

Comparison Of Ketorolac Versus Ibuprofen For Postoperative Pain Management In Total Abdominal Hystrectomy Surgeries

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Abstract:-

Background -

Postoperative pain management is crucial for ensuring patient comfort and promoting faster recovery. Pharmacological interventions, such as NSAIDs, play an essential role in reducing pain intensity while minimizing opioid-related side effects. Ketorolac, a potent NSAID, and ibuprofen are both commonly used for pain relief. This study focuses on comparing the efficacy of these two drugs for pain management in total abdominal hysterectomy surgeries.

Aim -To assess and compare the effects of intravenous ketorolac and intravenous ibuprofen on postoperative pain management in total abdominal hysterectomy patients.

Materials and Methods: A randomized single-blind study was conducted on 30 patients, divided into two groups (Group K: ketorolac, Group I: ibuprofen). Various parameters, including VAS pain scores, sedation, time for rescue analgesia, and the number of rescue analgesics, were compared.

Participants: 30 patients undergoing total abdominal hysterectomy, randomized into two groups (Group K: ketorolac, Group I: ibuprofen).

Inclusion Criteria: Patients between 18 and 65 years of age undergoing elective surgery, ASA grade I or II.

Exclusion Criteria: Patients with NSAID hypersensitivity, coagulation disorders, bronchial asthma, hepatic or renal failure, and peptic ulcers.

Methodology: Patients received lumbar subarachnoid block, followed by either 30 mg of ketorolac or 800 mg of ibuprofen postoperatively. Rescue analgesics were provided if needed.

Results: The postoperative pain scores were significantly lower in the ibuprofen group. Time for first rescue analgesia and the total number of rescue analgesics required were also lower in the ibuprofen group.

Conclusion: Intravenous ibuprofen was superior to ketorolac for reducing postoperative pain, providing better hemodynamic stability and lesser opioid consumption.

Keywords: Ketorolac, Ibuprofen, postoperative pain, hysterectomy, analgesia, VAS score.

I. Introduction

Postoperative pain management is a critical aspect of patient care following surgical procedures⁽¹⁾. Effective pain control not only improves patient comfort and satisfaction but also facilitates faster recovery and reduces the risk of complications⁽²⁾. It involves a combination of pharmacological and non-pharmacological interventions depending on the individual patient's needs and the type of surgery performed⁽³⁾.

Effective postoperative pain management requires a multidisciplinary approach involving surgeons, anesthesiologists, nurses, pharmacists, and other healthcare professionals⁽⁴⁾. Individualized pain management plans should consider factors such as the patient's medical history, surgical procedure, pain intensity, and risk factors for adverse effects⁽⁵⁾.

Pharmacological interventions commonly used in postoperative pain management include opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, and adjuvant medications such as local anesthetics⁽⁶⁾. Opioids are often necessary for managing moderate to severe pain but are associated with adverse effects such as sedation, respiratory depression, nausea and constipation⁽⁷⁾. Therefore, opioid-sparing strategies, such as multimodal analgesia, are increasingly favoured to minimize opioid-related side effects while providing effective pain relief⁽⁸⁾.

Non-pharmacological interventions, including regional anesthesia techniques (e.g., epidural analgesia, peripheral nerve blocks), physical therapy, acupuncture, and psychological interventions (e.g., relaxation techniques, cognitive-behavioral therapy), can complement pharmacological treatments and help optimize pain control and patient outcomes⁽⁹⁾.

Ketorolac tromethamine, commonly known as ketorolac, is a potent nonsteroidal anti-inflammatory drug (NSAID) used primarily for its analgesic and anti-inflammatory properties. It is available in both oral and parenteral formulations and is frequently utilized for the short-term management of moderate to severe pain, such as postoperative pain, musculoskeletal pain, and renal colic⁽¹⁰⁾.

It is considered one of the most potent NSAIDs available for managing pain, comparable to opioid analgesics in efficacy⁽¹¹⁾. This potency is attributed to its mechanism of action, which involves inhibition of cyclooxygenase (COX) enzymes, thereby reducing the production of prostaglandins involved in pain and inflammation⁽¹²⁾.

One of the most concerning adverse effects is the increased risk of gastrointestinal (GI) ulcers, bleeding, and perforation⁽¹³⁾. The mechanism underlying this risk involves the suppression of prostaglandin synthesis by ketorolac, which normally helps maintain mucosal integrity in the stomach and intestines⁽¹⁴⁾. To mitigate this risk, ketorolac is typically recommended for short-term use, usually not exceeding five days, and caution is advised in patients with a history of GI ulcers or bleeding disorders.⁽¹⁵⁾

Another important consideration is the potential for cardiovascular events associated with ketorolac use. NSAIDs, including ketorolac, have been linked to an increased risk of myocardial infarction, stroke, and other cardiovascular complications, particularly in patients with preexisting cardiovascular disease or risk factors⁽¹⁶⁾. The exact mechanisms underlying these cardiovascular effects are not fully understood but may involve alterations in platelet function, renal hemodynamics, and vascular reactivity⁽¹⁷⁾.

Ketorolac can cause dose-dependent decrease in renal blood flow and glomerular filtration rate, potentially leading to acute kidney injury or exacerbation of chronic kidney disease⁽¹⁸⁾.

Ibuprofen is a nonsteroidal anti-inflammatory drug (NSAID) commonly used to relieve pain, reduce inflammation, and lower fever⁽¹⁹⁻²⁰⁾. Ibuprofen comes in different forms such as tablets, capsules, and liquid suspension⁽²¹⁾. Racemic ibuprofen and S(+) enantiomer are mainly used in the treatment of mild to moderate pain related to dysmenorrhea, headache, migraine, postoperative dental pain, management of spondylitis, osteoarthritis, rheumatoid arthritis and soft tissue disorder⁽²²⁾.

Therapeutic applications include PDA, Rheumatoid arthritis, Osteoarthritis, cystic fibrosis, orthostatic hypotension, dental pain, dysmenorrhoea, headache, fever, prophylaxis of alzheimer's disease, parkinson's disease, breast cancer.⁽²³⁾

Common side effects include stomach upset, nausea, heartburn, and dizziness. Long-term or high-dose use can increase the risk of more serious side effects such as stomach ulcers, gastrointestinal bleeding, kidney damage and cardiovascular issues, rashes and dress syndrome.^(24,25)

Contraindications include known history of hypersensitivity or allergic reactions to the drug itself, other NSAIDs, or aspirin.⁽²⁶⁾

In preterm neonates, ibuprofen lysine IV formulation is contraindicated in those with congenital heart diseases requiring patency of the PDA, active bleeding, thrombocytopenia, renal impairment, coagulation defects, and proven or suspected necrotizing enterocolitis⁽²⁷⁾

Aim

The aim of the study is to assess and compare the effect of intravenous ketorolac versus intravenous ibuprofen as analgesic for postoperative pain management in total abdominal hysterectomy patients.

Objectives:

- 1) To assess the efficacy of intravenous ketorolac and ibuprofen
- 2) Reduce the postoperative pain
- 3) Reduce rescue analgesic requirements
- 4) Reduce the consumption of opioids

II. Materials And Methods

Ethical considerations: Approval from the institutional ethical committee of Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram (Dist), Andhra Pradesh was obtained. We have taken informed consent from every patient included in the study. We have taken permission for data collection and publication.

Study site type and source of patients: This randomized single blinded study was done in the Department of Anaesthesiology at MIMS, Vizianagaram, Andhra Pradesh, India.

Study duration and sample size: 6 months: March 2023 to August 2023

Study Subjects

30 Patients were randomized into 2 groups of 15 patients each as follows:

1. Group K (Received iv ketorolac)
2. Group I (Received iv ibuprofen)

Inclusion Criteria

- 1) Patients between 18 and 65 years who have given their consent.
- 2) ASA grade I and grade II
- 3) Elective surgery for Total abdominal hysterectomy

Exclusion Criteria

- 1) Hypersensitivity to NSAIDS
- 2) Coagulation disorders
- 3) Bronchial Asthma
- 4) Hepatic and Renal failure
- 5) Peptic ulcer
- 6) Alcohol and substance addiction
- 7) Psychiatric and neurological diseases

III. Methodology

After obtaining approval of the Institutional Review Board, all women scheduled for total abdominal hysterectomy at a single institution were screened for participation.

Those excluded had allergy to any NSAID; renal dysfunction, hepatic dysfunction, gastrointestinal ulcers, bleeding, or perforation or poorly controlled asthma.

All patients provided written, informed consent.

Randomization occurred via standard computer-based, pseudo-random number generation using opaque sealed envelopes, under supervision of the Director of Pharmacy. Group allocation remained concealed to all participants, healthcare providers, and data collectors until after study conclusion and database lock.

All patients were given lumbar subarachnoid block in the sitting position with bupivacaine 15 mg (3cc) and dexmedetomidine 10 µg, and no other intra-operative analgesic medication.

Patients are kept in supine position following intrathecal injection to achieve a minimum T6 analgesia level, measured 10 min later.

All patients received intravenous hydration prior to placement of the subarachnoid block, and replacement of intra-operative losses with a balanced electrolyte, clear intravenous fluid.

Patients received

30 mg ketorolac (K)

800 mg ibuprofen(I) diluted in 100 mL NaCl administered within 30 min of skin closure, followed by 3 additional doses every 6 hours.

Patients received instructions to request rescue analgesia if pain occurs.

Rescue analgesia Tramadol 100mg iv given.

Parameters

Age

Height

Weight

Hemodynamic variables

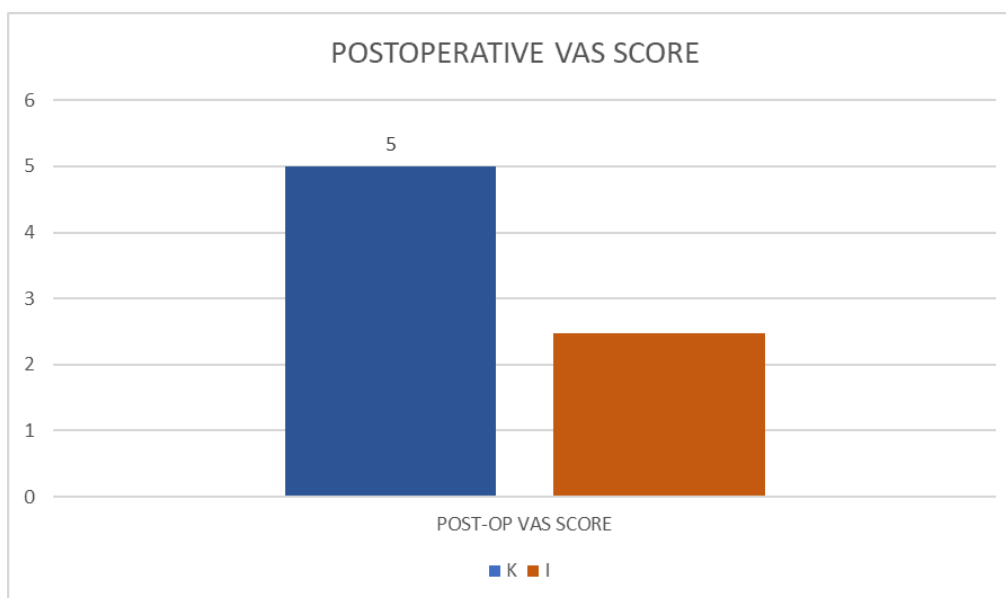
VAS score

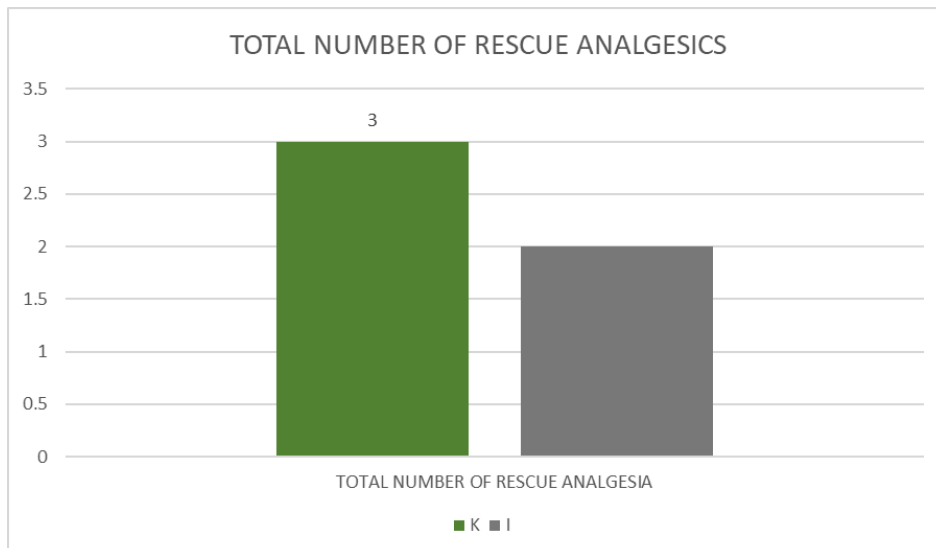
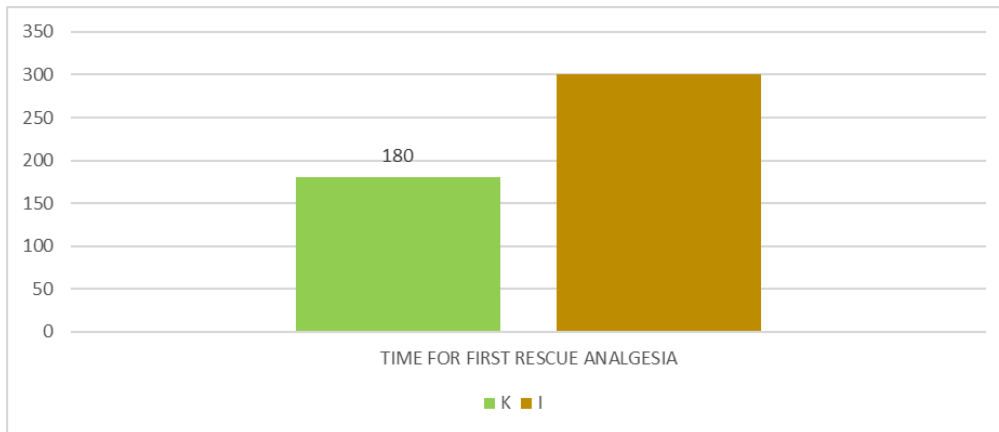
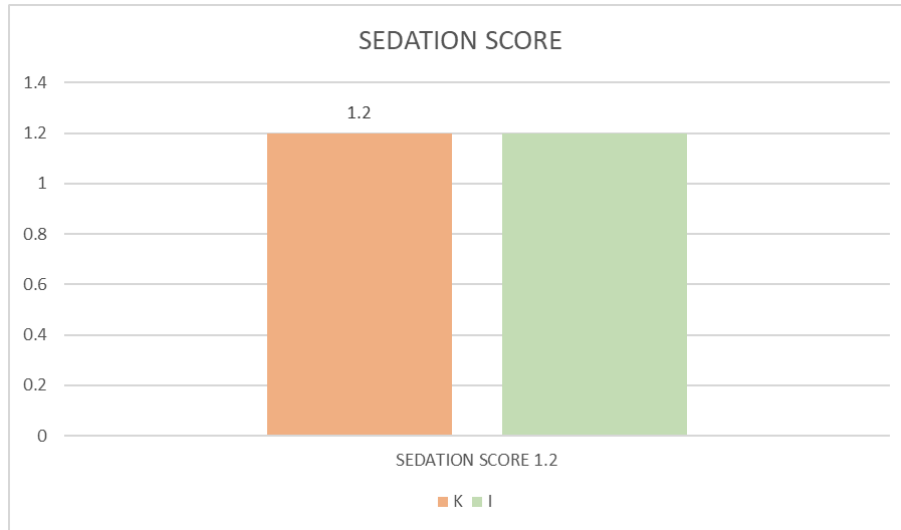
Sedation score

Rescue analgesics

Total number of rescue analgesics

Parameters	Ketorolac (Mean ±Sd)	Ibuprofen (Mean ±Sd)	P Value
Age (Years)	47.53±8.47	51.73±7.50	0.16
Height(Cm)	149.47±4.08	149.8±5.31	0.85
Weight(Kg)	60.20±2.63	57.47±3.81	0.63
Systolic Blood Pressure (Sbp)	126.7 ±20.53	125.93±15.29	0.90
Diastolic Blood Pressure (Dbp)	78.71± 10.70	80.14±14.20	0.75
Heart Rate (Bpm)	77.2±5.8	79.5± 4.2	0.22
Saturation (%)	97.77±0.2	97.62±0.1	0.09
Postoperative Pain Score (Vas Score)	5±0.63	2.47±0.50	<0.0001*
Patient Satisfaction Score	4±2.1	3±1.5	0.14
Sedation Score	1.2±0.42	1.2±0.45	1
Time For First Rescue Analgesics(Min)	180±5.52	300±15.62	<0.0001*
Total Number Of Rescue Analgesics (Tramadol)	3±1.1	2± 0.8	0.008*





IV. Discussion

NSAIDs have long been employed in diverse clinical contexts to alleviate pain and inflammation. Moreover, evidence suggests that combining NSAIDs with opioid analgesics is more effective for managing postoperative pain and inflammation than using either as a monotherapy. However, the adverse side effects of opioids—such as respiratory depression, drowsiness, moderate sedation, itching, ileus, urinary retention, and inadequate pain relief from tissue inflammation—prompted us to investigate a different NSAID, ibuprofen.⁽²⁸⁾

This study was a randomized controlled trial with 30 patients that allocated into two groups, Group K and Group I and compared two intravenous NSAIDs, ketorolac and ibuprofen, to assess pain management and patient satisfaction within a standardized postoperative pain regimen following total abdominal hysterectomy surgery. Generally, patients were very satisfied with their pain management in the hospital and reported low levels of pain.

Demographic data was obtained by T-test. Chi-square test was used to compare categorical values across the group.

There was no significant difference between the two groups in terms of age, height and weight.

In this study, mean postoperative pain scores in ibuprofen (I) group was 2.47 ± 0.50 and in ketorolac (K) group was 5 ± 0.63 .

The mean time for first rescue analgesia in ketorolac (k) group was 180 ± 5.52 min and in ibuprofen (I) group was 300 ± 15.62 min.

The total number of rescue analgesics in ketorolac group was 3 ± 1.1 . The total number of rescue analgesics in ibuprofen group was 2 ± 0.8 .

Postoperative pain scores were lower in ibuprofen group (2.47 ± 0.50) when compared to ketorolac (5 ± 0.63) group which was statistically significant ($p < 0.0001$).

Similarly, **Shehab, Ahmed S et al .(2024)**⁽³⁰⁾ Ibuprofen group) showed a lower VAS score through all the 24 h postoperatively at rest and during movement with all over VAS at rest (3.17 ± 1.08) versus (4.32 ± 1.3) $P=0.008$ and all over VAS during movement (3.21 ± 1.11) versus (4.56 ± 1.92) $P=0.001$.

Mohammad Mehdi Forouzanfar et al 2019⁽³¹⁾ pain severity in the ketorolac group was significantly higher than the group receiving ibuprofen ($P < 0.0001$) for all comparisons.

Patient satisfaction score was higher in ketorolac when compared to ibuprofen group . Similarly, **Sarah Amin et al 2024**⁽³²⁾ , concluded that patients' satisfaction was slightly higher in the ketorolac group than the ibuprofen group.

Iman S. Aboul Fetouh et al 2022⁽³³⁾ revealed less pain and better satisfaction scores in the ketorolac group.

Negin Shahrokhzadeh et al ,2023⁽³⁴⁾ demonstrated that the postoperative administration of ketorolac 30 mg presents better results on patient satisfaction when compared to parecoxib after third molar surgery. Sedation score did not much differed in ketorolac and ibuprofen groups.

Similarly, **Nancy A. Morrison et al, 1994**⁽³⁵⁾ concluded that there was no significant difference between the ketorolac, ibuprofen and acetaminophen regarding the sedation scores.

Gago Martínez A et al, 2016⁽³⁶⁾ documented that relative to Ramsay-Hunt sedation scale, 1 h after surgery 82.54% and 81.94% of patients treated with placebo and ibuprofen, respectively, were calm, co-operative and communicative. From then up to 24 h the proportion of patients being calm, co-operative and communicative were also very similar in both treatment arms, ranging between 87.54% and 94.44% in the ibuprofen group, and between 88.89% and 96.83% in the placebo group.

Time for first rescue analgesic was earlier in ketorolac group (180 ± 5.52 min) when compared to ibuprofen group (300 ± 15.62 min) which was statistically significant ($p < 0.0001$).

Likewise, **Shehab, Ahmed et al, 2024**⁽³⁰⁾ reported that first analgesic dose in group B (ibuprofen group) with a mean value of (328.0 ± 89.63) min versus (158.40 ± 57.13) min in group A (ketorolac group) $P=0.001$ with more haemodynamic stability.

Uribe AA et al 2018⁽³⁷⁾ documented that the mean time to first rescue medication was 77.62 ± 33.03 and 55.78 ± 35.37 for the ibuprofen and ketorolac group, respectively (p -value = 0.0456). This study showed lesser time for first rescue analgesia when compared to our study in both the groups.

Total number of rescue analgesia were lower in ibuprofen group (3 ± 1.1) when compared to ketorolac group (2 ± 0.8) which was statistically significant ($p = 0.008$)

Sadik abdel et al ,2024⁽³⁸⁾ interpreted that Ibuprofen group had lower VAS scores than ketorolac group ($p < 0.05$). While the first call for rescue analgesia was comparable in both groups ($p = 0.779$), the total dosages and frequency of rescue analgesia consumption were significantly reduced in the ibuprofen group ($p = 0.036$ and 0.048 , respectively).

Rabbia Zubair et al , 2021⁽³⁹⁾ inferred that patients in Ketorolac group were found to be taken more of rescue analgesia than the Ibuprofen group. The difference was statistically significant i.e.17 patients in Ibuprofen group v/s 25 in Ketorolac group (p -value 0.02).

V. Conclusion

This study concluded that intravenous Ibuprofen is superior to Ketorolac to reduce the postoperative pain, better hemodynamic stability, lesser opioid consumption, better VAS scores with no side effects within first 24 hrs after total abdominal hysterectomy surgeries.

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