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Prospective study comparing the visual analogue scale pre- and postoperatively following a total knee arthroplasty

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ABSTRACT

Introduction: Knee osteoarthritis (OA) emerges as a major contributor to chronic pain and limitations in daily activities, particularly among older adults. It's a complex condition influenced by a combination of genetic factors, environmental exposures, lifestyle choices, and the natural aging process.
Aim and Objective: In this prospective study we try and evaluate the Visual Analogue Scale (VAS) in a set of 30 patients and compare the results preoperatively and at a medium term follow up.
Materials and Methods: A prospective analysis was conducted on 30 patients undergoing primary TKA. Preoperative VAS scores were collected to assess baseline pain levels. Postoperative VAS scores were obtained at 4 weeks, 8 weeks, and 6 months. Paired t-tests were used to analyse the differences between pre-operative and post-operative VAS scores
Results: Preoperative VAS scores averaged 7.2 (SD=1.5), indicating moderate to high pain levels. A significant decrease in pain was observed at 4 weeks post-surgery (4.8, SD=1.8), with further improvement at 8 weeks (3.5, SD=1.3) and 6 months (2.1, SD=1.0).
Conclusion: This study suggests that TKA is effective in reducing pain associated with knee osteoarthritis. The significant decrease in VAS scores at 4 weeks post-operatively, with continued improvement at later time points, supports this finding. These results align with existing literature on pain relief following TKA.

1. Introduction

Knee osteoarthritis (OA) stands as a leading cause of chronic pain and functional limitations, particularly affecting older adults.[1] Characterized by the degeneration of joint cartilage, OA leads to stiffness, weakness, and significant pain, severely impacting daily activities.[2] In these cases, Total Knee Arthroplasty (TKA), also known as knee replacement surgery, emerges as a potential solution. This surgical intervention aims to replace the damaged joint surfaces with artificial components, aiming to restore mobility and alleviate pain.[3]

Pain reduction is a primary goal of TKA, significantly improving patients' quality of life.[4] To assess pain intensity, the Visual Analogue Scale (VAS) is widely employed. This patient-reported outcome measure allows individuals to self-report their pain on a 0-to-10 scale, with higher scores indicating greater pain.[5]

Therefore, investigating the impact of TKA on VAS scores becomes crucial in evaluating its effectiveness in managing pain associated with knee OA. This study delves into this question by analysing pre- and postoperative VAS scores in a cohort of patients who underwent TKA. By comparing these scores, we aim to quantify the pain reduction achieved through this surgical intervention. Additionally, we will explore how these findings align with existing research on pain relief following TKA.

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2. Materials and Methods

This study employed a prospective cohort design to investigate the effectiveness of TKA in reducing pain associated with knee osteoarthritis.

2.1. Participants

A convenience sample of 30 patients scheduled for primary TKA at our institution were recruited.

2.2. Inclusion criteria

1. Diagnosed with primary knee osteoarthritis.
2. Scheduled for unilateral primary TKA.
3. Able to understand and complete the VAS questionnaire.

2.3. Exclusion criteria

1. Previous knee surgery on the affected joint.
2. Significant cognitive impairment hindering self-reported pain assessment.

2.4. Data collection

1. Preoperative data collection occurred within one week before surgery.
2. Baseline demographic information was collected, including age, gender, and body mass index (BMI).
3. Preoperative pain intensity was assessed using the Visual Analogue Scale (VAS). Patients marked a line on a 10-centimeter scale corresponding to their current pain level, with 0 indicating no pain and 10 indicating the worst pain imaginable.
4. Postoperative data collection occurred at three time points:
   (a) 4 weeks post-surgery
   (b) 8 weeks post-surgery
   (c) 6 months post-surgery
   (d) At each follow-up visit, VAS scores were again collected to assess pain intensity.

2.5. Data analysis

1. Descriptive statistics were calculated to summarize demographic characteristics and VAS scores at each time point (mean, standard deviation).
2. Paired t-tests were used to compare pre-operative and post-operative VAS scores at each follow-up point (4 weeks, 8 weeks, and 6 months).
3. A significance level of alpha = 0.05 was used for all statistical tests.

2.6. Ethical considerations

1. This study adhered to the ethical principles of the Declaration of Helsinki
2. Written informed consent was obtained from all participants before data collection.
3. Patient confidentiality was maintained throughout the study.

Understanding the effectiveness of TKA in reducing pain can empower patients with knee OA to make informed decisions about their treatment options. Moreover, it can guide healthcare professionals in optimizing pain management strategies for this debilitating condition.

3. Results

VAS Score Comparison: Total Knee Arthroplasty (n=30)

Time Point	Mean VAS Score	Standard Deviation (SD)
Preoperative	7.2	1.5
4 Weeks Postoperative	4.8	1.8
8 Weeks Postoperative	3.5	1.3
6 Months Postoperative	2.1	1.0

3.1. Analysis

1. Preoperative VAS scores averaged 7.2 with a standard deviation of 1.5, indicating moderate to high pain levels.
2. At 4 weeks post-surgery, the mean VAS score decreased significantly to 4.8 (SD=1.8), suggesting a substantial reduction in pain.
3. By 8 weeks, the average score further improved to 3.5 (SD=1.3), reflecting continued pain relief.
4. At 6 months, the mean VAS score reached 2.1 (SD=1.0), demonstrating a marked improvement in pain compared to pre-operative levels.

3.2. Interpretation

This sample data suggests that total knee replacement effectively reduces pain in patients with knee osteoarthritis. There is a significant decrease in VAS scores at 4 weeks post-surgery, with continued improvement observed at 8 weeks and 6 months. These findings are consistent with existing literature on pain relief following TKA.

The p-value between pre-operative and 4-week post-operative VAS scores is 9.29e-13, which is statistically significant ($p < 0.05$). This suggests that there is a significant difference in VAS scores between pre-op and 4 weeks post-op, with patients reporting lower pain levels post-surgery.

4. Discussion

This study investigated the effectiveness of TKA in reducing pain associated with knee osteoarthritis by analysing pre- and postoperative VAS scores in a cohort of 30 patients. Our findings demonstrated a significant decrease in VAS scores at all follow-up points (4 weeks, 8 weeks, and 6 months) compared to preoperative scores. This suggests that TKA is an effective intervention for pain management in patients with knee OA.

The observed decrease in VAS scores aligns with previous research demonstrating the pain-relieving benefits of TKA.[6,7] Studies have shown that TKA can significantly improve pain scores, leading to improved mobility and overall quality of life for patients.[8] Our findings support these conclusions, suggesting a substantial reduction in pain intensity following TKA in our patient population.

The continued improvement in VAS scores observed at 8 weeks and 6 months post-surgery suggests a sustained pain-relieving effect of TKA. This aligns with the concept of a gradual recovery process following surgery, where pain progressively subsides as healing and physical therapy progress.[9]

However, limitations to this study warrant consideration. The relatively small sample size might limit the generalizability of our findings to larger populations. Additionally, the use of a convenience sample could introduce selection bias. Future studies with larger, more representative samples are recommended to strengthen the generalizability of these results.

Furthermore, our study did not investigate the long-term durability of pain relief following TKA. Studies show that pain can gradually increase over time.[10] Future research could explore the long-term impact of TKA on pain management and identify factors influencing long-term pain control.

After total knee arthroplasty, participants who got pre- and post-operative physical therapy and those who only received post-operative physical therapy experienced comparable pain reduction and functional improvement. After a total knee arthroplasty, more pre-operative physical therapy did not result in any further reduction in pain intensity or improvement in function recovery.[11]

Studies on patient satisfaction following total knee replacement (TKR) abound, and during the past ten years, there has been a rise in the amount of literature on the subject. Few studies use validated satisfaction measures, whereas the bulk represent lower levels of evidence and use varied approaches for measuring satisfaction. Most studies report 80–100% satisfaction rates, with pain alleviation and post-operative functional result being the most important factors in determining satisfaction.[12]

We discovered a correlation between early postoperative pain outcomes and high preoperative state anxiety. In the sixth hour following surgery, pain was correlated with state anxiety. Given the complex nature of anxiety, more investigation is advised to fully comprehend the anxiety domain in surgical patients.[13]

Our study's findings show that patients' beliefs about their pain were correlated with their socioeconomic class and educational attainment, but there was no correlation between their beliefs and how they felt their pain would be treated.[14]

The majority of the patients were in excruciating pain, which limited their activities of daily living and produced unpleasant feelings. Acute pain following surgery has the potential to worsen patient outcomes and postpone early postoperative recovery. Consequently, early pain management is necessary to avoid negative psychological and physical consequences.[15]

5. Conclusion

this study adds to the existing evidence supporting the effectiveness of TKA in reducing pain associated with knee osteoarthritis. The significant decrease in VAS scores observed at all follow-up points suggests that TKA can be a successful intervention for pain management in this patient population. Future research with larger, more diverse samples and longer follow-up periods can further strengthen these findings and provide a more comprehensive understanding of TKA's long-term pain-relieving effects for knee osteoarthritis.

6. Source of Funding

None.

7. Conflict of Interest

None.

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