Evaluation of analgesic use in physical trauma patients presenting to the emergency department of a tertiary care hospital: a cross-sectional study

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ABSTRACT

Introduction: Effective pain management is essential in trauma cases to ensure patients' recovery and stabilization presenting to the emergency room. The objective of this study was to observe the prescription pattern, route of administration and compare pre- and post-analgesic pain scores among trauma patients presenting to the emergency department of a tertiary care hospital. The rationale of this study is to generate local evidence on analgesic prescription pattern, route of administration and changes in pain scores before and after analgesic use.

Methods: This was a descriptive cross-sectional study to assess analgesic use in physical trauma cases at Nepal Medical College and Teaching hospital. The study was conducted from 1st January to 30th June 2024 following ethical approval from the Institutional Review Committee (reference number: 41-080/081). A total of 150 trauma patients admitted in the emergency department were observed. The sampling method used was convenience sampling. Data entry and analysis was done using Statistical Package for the Social Sciences version 16.

Results: Among 150 trauma patients (73.3% male, mean age 32.4 ± 16.7 years), road traffic accidents were the most common cause (43.3%). Acetaminophen (45.3%) and diclofenac (44%) were the most frequently prescribed analgesics, mainly via intravenous (52%) and intramuscular (37.3%) routes. Analgesic administration led to a significant reduction in pain scores (numeric rating scale-NRS) across all baseline pain categories (Wilcoxon signed-rank test, $p < 0.05$), with the greatest reduction observed in patients with worst, severe, and moderate pain.

Conclusion: Non-opioid analgesics effectively managed pain in trauma patients, with minimal opioid use. Intravenous and intramuscular administration were preferred for rapid pain relief. Adoption of multimodal strategies, including opioids, ketamine, or regional analgesia, could further enhance pain management in emergency settings.

Keywords: analgesics, emergency medical services, pain management, trauma.

INTRODUCTION

Tertiary care hospitals are often the primary destination for physical trauma cases where the use of analgesics is pivotal in achieving optimal patient outcomes. Effective pain management not only aids in recovery but also supports accurate evaluation and stabilization efforts during emergencies.[1]

However, there is a need to assess and evaluate the current practices of analgesic use in physical trauma management to ensure that pain is adequately managed while minimizing potential risks and complications.[2] The administration of analgesics in physical trauma cases is a complex decision influenced by various factors, including patient condition, type and severity of trauma, and hospital protocols.[3] The objective of this study was to observe the prescription pattern, route of analgesic administration, compare pre- and post-analgesic pain scores among trauma patients presenting to the emergency department of a tertiary care hospital.

The rationale of this study was to generate

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local evidence on analgesic prescription pattern, route of administration and changes in pain scores before and after analgesic use.

METHODS

A descriptive cross-sectional study was conducted at Nepal Medical College and Teaching Hospital (NMCTH), Kathmandu, Nepal. The study was conducted from January to June 2024 for 6 months following ethical approval from the Institutional Review Committee (reference number: 41-080/081). Patients presenting to the emergency department with pain due to physical trauma who received analgesics as part of their treatment were included in the study. Patients who received analgesic prior to arrival at the hospital were excluded from the study. Unconscious patients and those with contraindications to specific analgesics agents such as known drug allergies or relevant medical conditions (e.g., renal or hepatic failure in past medical history) were excluded. Patients unable to respond to the numeric rating scale, including children younger than 9 years and individuals who were deaf or mute, were also excluded.

The minimum sample size was calculated as follows,
$n = z^2pq/d^2$
Where,
z=1.96 at 95% Confidence Interval
p = prevalence of analgesic use in physical trauma patients at emergency department = 50%
q=(1-p)
d= margin of error, 8% (0.08) (A margin of error of 8% was considered given the exploratory nature of the hospital based observation study)
Substituting the values:
$n = (1.96)^2 \times 0.5 \times (1-0.5)/(0.08)^2$

Now, calculate:
$n = 3.8416 \times 0.25/0.0064$
$n = 0.9604/0.0064$
$n = 150.06$
$n \sim 150$
The minimum sample size was calculated to be 150.

Written consent was obtained and data were collected from 150 patients using convenience sampling. A pre-formed questionnaire was used to collected information on the demographic characteristics (age, gender) and type of physical trauma. Medical history, along with the history of analgesics consumed was obtained at the bedside by medical officer in the emergency department of NMCTH.

The Numeric Rating Scale (NRS) is commonly used to assess pain intensity, allowing patients to rate pain from 0 to 10.[4,5] It helps categorize pain severity and assess the effectiveness of analgesic treatments. Studies show that the NRS, Visual Analog Scale (VAS) and Verbal Rating Scale (VRS), effectively measures pain intensity and guides analgesic use. These tools are reliable for evaluating pain in clinical settings, categorizing pain severity and assessing treatment outcomes.[6]

A numeric rating scale (NRS) was used to assess a person's level of pain before and after administration of analgesics (reassessment of pain within 30 to 60 min). Zero was considered as no pain, 1-3 as mild discomforting pain, 4-6 as moderate pain, 7-9 as severe pain, and 10 as worst pain imaginable. The name of analgesics administered, route of drug administration and dosage form were noted. Pain reassessment was performed within 30 minutes after parenteral drug administration and within 60 minutes after oral drug administration, using the Numeric Rating Scale (NRS) through verbal communication with the patient. Data entry and analysis were done using Statistical Package for the Social Sciences version 16. Normality of paired differences was assessed using the Shapiro–Wilk test, which showed significant deviation from normality ($p < 0.001$). Therefore, the Wilcoxon signed-rank test was used to compare pre- and post-analgesic pain scores.

RESULTS

This study examined 150 physical trauma cases admitted to the emergency department of NMCTH. Of the 150 cases, 110 (73.3%) were male and 40 (26.7%) were female. Patients ranged in age from 10 to 86 years, with a mean age of 32.43 ± 16.74 years. The young adult age group (18–30 years) constituted the largest proportion of physical trauma cases 56 (37.3%),

Table 1: Distribution of analgesic prescriptions according to type of physical trauma.

Types of physical trauma	Acetaminophen	Diclofenac	Acetaminophen Ibuprofen	Fentanyl	Total
Road traffic accidents	27 (18%)	33 (22%)	4 (2.6%)	1 (0.6%)	65 (43.33%)
Fall injury	22 (14.66%)	14 (9.3%)	7 (4.6%)	0 (0%)	43 (28.66%)
Physical assault	16 (10.66%)	17 (11.33%)	3 (2%)	1 (0.6%)	37 (24.70%)
Others	3 (2%)	2 (1.3%)	0 (0%)	0 (0%)	5 (3.3%)
Total	68 (45.30%)	66 (44%)	14(9.3%)	2(1.3%)	150 (100%)

Table 2: Analgesic prescription patterns and comparison of pre- and post-analgesic pain scores using Wilcoxon signed-rank test.

Pain category	n (%)	Decreased pain n(%)	Increased pain n (%)	No change in pain n (%)	Test statistics
Worst pain	8 (5.3%)	8 (100%)	0	0 (0%)	Z=-2.565; p=0.010
Severe pain	67 (44.6%)	65 (97%)	0	2 (2.9%)	Z=-7.233; p<0.001
Moderate pain	63 (42%)	61 (96.8%)	0	2 (3.1%)	Z=-7.588; p<0.001
Mild pain	12 (8%)	8 (66.6%)	0	4 (33.3%)	Z=-2.828; p=0.005
Total	150 (100%)				

Table 3: Routes of administration of prescribed analgesics.

Route of drug administration	Acetaminophen	Diclofenac	Ibuprofen acetaminophen	Fentanyl	Total
Intravenous (IV)	66 (44%)	10 (6.6%)	0 (0%)	2 (1.3%)	78 (52%)
Oral	2 (1.3%)	0 (0%)	14 (9.3%)	0 (0%)	16 (10.6%)
Intramuscular (IM)	0 (0%)	56 (37.3%)	0 (0%)	0 (0%)	56 (37.3%)
Total	68 (45.3%)	66 (44%)	14 (9.3%)	2 (1.3%)	150 (100%)

followed by early middle age (31–45 years) 43 (28.7%). Adolescents accounted for 24 (16%), while elderly patients (≥61 years) represented 13 (8.7%) of the total cases.

Among the 150 patients, road traffic accidents (RTAs) were the most common cause of injury 65 (43.33%), followed by fall injuries 43 (28.66%) and physical assault 37 (24.70%). Other causes accounted for a small proportion 5 (3.3%).

Acetaminophen 68 (45.3%) and diclofenac 66 (44%) were the most frequently prescribed analgesics across all injury categories. In patients with RTAs, diclofenac 33 (22%) was prescribed slightly more often than acetaminophen 27 (18%). Similarly, in physical assault, diclofenac 17 (11.33%) marginally exceeded acetaminophen use 16 (10.6%). In contrast, fall injuries were more commonly managed with acetaminophen 22 (14.6%) than diclofenac 14 (9.3%). The acetaminophen–ibuprofen combination was used infrequently (9.3% overall), with the highest use observed in fall injuries 7 (4.6%). Fentanyl use was minimal 2 (1.3%) and limited to patients with RTAs and physical assault. Non-opioid analgesics, particularly acetaminophen and diclofenac, were the mainstay of pain management across all types of physical trauma, while opioid use was minimal.

When stratified by baseline pain severity, a significant reduction in pain scores was observed across all pain categories following analgesic administration (Wilcoxon signed-rank test). The highest proportion of pain reduction was seen among patients with worst, severe, and moderate

pain, whereas a greater proportion of unchanged pain scores was observed in the mild pain category.

Acetaminophen was most frequently administered via the intravenous route 66 (44%), followed by diclofenac via the intramuscular route 56 (37.3%). The ibuprofen–acetaminophen combination was predominantly administered orally 14 (9.3%), whereas fentanyl was infrequently administered intravenously 2 (1.3%). (Table 3).

DISCUSSIONS

The study examines analgesic use in 150 physical trauma patients in a tertiary care hospital's emergency department. The study found that males (73.3%) were the predominant trauma patients, reflecting global trends linked to occupational hazards, risky behaviors, and road accidents.[7,8] The mean age of 32.43 years highlights the vulnerability of the working age population, emphasizing the socioeconomic impact of trauma. The broad age range (10–86 years) indicates that trauma affects all age groups.

The study found that road traffic accidents (43.3%), falls injury (28.7%), and physical assaults (24.7%) were the leading causes of physical trauma. While occupational injuries, sports accidents, trekking, and burns accounted for 3.3% of cases, the findings highlight the need for targeted public health interventions, such as road safety and fall prevention programs, to reduce trauma-related burdens.[9]

Non-opioid analgesics were the cornerstone of pain management in this study. Acetaminophen (45.3%) and diclofenac (44%) were the most frequently prescribed analgesics across all trauma categories, while opioid use was minimal. This prescribing pattern reflects a preference for agents with proven efficacy and favorable safety profiles, particularly in emergency settings where rapid assessment and risk minimization are essential.[10] The limited use of fentanyl (1.3%) likely reflects concerns regarding opioid-related adverse effects, dependency, and monitoring requirements.[11]

The infrequent use of combination therapy with acetaminophen and ibuprofen (9.3%) aligns with evidence suggesting that combining NSAIDs with acetaminophen may not provide superior analgesia compared to acetaminophen alone in certain trauma settings.[12] Fabbri A et al. preferred fentanyl as an opioid due to its minimal impact on hemodynamics and lack of central nervous system depression.[1] Calil AM et al. favored metamizole and paracetamol over opioids for analgesia.[3] Haske D et al. concluded that NSAIDs are preferred more often than opioids for pain management in trauma patients treated by Emergency Medical Services.[13] Other studies have highlighted opioids such as fentanyl and morphine as effective options when carefully titrated.[1,13] In contrast, studies from Nepal conducted in 2021 at Patan academy of health sciences and 2022 at Nobel medical college emergency department have reported higher use of agents such as pethidine, ketorolac, tramadol, and diclofenac.[14,15] These variations likely reflect institutional protocols, availability of drugs, and clinician preferences.

The use of the Numeric Rating Scale (NRS) enabled objective assessment of pain severity and treatment response. Significant reductions were observed in pre- and post-analgesic pain scores for acetaminophen, diclofenac, and the acetaminophen–ibuprofen combination, indicating effective pain control. When pain outcomes were stratified by baseline severity, a significant reduction in pain scores was observed across all pain categories following analgesic administration. Patients presenting with worst, severe, and moderate pain demonstrated the highest proportion of pain reduction, whereas a greater proportion of unchanged pain scores was observed in the mild pain category. This finding likely reflects a floor effect, whereby patients with mild baseline pain have limited scope for further measurable pain reduction.[16] The consistent reduction in pain across categories supports the effectiveness of the prescribed analgesics.

Regarding routes of administration, intravenous delivery was most common (52%), followed by intramuscular administration (37.3%). The preference for intravenous administration is consistent with emergency care guidelines emphasizing rapid onset of analgesia in acute trauma.[17,18] The reliance on IM routes in our setting may reflect ease or habit However, the relatively high rate of intramuscular injections is notable, as this route is generally discouraged

due to delayed onset and variable absorption.[19,20,21] The absence of intranasal, regional, or ketamine-based analgesia suggests a conservative prescribing approach, possibly influenced by concerns regarding safety, training, or resource availability. European emergency guidelines recommend IV morphine for severe pain, within a multimodal framework, and encourage local or regional analgesia when possible.[20]

Our findings reveal a clear preference for non-opioid agents primarily acetaminophen and diclofenac with sparse opioid utilization, and no observed use of ketamine or regional anesthesia. In contrast, trauma pain guidelines emphasize multimodal analgesia incorporating non-opioids, titrated opioids, ketamine (especially as an adjunct or opioid-sparing option), and regional anesthesia when feasible.[19,20,22,23] Uptake of multimodal strategies has been demonstrated to improve analgesic outcomes while reducing opioid consumption.[23] The absence of ketamine or nerve blocks in our practice suggests a conservative prescribing culture perhaps influenced by opioid safety concerns. Adopting guideline-supported multimodal protocols could enhance analgesia, limit opioid exposure, and align care with best practices.

CONCLUSION

A conservative analgesic approach for pain management with non-opioid medications were prescribed to achieve acceptable pain relief while minimizing the risk associated with opioids such as dependence. Non-opioid analgesics effectively managed pain in trauma patients, with minimal opioid use. While intravenous administration was preferred for rapid relief, high intramuscular administration indicates room for optimizing route selection. Adoption of multimodal strategies, including opioids, ketamine, or regional analgesia, could further enhance pain management in emergency settings.

LIMITATIONS

Subjective pain assessment may also affect accuracy. Pain reassessment was limited to short-term outcomes and did not capture longer-term analgesic effectiveness. To improve research, future studies should be multicentre with longer follow-ups. Key recommendations include application of multimodal strategies.

Conflict of Interest: None.

Data availability statement: The data are available from the corresponding author upon reasonable request.

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