

Pain management optimisation strategies, evaluation after total knee replacement surgery using Tramadol and Acetaminophen

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Abstract

Objectives: Total Knee Replacement (TKR) is a common orthopaedic surgical procedure executed to relieve pain and restore function in patients with severe knee joint pain. However, Notable postoperative pain is predominately experienced after surgery and that may interfere with early functional recovery. Effective pain control strategies are required to improve patient recovery and clinical outcomes. The combination of Tramadol and Acetaminophen is widely used as part of the therapy for pain management. This research aims to evaluate the effectiveness of tramadol and acetaminophen in reducing postoperative pain in patients undergoing total knee replacement surgery and to assess variations in pain reduction among patients using different factors.

Methodology: Prospective observational study in orthopaedic department at tertiary care hospital for 6 months is done. Subjects with osteoarthritis (OA) who underwent TKR will have their pain score recorded. To be eligible for inclusion, patients must satisfy the following requirements: they must be above 50 years old, have a confirmed diagnosis of OA and have access to their medication chart. The goal of this study is to conduct a focused investigation on pain management after combinational therapy by excluding pt's under 50 years, individuals with cancer and pregnancy. Age, gender, comorbidities, length of illness, and medication usage are some of the demographic details that will be collected. Postoperative pain was assessed using the Numeric Rating Scale (NRS) and Visual Analog Scale (VAS) for the consecutive days following surgery. Patients received a combination therapy of tramadol and acetaminophen as part of the postoperative analgesic regimen. Pain scores were recorded daily and analysed to determine the trend of pain reduction. Additional observations were made to compare the relation between pain reductions with respect to other factors among every patient.

Results: A non-random purposive selecting strategy was used to choose 62 patients in total for the investigation. The results showed a gradual reduction in pain scores over the consecutive postoperative period in most patients receiving tramadol and acetaminophen. Pain levels were highest on the first postoperative day and progressively decreased in further days. However, a comparatively slower reduction in pain scores was observed in patients with comorbid patients, suggesting that these groups may experience delayed pain relief due to factors such as impaired healing, altered pain perception, and comorbid conditions.

Conclusion: From the obtained data we analysed that affected individuals are more females (61%). The combination of Tramadol (TRA) and Acetaminophen (APAP) was found to be an effective strategy for postoperative pain management, demonstrating a steady reduction in pain scores over the days. However, comorbid patients showed delayed pain reduction.

Keywords: TKR, OA, NRS, VAS, TRA, APAP, analgesic regimen

Introduction

Osteoarthritis (OA) is the most common type of arthritis and a leading cause of disability worldwide. It is a chronic and progressive condition involving the joints and affects the articular cartilage and the surrounding tissues. It is characterized by the progressive changes in the cartilage and the underlying bone, as well as the formation of osteophytes.

Osteoarthritis, therefore, a chronic degradative joint disease with increasing damage to the articular cartilage, remodeling of the bone beneath the cartilage, and growth of bony spurs, as well as mild synovial inflammation. These changes cause pain, stiffness, and limited movement in the affected joint.

Osteoarthritis is also known as Wear-and-tear arthritis. It is the most common form of arthritis and primarily affects weight-bearing joints such as knees, hips, and spine. However, other joints such as the hands are also affected. Osteoarthritis is more common in the elderly and has considerable social and economic impacts because of the

reduced productivity and the cost of managing the condition.

Epidemiology

Globally, 607 million people had osteoarthritis (OA) in 2021. There were 46.6 million new cases and 21.3 million disability-adjusted life years (DALYs) that year. The age-standardized incidence, prevalence, and DALY rates rose to 535.00, 6967.29, and 244.50 per 100,000 people. Knee OA made up more than 56% of these cases. The rates of OA were higher in women than in men. East Asia, South Asia, and Western Europe had the highest numbers, while China, India, and the United States had the most significant burdens. Additionally, a high body mass index (BMI) led to 4.43 million DALYs, which is an increase of 205.10%. Projections indicate that the burden of OA will keep growing over the next 30 years.

Osteoarthritis affected 528 million people globally in 2019, a 113% increase from 1990. Approximately 60% of those

with osteoarthritis are female, and 73% of those affected are over 55. The knee is the most commonly affected joint, with a prevalence of 365 million, followed by the hand and hip. Rehabilitation could be beneficial for 344 million people with moderate to severe osteoarthritis. Osteoarthritis is predicted to become more commonplace worldwide due to aging populations, rising obesity and injury rates, and other factors.

Primary (Idiopathic) Osteoarthritis

Primary osteoarthritis occurs without a clear cause and mainly relates to aging and the natural wear and tear of the joints. It typically develops gradually and often affects the knees, hips, spine, and small joints of the hands.

Secondary Osteoarthritis

- 1. Aging:** Aging is a key factor in the development of osteoarthritis. As people get older, the cartilage in the joints becomes thinner, loses elasticity, and its ability to heal diminishes. This leads to gradual joint degeneration.
- 2. Joint Injury or Trauma:** Past joint injuries, like fractures, or ligament tears, can damage the cartilage and joint structures. This damage may later lead to osteoarthritis.
- 3. Obesity:** Obesity contributes to osteoarthritis by placing extra stress on weight-bearing joints, such as the knees and hips. This additional pressure speeds up cartilage breakdown.
- 4. Genetic Factors:** Genetic factors play a role in osteoarthritis. Individuals with a family history of the disease may inherit structural or biochemical issues in their cartilage, raising their risk.
- 5. Congenital or Structural Joint Abnormalities:** Congenital abnormalities, like joint malalignment or hip dysplasia, can cause uneven weight distribution across the joint surface. This may speed up cartilage degeneration.

Pathophysiology

Osteoarthritis is considered to be a degenerative arthritis in which there is progressive destruction of articular cartilage and changes in underlying bone and supporting structures. The pathophysiology of osteoarthritis is believed to start with damage to the articular cartilage, which can occur due to various reasons, resulting in loss of smooth and elastic consistency. The chondrocytes present in the cartilage produce destructive enzymes called matrix metalloproteinases, which destroy collagen and proteoglycans, thereby causing more damage to the cartilage.

Various pro-inflammatory cytokines, including IL-1 and TNF- α , are produced, which cause more inflammation and damage to the cartilage. The underlying bone is exposed and becomes thick due to this damage, which is called subchondral sclerosis. The body tries to compensate for this damage by developing new bony outgrowths called osteophytes at the margins of the joint. In addition, there is mild inflammation of the synovial membrane due to damage

to the cartilage, resulting in increased fluid in the joint, causing swelling.

Methodology

Materials and Methods

Study Design and Duration: This research followed participants for six months in a prospective observational fashion.

Source of Data

1. Patient prescriptions.
2. Case report forms.
3. Patient case sheets / Medications charts.
4. Pain assessment scales.

Sample Size

The study will include all cases of patients who underwent TKR for osteoarthritis in the Department of Orthopaedics during the study period, with an estimated sample size of 62.

Inclusion Criteria

- Patients with osteoarthritis.
- Patients who underwent TKR.
- Men and women aged ≥ 50 years.
- Willing and able to give written informed consent form.

Exclusion Criteria

- Patients with cancer.
- Pregnancy and lactating women.
- Patients below 50 years.

Study Centre: The research took place at Kamineni academy of medical science, Research centre and Hospital, Lb Nagar, Hyderabad, Inpatient of orthopaedic department.

Plan of Study

The suggested research was intended to be conducted in four stages.

- Phase I Getting hospital authorities' approval and submitting the protocol.
- Literature research and the creation of a permission form, patient data, and a structured data input format.
- Phase II involves gathering data and conducting a literature survey (continued).
- Phase III involves screening the lab data, analyzing the data, presenting the data graphically, and interpreting the data.
- Phase IV involves creating the project report and submitting it to the research department.

Results

Demographic Details

Table 1: Age

S. No	Age (years)	Frequency	Percentage (%)
1	>70	20	32.3
2	50-60	19	30.6
3	61-70	23	37.4

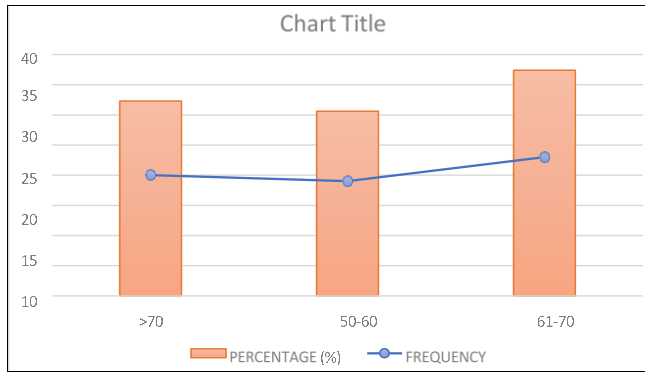


Fig 1

The study included a total of 62 patients undergoing total knee replacement surgery, all of whom received Tramadol/Acetaminophen as part of postoperative pain management. Most patients belonged to the 61–70 years age group (37.1%), followed by those aged above 70 years (32.3%) and 50–60 years (30.6%).

Gender: This statistic depicts the gender wise distribution of subjects with severe osteoarthritis who underwent TKR Surgery. About 62 were taken into consideration within given period of time.

Table 2: Gender

Gender	No. of subjects	Percentage (%)
Males	24	38.7%
Female	38	61.2%

Among the 62 patients included in the study, females constituted the majority (61.3%), while males accounted for 38.7%. This reflects a higher prevalence of osteoarthritis and subsequent total knee replacement surgeries among females. All patients, irrespective of gender, received a standardized regimen of Tramadol/Acetaminophen for pain management. The gender distribution provides a basis for comparing differences in pain perception and response to treatment. Such variation is clinically relevant, as hormonal and physiological factors may influence pain outcomes.

Table 3: Past Medical history

Condition	Frequency
Hypertension (HTN)	16
Diabetes Mellitus (DM)	3
Hyperthyroidism	2
Hypothyroidism	3
HTN + DM	11
HTN + Hypothyroidism	3
No comorbidities	24

Data shows the number of different health conditions found within the subjects. Most of the subjects were found to have no condition (Nil) - 24 individuals. This shows that most of the subjects were healthy.

A smaller number of subjects were found to have hypertension combined with diabetes mellitus, totaling 11 subjects. Diabetes mellitus alone was found in only 3 subjects. Thyroid disorders were found to be fewer, with hypothyroidism found in 3 subjects, while hyperthyroidism was found in 2 subjects. Furthermore, 3 subjects were found to have hypertension combined with hypothyroidism. Most

subjects were found to have health conditions, with hypertension being the most common.

Table 4: Effectiveness of Tramadol/Acetaminophen

Paired T test		Mean	Std. Deviation	Std. Error Mean	Two-Sided p
Pair 1	Pain score before visit - PS after surgery Day 1	1.5	0.647	0.082	<.001
Pair 2	Pain score before visit - PS Day 2	2.242	0.935	0.119	<.001
Pair 3	Pain score before visit - PS Day 3	3.484	1.251	0.159	<.001
Pair 4	Pain score before visit - PS Day 4	5.279	1.743	0.223	<.001

The effectiveness of Tramadol/Acetaminophen in reducing postoperative pain was assessed using paired t-test analysis. A statistically significant reduction in pain scores was observed when comparing preoperative values with postoperative Day 1, Day 2, Day 3, and Day 4 ($p < 0.001$ for all comparisons). The mean difference in pain scores increased progressively over time, indicating sustained analgesic effectiveness.

Discussion

Pain management after total knee replacement Surgery in osteoarthritis patients using Tramadol and Acetaminophen was estimated in this prospective observational investigation. We gathered information from inpatients for this investigation. Non-random purposive sampling was used to select 62 patients for the study.

The study comprised 62 subjects, who showed a fair distribution of ages, although the majority belonged to the age group of 61-70 years (37.4%), followed by those above 70 years (32.3%), and the least number of subjects belonged to the age group of 50-60 years (30.6%). This suggests that the sample was slightly skewed towards older people, which is expected in diseases requiring surgical interventions, especially degenerative disorders. The gender distribution showed more females (38) compared to males (24), which might reflect a higher prevalence of the condition among females or more health-seeking behavior among females. The comorbidity analysis showed that the majority of the subjects had no associated diseases, although among those who had, hypertension was the commonest, followed by hypertension and diabetes mellitus. This is expected because it is known that patients within this age group are more likely to have other diseases, which might affect the outcome of their condition.

Preoperative pain levels were high for the majority of the patients, as indicated by a mean score of ≈ 6.37 . This validates the rationale for surgery. Pain levels were under control on the day after surgery, as indicated by a score of 0. This validates the use of anesthesia during surgery. On the other hand, the majority of the patients had moderate levels of pain on the first day after surgery, as indicated by a score between 4 and 6 for 79% of the patients.

Analysis according to the age groups indicated that the patients over 70 years had high pain levels and slower recovery compared to the younger groups. This may be

attributed to the fact that the body's resilience decreases with age, and the healing process is slower.

Analysis according to the gender groups indicated that the female groups had slightly higher average pain levels compared to the male groups at all stages. However, both groups had a declining average pain level. This may be attributed to various factors related to the female body compared to the male body.

Conclusion

The present study results reveal that surgical intervention is effective in significantly reducing pain among patients. It was found that the mean preoperative pain score was moderate to severe (≈ 6.37). Pain was completely under control during surgery due to good anesthesia. Although moderate pain was present on Day 1 postoperatively, a steady decline in pain scores was observed on Day 4 (≈ 3.32). This reveals the effectiveness of postoperative pain management and the healing process.

The results of the present study also reveal that age, gender, and comorbid conditions affect pain. It was observed that older patients (>70 years) and those with comorbid conditions had higher pain scores and took longer to recover. However, young patients recovered fast. It was also observed that females had slightly higher pain scores than males. However, both genders had similar recovery patterns. Thus, the results of this study reveal that surgical intervention and combinational therapy of tramadol and acetaminophen were effective in significantly reducing pain among patients. Pain scores were reduced to almost half by the fourth postoperative day.

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