgesia and standardized tools like TOTPAR in managing postoperative pain. However, continued exploration of personalized pain protocols and adjunctive strategies will be essential to optimize recovery outcomes.

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