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Comparison of Intravenous Paracetamol and Intravenous Ketorolac in Postoperative Pain Control After Hip Surgery

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Author`s Contribution

[1,2,3,] Conception and design, Acquisition of data, Drafting the work or revising it critically for important intellectual content, Article writing, Statistical analysis Proofreading, [4,5]Data Collection, [6]Analysis, Literature review,

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ABSTRACT

Objective: To compare the analgesic effects of intravenous paracetamol versus ketorolac to control pain after hip surgery.

Methodology: This prospective comparative study was conducted at Ali Medical Centre Islamabad from Dec 2022-Dec 2023. One hundred and eighteen (n=118) patients who underwent hip surgeries were included in this study. Patients were equally distributed into two groups. In group A, intravenous Paracetamol was administered for post-surgery analgesia. In group B, intravenous ketorolac was utilized for pain relief. A Visual Analogue Scale (VAS) was used to assess pain in both groups at 2, 6-, 12-, 24-, and 48-hours post-surgery. Collected data was analyzed using the SPSS version 23.

Results: One hundred and eighteen (n=118) patients had a mean age of 61.5±0.5 years. 43(36.4%) patients were male and 75(63.6%) patients were female. Significant pain (VAS score >4) in Group A at 2, 6-, 12-, 24-, and 48-hours post-surgery was present in 29(49.1%), 9(15.2%), 9(15.2%), 7(11.8%), and 18(30.5%) patients respectively. In Group B, the significant pain (VAS score >4) was recorded at the same time intervals, in 6(10.1%), 4(6.7%), 2(3.3%), 1(1.6%), and 3(5.0%) patients respectively. The mean doses of rescue analgesia required in Group A was 1.3±0.5 and in Group B, it was 0.3±0.6 (p-value ≤ 0.001).

Conclusion: Intravenous ketorolac provides better analgesia than paracetamol after hip surgery. Moreover, doses of rescue analgesia required with intravenous paracetamol were more as compared to ketorolac.

Key Words: Analgesia, Hip, Ketorolac, Paracetamol.

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Introduction

Hip surgeries are commonly performed by orthopedic surgeons in both emergency and elective settings.[1] It not only provides adequate pain relief but also improves the functional status of the hip joint and significantly improves the quality of life. [2] Each year, more than one million Total Hip Arthroplasties (THA) are being performed by surgeons globally, and it is anticipated that this number will have a substantial increase in near future.[3] Multiple prospective and retrospective studies have revealed that average age of patients requiring hip surgery is more the 50 years.[4,5] At this age, one of the prime concerns that patients express during the pre-surgery counseling session is regarding post-operative pain and discomfort.[6] This anxiety among patients is even more prevalent in our region, where modern analgesic facilities and expertise are scarce.[7] Adequate analgesia after hip surgery is one of the prime concerns of operating surgeons. It not only enhances the overall patient's satisfaction but also helps in early mobilization and better post-operative outcomes.[8]

Intravenous analgesic drugs after hip surgery are the most common and cost-effective mode of analgesia in our country. Various classes of analgesic drugs are being used by surgeons with the end goal of providing better analgesia without adding any significant adverse effects associated with these analgesic drugs. These drugs can be used either

alone or in combination, and there always remains a possibility that rescue analgesia may be required to achieve adequate analgesic effects. [9,10]

Paracetamol and ketorolac are the two commonly used analgesic drugs after hip surgery. Paracetamol is regarded as a first-line analgesic and antipyretic drug used to control mild to moderate pain. It can be provided via oral, rectal, and intravenous routes. This drug delivers its analgesic effects by selectively inhibiting cyclooxygenase (COX) in the brain.[11] However, it does not have peripheral anti-inflammatory properties. The drug undergoes primary metabolism in the liver, and its use is contraindicated in severe liver disease. Common adverse effects associated with the drug include nausea, vomiting, constipation, and pruritus.[12] Another commonly used intravenous analgesic drug after orthopedic surgery is nonsteroidal anti-inflammatory drugs (NSAIDs). NSAIDs also exhibit their analgesic effects by inhibiting the enzyme cyclooxygenase (COX). Moreover, NSAIDs also have potent anti-inflammatory properties. However, their overdose or prolonged use can cause gastrointestinal and renal problems.[13] Opioid drugs also possess strong analgesic properties. However, their use as a first-line analgesic drug after surgery is usually not practiced in our country due to the addiction it can cause. A study conducted in Korea concluded that Paracetamol was as effective as Ketorolac in reducing post-operative pain.[14] In another study conducted at Johns Hopkins University, United States, the author concluded that ketorolac had superior analgesic properties compared to paracetamol.[15]

There is still no consensus among the surgeons regarding the ideal intravenous analgesic drug after orthopedic hip surgery. The reason for this disagreement is the lack of sufficient evidence-based data about the subject in the available literature. Hence, a study needed to be conducted to compare the analgesic properties of paracetamol and ketorolac after hip surgery.

Methodology

This prospective comparative study took place at the Orthopedic Surgery Department of "Ali Medical Centre Islamabad" from Dec 2022-Dec 2023 after obtaining approval granted from the hospital's ethical review board (Serial no # 606). The WHO Sample Size Calculator was used to calculate the sample size. The following parameters were utilized: 90% power of the test, 5% level of significance, mean pain score with paracetamol =83.4, and mean pain score with ketorolac = 77.3.[16] Based on these, the total sample size of one hundred and eighteen(n=118) patients was calculated.

Patients aged between 30-70 years, either of the male or female genders, having American Society of Anesthesiologists (ASA) grade I/II/III, who underwent elective/emergency hip surgery and provided informed written consent to be included in the study.

Patients who were ASA grade IV/V and had previous hip or pelvic surgery. Patients with known psychiatric disorders or having documented substance dependency/allergy were also excluded. Moreover, patients with chronic liver disease, renal disorder, cardiovascular disorder, neuro-muscular disorder, known malignancy, and getting chemotherapy/radiotherapy were also removed from the study. Patients who developed any serious complication during the surgery were excluded from the study.

Participants were selected through "non-probability consecutive sampling," and informed written consent was obtained. Participants were divided into two equal groups (Group A and Group B) using a paper lottery method. Age, gender, obesity status (BMI$\geq$30kg/m^2), and ASA grade of all patients were recorded. All patients received General Anesthesia through a similar technique. Propofol and Atracurium were used for induction of anesthesia. Maintenance of anesthesia was achieved using Isoflurane All surgeries were performed by the consultant orthopedic surgeon. Patients were shifted to the ward after surgery. In Group A, intravenous paracetamol (01g thrice daily) was administered for pain relief. In Group B, intravenous ketorolac (30 mg thrice daily) was administered for analgesia. Rescue analgesia was provided by Nalbuphine (10mg for 70kg adult). Visual Analogue Scale (VAS) was used to assess pain, and patients were educated about the interpretation of VAS before surgery. The 0cm mark on VAS represented no pain, and the 100cm mark represented the worst pain.[17] Assessment of pain using VAS was done at 2, 6-, 12-, 24-, and 48-hours post-surgery. Rescue analgesia was administered in the presence of significant pain which was defined as VAS score >4. Total doses of rescue analgesia till 48 hours post-surgery were documented in each group. 48 hours after surgery, each patient was asked whether he/she was satisfied with the analgesia. All data was recorded in a pre-designed proforma.

The Statistical Package for Social Sciences (SPSS) version 23 software was used for statistical data analysis. Quantitative variables (age, and doses of rescue analgesia)

were represented using mean ± standard deviation (SD). The normal distribution of data (doses of rescue analgesia) was assessed using the Shapiro-Wilk Test and the data was not normally distributed. Non-parametric tests (Independent-Samples, Mann-Whitney U test) were used to reject the null hypothesis in not normally distributed data. Frequency and percentages of categorical variables (gender, obesity, ASA grade, significant pain, patient's satisfaction) were calculated. The Chi-Square test was used to compare categorical variables, and the Independent Samples T-Test was used for quantitative variables. A p-value of ≤ 0.05 was considered significant.

Results

One hundred and eighteen (n=118) patients were included in the study and were divided into two equal groups. The mean age of the participants was 61.5±0.5 years, including 43(36.4%) males and 75(63.6%) females. 65(55.1%) patients were obese (BMI ≥30kg/m^2). 32(27.1%) patients were ASA grade I, 66(55.9%) patients were ASA grade II and 20(16.9%) patients were ASA grade III. The comparison of baseline characters and ASA grades between the two groups is tabulated in Table I.

Table I: Comparison of baseline characters and ASA grade among Group A and Group B (n =118)

Characters		Group A (paracetamol) (n = 59)	Group B (ketorolac) (n = 59)	p-value
Gender (%)	Male	22(37.2%)	21(35.5%)	0.84
	Female	37(62.7%)	38(64.4%)	
Mean age ± SD (years)		62.1±5.7	60.9±7.0	0.32
Obesity (BMI ≥30kg/m^2), %		36(61.0%)	29(49.1%)	0.19
ASA grade (%)	ASA I	13(22.0%)	19(32.2%)	0.11
	ASA II	32(54.2%)	34(57.6%)	
	ASA III	14(23.7%)	6(10.1%)	

At 02 hours post-surgery, 29(49.1%) in Group A had significant pain as compared to 06(10.1%) in Group B (p-value <0.001). At 06 hours post-surgery, 09(15.2%) in Group A had significant pain as compared to 04(6.7%) in Group B (p-value 0.14). At 12 hours post-surgery, 09(15.2%) in Group A had significant pain as compared to 02(3.3%) in Group B (p-value 0.02). At 24 hours post-surgery, 07(11.8%) patients in Group A had significant pain as compared to 01(1.6%) in Group B (p-value 0.02). At 48 hours post-surgery, 18(30.5%) patients in Group A had significant pain as compared to 03(5%) in Group B (p-value <0.001). This comparison is shown in Table II.

The mean doses of rescue analgesia administered in group A was 1.3±0.5 and in group B, it was 0.3±0.6 (p-value <0.001). In group A, 39(66.1%) patients were satisfied with the analgesia, and in group B 54(91.5%) patients were satisfied (p-value 0.001). This comparison between the two groups is shown in Table III.

Table II: Comparison of significant pain between two groups. (n = 118)

Post-operative pain	Group A (paracetamol) (n = 59)	Group B (ketorolac) (n = 59)	p-value
VAS score >4 -02 hours	29(49.1%)	06(10.1%)	<0.001
VAS score >4 -06 hours	09(15.2%)	04(6.7%)	0.14
VAS score >4 -12 hours	09(15.2%)	02(3.3%)	0.02
VAS score >4 -24 hours	07(11.8%)	01(1.6%)	0.02
VAS score >4 -48 hours	18(30.5%)	03(5%)	<0.001

Table III: Comparison of doses of rescue analgesia and patient's satisfaction. (n = 118)

Post-surgery parameters	Group A (paracetamol) (n = 59)	Group B (ketorolac) (n = 59)	p-value
Doses of rescue analgesia, Mean ± SD	1.3±0.5	0.3±0.6	<0.001
Satisfaction (%)	39(66.1%)	54(91.5%)	0.001

Discussion

After hip surgery, adequate pain management plays a vital role in the recovery of patients after surgery. It decreases the morbidity of the patients and enhances the early return to normal daily activities. Although opioids possess very strong analgesic properties, still their use as a routine first-line analgesic drug is discouraged due to significant side effects associated with it, including respiratory depression, ileus vomiting, and nausea.[18] Commonly used drugs for post-surgery analgesia include paracetamol and ketorolac. Paracetamol carries antipyretic and analgesic properties. Ketorolac in addition to these, also carries strong anti-inflammatory action. These two drugs also have various side effects associated with their use and there is also a marked difference in their price range as per current market rates. Surgeons mostly prefer any one of these

drugs depending upon their personal preference or departmental guidelines, and still, there are very limited studies conducted to compare their analgesic properties after hip surgeries.

We conducted a study and included patients who underwent hip surgeries. Most of the participants included in our study were above 50 years of age. Cieremans et al. and Skarin et al. also documented in their studies that the mean age of patients who underwent hip surgeries was more than 50 years. [19,20] The commonest cause of THA in our patients was advanced-stage osteoarthritis. In a meta-analysis study, Salman et al. documented osteoarthritis to be one of the most common causes of THA.[21] More than half of our participants had obesity. Cicuttini et al. documented obesity to be one of the major modifiable risk factors for osteoarthritis, significantly affecting the hip joints.[22] We observed that intravenous ketorolac provided superior analgesia after hip surgeries, as compared to intravenous Paracetamol. In similar studies, Zhou et al. and Ans et al. concluded that no significant difference existed between paracetamol and ketorolac efficacy in terms of pain relief which contradicts the results of our study.[16,23] Watcha et al., Naidu et al., and Sadeghein et al., in their studies, documented that ketorolac has better analgesic properties as compared to paracetamol, which aligns with the results of our study.[24,25,26]

The results of our study support the hypothesis that after hip surgery, the use of ketorolac provides better pain relief than paracetamol. Moreover, ketorolac also reduces the dependency on rescue analgesia and provides better patient satisfaction.

Conclusion

Intravenous ketorolac is superior analgesia after hip surgery, as compared to paracetamol. Ketorolac reduces the reliance upon rescue analgesia and enhances patient satisfaction in the post-surgery period. Surgeons should meticulously evaluate the appropriate analgesia, keeping in mind the potency, cost, and side effects associated with it.

Limitations: Single center study, limited sample size and limited follow-up period were few limitations of this study.

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