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Research Article

Postoperative Pain Assessment using Visual Analogue Scale

Yugandhar GR1*

[1]Associate Professor, Department of General Surgery, Bhaskar Medical College, Yenkapally, Moinabad, Ranga Reddy, Hyderabad, Telangana 500075.

*Corresponding Author
Yugandhar GR
Associate Professor,
Department of General Surgery,
Bhaskar Medical College,
Yenkapally,
Moinabad, Ranga Reddy,
Hyderabad, Telangana 500075.
Email:
dr.yugandhar@gmail.com

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Abstract: *Introduction:* Postoperative pain is a frequent and important concern after surgery, as inadequate pain relief can delay recovery, restrict early mobilisation, and reduce patient comfort. Careful assessment of pain during the postoperative period is therefore essential for appropriate management. The Visual Analogue Scale (VAS) is a simple and widely accepted tool used to measure pain intensity in surgical patients.**Objective:** To evaluate postoperative pain intensity and its progression over time using the Visual Analogue Scale in patients undergoing surgery.**Materials and Methods:** This prospective observational study was carried out among 180 postoperative patients. Pain intensity was measured using the Visual Analogue Scale, with scores ranging from 0 to 10, where 0 indicated no pain and 10 indicated the worst imaginable pain. Pain assessment was performed at fixed postoperative intervals, namely at 0 hours, 2 hours, 6 hours, 12 hours, and 24 hours. All patients received standard postoperative analgesic treatment according to institutional practice. The recorded VAS scores were analysed to observe the pattern of pain reduction over time.**Results:** A total of 180 patients were included in the analysis. Pain was highest in the immediate postoperative period, with a mean VAS score of 6.8 ± 1.2 at 0 hours. The mean score then declined to 5.2 ± 1.1 at 2 hours, 4.1 ± 0.9 at 6 hours, and 3.2 ± 0.8 at 12 hours. By 24 hours, the mean VAS score had reduced further to 2.1 ± 0.7. The progressive decline in pain scores across the postoperative observation period was statistically significant ($p < 0.001$), showing a clear improvement in pain control with time.**Conclusion:** Postoperative pain was most pronounced in the immediate recovery phase and steadily decreased during the first 24 hours after surgery. The Visual Analogue Scale was useful for sequential pain assessment, and the findings indicate that routine postoperative analgesic care was effective in achieving gradual pain relief in most patients.

Keywords: Postoperative pain, Visual Analogue Scale, pain intensity, analgesia, postoperative recovery

INTRODUCTION

Pain following surgery is an expected physiological response to tissue injury, yet its intensity and duration vary widely depending on the type of procedure, individual pain thresholds, and perioperative care. Despite advances in anaesthesia and analgesic techniques, postoperative pain continues to be inadequately managed in a significant proportion of patients, especially in resource-limited settings [1]. Poorly controlled pain can interfere with early ambulation, impair respiratory function, prolong hospital stay, and increase the risk of complications such as thromboembolism and delayed wound healing [2].

The mechanisms underlying postoperative pain are complex and involve both peripheral and central sensitisation. Surgical trauma leads to the release of inflammatory mediators such as prostaglandins, bradykinin, and cytokines, which activate nociceptors and amplify pain signalling [3]. In addition, repeated nociceptive input can result in central sensitisation, lowering pain thresholds and prolonging pain perception even after the initial stimulus has subsided [4]. These processes highlight the need for early and effective pain control strategies.

Accurate assessment of pain is a crucial step in postoperative care. Since pain is inherently subjective, reliable tools are required to quantify its intensity in a reproducible manner. Among the available methods, the Visual Analogue Scale (VAS) is one of the most widely used instruments in both clinical and research settings [5]. It consists of a continuous scale, typically 10 cm in length, anchored by descriptors such as “no pain” and “worst imaginable pain,” allowing patients to express their pain intensity numerically or visually [6]. The simplicity, sensitivity, and ease of administration make VAS particularly useful for serial assessments in the postoperative period.

Several studies have demonstrated that VAS provides a sensitive measure of changes in pain intensity over time and is effective in evaluating the response to analgesic interventions [7]. It has also been shown to have good reliability and validity across different patient populations, including those undergoing major and minor surgical procedures [8]. Moreover, VAS allows clinicians to categorise pain into mild, moderate, and severe levels, facilitating appropriate titration of analgesic therapy [9].

Effective postoperative pain management relies on a multimodal approach that includes pharmacological and non-pharmacological strategies. Commonly used analgesics include non-steroidal anti-inflammatory drugs (NSAIDs), opioids, and regional anaesthesia techniques [10]. The goal is not only to reduce pain intensity but also to minimise adverse effects associated with analgesic medications. Regular monitoring using tools such as VAS enables clinicians to adjust treatment regimens based on patient response [11].

Despite the availability of standard pain management protocols, variability in pain perception and response to treatment remains a challenge. Factors such as age, gender, type of surgery, psychological status, and preoperative pain levels can influence postoperative pain outcomes [12]. Therefore, continuous evaluation using validated tools is essential to understand pain patterns and optimise patient care.

In recent years, there has been increasing emphasis on patient-centred care and enhanced recovery after surgery (ERAS) protocols, which highlight the importance of effective pain control as a key component of recovery [13]. Timely assessment and management of pain contribute to improved patient satisfaction, reduced morbidity, and faster return to normal activities [14-19]. Given these considerations, systematic assessment of postoperative pain using a standardised tool such as the Visual Analogue Scale is essential in clinical practice. Evaluating pain trends over time can provide valuable insights into the effectiveness of analgesic strategies and help identify areas for improvement. The present study was therefore undertaken to assess postoperative pain intensity at different time intervals using VAS and to analyse its pattern of reduction during the early postoperative period.

MATERIALS AND METHODS

Study design and setting

The present study was designed as a prospective observational study to assess the intensity of postoperative pain at predefined time intervals using the Visual Analogue Scale. It was carried out at Bhaskar Medical College, Amdapur X Road, Yenkapally, Moinabad, Ranga Reddy, Hyderabad, Telangana 500075. This institution functions as a tertiary care teaching hospital and receives patients from both urban and surrounding rural areas, thereby providing a broad clinical base for postoperative evaluation. The study was conducted during the period from 2024 to 2025. During this time, patients who underwent surgery and satisfied the eligibility criteria were screened and enrolled for observation.

A prospective design was considered appropriate because it allowed pain scores to be documented in a planned and uniform manner after surgery, rather than relying on case records or retrospective interpretation. This approach helped ensure that each patient was assessed at the same postoperative intervals and under comparable clinical conditions. Since the study aimed to observe postoperative pain trends under routine hospital practice, no change was made to the standard treatment protocol followed in the institution.

Study population and sample size

The study included 180 patients who underwent surgical procedures during the study period. Adult patients of either sex were considered eligible for inclusion. Recruitment was done consecutively, and patients were enrolled as they became available and fulfilled the predefined criteria. The final sample size of 180 was considered adequate to describe postoperative pain patterns across the selected time points and to allow meaningful comparison of pain intensity over the first 24 hours after surgery.

The study population represented routine surgical patients receiving standard perioperative and postoperative care at the institution. By including a sizeable group of patients over the study duration, the investigators were able to obtain a clearer picture of how pain behaved in the immediate and early recovery period. The intention was not only to record pain at a single point, but to understand its progression over time and to examine how effectively routine analgesic measures were controlling it.

Inclusion criteria

Patients were included in the study if they were 18 years of age or older and had undergone surgery under general anaesthesia or regional anaesthesia during the study period. Only those who were conscious, cooperative, and able to understand the method of pain scoring were enrolled. Since the study relied on self-reporting of pain using the Visual Analogue Scale, the ability to comprehend instructions and provide a response was essential.

Patients who agreed to participate and gave written informed consent were included. The study focused on individuals in the postoperative period who could be followed from the immediate recovery phase up to 24 hours after surgery. This ensured that pain measurements reflected the patient's own perception and could be recorded consistently at the scheduled intervals.

Exclusion criteria

Patients were excluded if they were unable to communicate effectively or had any condition that would interfere with reliable pain assessment. This included individuals with impaired consciousness, confusion, significant cognitive dysfunction, severe hearing or speech difficulty, or any neurological or psychiatric condition that made VAS scoring unreliable. Patients who remained intubated or required prolonged ventilatory support in the postoperative period were also excluded because direct self-reporting of pain was not feasible in such circumstances.

Emergency surgical cases were not included, as the perioperative course in such patients is often influenced by additional physiological stress, varied preparation time, and urgent clinical priorities that may affect pain perception and management. Patients with a known history of chronic pain syndromes or those already receiving long-term analgesic therapy were also excluded, since such conditions could alter baseline pain thresholds and confound postoperative pain evaluation. Similarly, critically ill patients requiring extended intensive care monitoring were not considered for inclusion in order to maintain uniformity in follow-up and pain assessment.

Data collection procedure

Data collection was carried out in a systematic and structured manner using a predesigned case record form. Basic demographic and clinical details such as age, sex, type of surgery, and type of anaesthesia administered were documented before or immediately after the operative procedure. The patients were informed about the purpose of postoperative pain assessment and were familiarised with the Visual Analogue Scale before surgery, whenever feasible. This preoperative orientation was important to ensure that patients clearly understood how to express their pain intensity after the procedure.

Postoperative pain was assessed at fixed intervals, namely at 0 hours, 2 hours, 6 hours, 12 hours, and 24 hours after surgery. The 0-hour reading referred to the immediate postoperative period after the patient had recovered sufficiently to respond meaningfully. At each interval, the patient was asked to indicate the severity of pain using the Visual Analogue Scale. The score was then recorded carefully in the study form. All assessments were performed in a uniform manner so that the recorded values reflected actual changes in pain intensity over time rather than differences in questioning or documentation.

This repeated assessment allowed the investigators to capture the natural decline or persistence of pain during the first postoperative day. It also provided an opportunity to understand whether the analgesic regimen being routinely followed in the hospital was producing satisfactory pain relief across the observation period.

Pain assessment tool

Pain intensity was measured using the Visual Analogue Scale, which served as the principal assessment tool in the study. The scale ranged from 0 to 10, where a score of 0 represented no pain and a score of 10 represented the worst imaginable pain. Patients were instructed to indicate the level that best matched the pain they were experiencing at the time of assessment. The Visual Analogue Scale was selected because it is simple, easy to administer, and widely accepted for evaluation of acute postoperative pain.

For better clinical interpretation, the scores were also grouped into categories of pain severity. Scores from 1 to 3 were considered mild pain, scores from 4 to 6 were considered moderate pain, and scores from 7 to 10 were taken as severe pain. This categorisation was useful in understanding not only the numerical trend in pain scores but also the clinical significance of those scores in relation to patient comfort and analgesic adequacy. The use of a standardised scale improved consistency in measurement and made comparison across different postoperative time points more meaningful.

Analgesic protocol

All patients received postoperative pain relief according to the standard institutional practice followed at Bhaskar Medical College. The study did not introduce any experimental drug, altered analgesic schedule, or separate intervention for research purposes. Instead, the investigators observed pain outcomes under the routine management protocol already in place. Depending on the nature of surgery, type of anaesthesia, and clinical requirement of the patient, postoperative analgesia generally consisted of commonly used medications such as non-steroidal anti-inflammatory drugs, paracetamol, and opioid analgesics where indicated.

The choice of analgesic agent, route of administration, and dosage was determined by the treating surgical and anaesthesia teams in accordance with hospital policy and individual patient needs. Rescue analgesics were administered whenever clinically required. Since the objective of the study was to document postoperative pain under real clinical conditions, all patients continued to receive the regular care considered appropriate by the treating team. This helped ensure that the observations remained relevant to everyday hospital practice.

Outcome measures

The primary outcome of the study was the intensity of postoperative pain as assessed by the Visual Analogue Scale at different predefined time intervals during the first 24 hours after surgery. The investigators were particularly interested in documenting how pain changed from the immediate postoperative period to the end of the first postoperative day.

Secondary outcome measures included the pattern of reduction in mean pain scores over time and the distribution of patients according to pain severity categories such as mild, moderate, and severe pain. These outcomes helped in understanding both the numerical decline in pain intensity and the proportion of patients who continued to experience clinically significant pain despite routine analgesic management. Together, these measures provided a broader view of postoperative pain behaviour in the study population.

Statistical analysis

All collected data were entered into a structured database and checked for completeness and accuracy before analysis. Statistical analysis was performed using appropriate software. Continuous variables, including

pain scores recorded on the Visual Analogue Scale, were summarised as mean and standard deviation. Categorical variables such as sex, type of surgery, and pain severity categories were expressed as frequencies and percentages.

The change in postoperative pain scores across the different assessment intervals was analysed using suitable statistical methods for repeated observations. Where appropriate, repeated measures analysis of variance or equivalent tests were applied to determine whether the reduction in pain scores over time was statistically significant. Associations between categorical variables were examined using the chi-square test when needed. A p-value of less than 0.05 was taken as statistically significant. This statistical approach allowed the investigators to evaluate whether the observed reduction in pain was likely to reflect a genuine trend rather than random variation.

Ethical considerations

The study was conducted only after obtaining approval from the Institutional Ethics Committee of Bhaskar Medical College. Ethical clearance was obtained before commencement of patient enrolment and data collection. All eligible patients were informed about the purpose of the study, the nature of participation, and the method of pain assessment. Written informed consent was obtained from each participant prior to inclusion.

Participation in the study was voluntary, and patients were assured that refusal to participate would not affect the treatment they received. Confidentiality of patient information was maintained throughout the study by recording data in a secure and anonymised manner. The study involved no deviation from standard clinical care, and no patient was subjected to additional risk for the purpose of research. The investigation was carried out in accordance with accepted ethical principles for biomedical research involving human participants.

RESULTS

Baseline characteristics of the study population

A total of 180 patients were included in the analysis. The study population comprised both male and female patients undergoing various elective surgical procedures under general and regional anaesthesia. The majority of patients were in the age group of 30–60 years. There was no significant difference in baseline characteristics that could influence postoperative pain perception across the cohort (Table 1).

Table 1: Demographic and clinical characteristics of study participants (n = 180)

Variable	Frequency (n)	Percentage (%)
Age (years)		
18–30	38	21.1
31–45	62	34.4
46–60	54	30.0
>60	26	14.4
Gender		
Male	102	56.7
Female	78	43.3
Type of Anaesthesia		
General Anaesthesia	108	60.0
Regional Anaesthesia	72	40.0

Chi-square value (Gender vs Pain category at 0 hr): $\chi^2 = 2.14$, $p = 0.34$

Values are expressed as frequency and percentage. No statistically significant association was observed between gender and immediate postoperative pain severity

Postoperative pain scores over time

Pain intensity was highest in the immediate postoperative period and showed a steady decline over time. The mean VAS score at 0 hours was 6.8 ± 1.2, indicating moderate to severe pain in a large proportion of patients. At 2 hours, the mean score reduced to 5.2 ± 1.1, followed by further decline to 4.1 ± 0.9 at 6 hours.

By 12 hours, pain scores had decreased to a mean of 3.2 ± 0.8, indicating that most patients experienced only mild discomfort. At 24 hours, the mean VAS score was 2.1 ± 0.7, reflecting effective pain control in the majority of cases (Table 2).

Table 2: Mean VAS scores at different postoperative intervals

Time Interval	Mean VAS Score	Standard Deviation
0 hours	6.8	1.2
2 hours	5.2	1.1
6 hours	4.1	0.9
12 hours	3.2	0.8
24 hours	2.1	0.7

ANOVA (Repeated Measures): F = 162.5, p < 0.001

Values are expressed as mean ± SD. A significant reduction in pain scores was observed across all time intervals

Distribution of pain severity categories

Pain scores were categorised into mild, moderate, and severe levels to better understand clinical relevance. In the immediate postoperative period, a large proportion of patients reported moderate to severe pain. Over time, there was a clear shift toward mild pain (Table 3).

Table 3: Distribution of pain severity at different time intervals

Time	Mild (1–3)	Moderate (4–6)	Severe (7–10)
0 hr	18 (10%)	112 (62%)	50 (28%)
2 hr	42 (23%)	111 (62%)	27 (15%)
6 hr	97 (54%)	75 (42%)	8 (4%)
12 hr	122 (68%)	48 (26%)	10 (6%)
24 hr	148 (82%)	32 (18%)	0 (0%)

Chi-square test (Pain category vs Time): $\chi^2 = 185.3$, $p < 0.001$

Values are expressed as frequency (percentage). There is a statistically significant shift from severe/moderate pain to mild pain over time.

Trend of pain reduction

A consistent downward trend in pain scores was observed across all postoperative intervals. The steepest decline occurred within the first 6 hours, followed by a gradual reduction thereafter. This suggests that the initial postoperative period is critical for effective pain control.

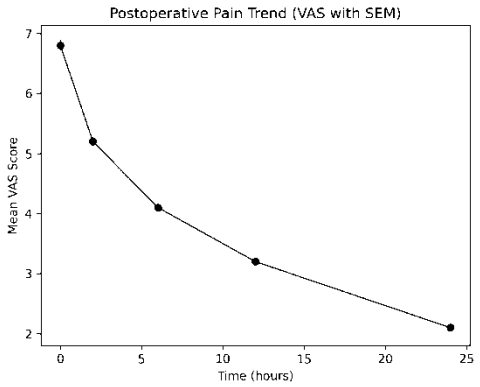

Figure 1: Trend of postoperative pain intensity measured using the Visual Analogue Scale over time

Pain score variability (SEM analysis)

The standard error of mean (SEM) decreased progressively over time, indicating reduced variability in pain perception among patients as recovery progressed (Table 4; Figure 2).

Table 4: SEM values of VAS scores

Time Interval	SEM
0 hr	0.09
2 hr	0.08
6 hr	0.07
12 hr	0.06
24 hr	0.05

SEM = SD / √n.

Lower SEM at later time points indicates more consistent pain control across patients

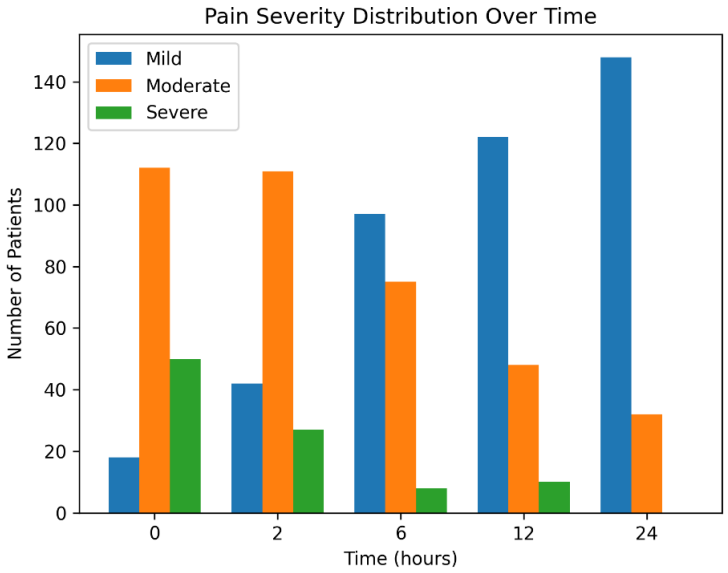

Figure 2: Distribution of patients according to pain severity at different postoperative intervals

Effectiveness of analgesic protocol

The progressive reduction in pain scores and disappearance of severe pain by 24 hours indicate that the standard postoperative analgesic regimen was effective in most patients. Only a small proportion of patients continued to report moderate pain at later time points, and no patients reported severe pain at 24 hours (Figure 3).

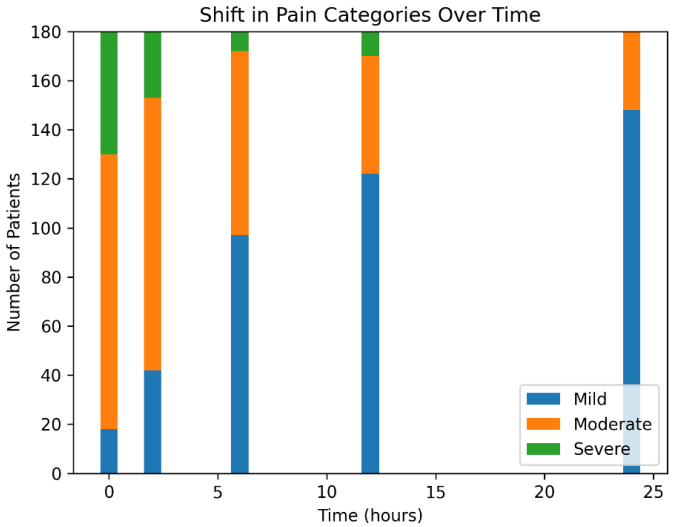

Figure 3: Temporal transition in pain severity categories during the first 24 hours after surgery

The study demonstrated that postoperative pain was highest immediately after surgery and declined steadily over the first 24 hours. Statistical analysis confirmed that the reduction in pain scores was significant. The findings also showed a clear clinical shift from moderate/severe pain to predominantly mild pain within 12–24 hours.

DISCUSSION

The present study evaluated postoperative pain patterns over the first 24 hours using the Visual Analogue Scale in a cohort of 180 patients. The findings demonstrate that pain intensity was highest in the immediate postoperative period and declined steadily with time, with a significant reduction observed by 24 hours. This pattern is consistent with the expected physiological response to surgical trauma and subsequent healing, where inflammatory mediators released at the site of tissue injury initially amplify nociceptive signals, followed by gradual resolution as the acute phase subsides [1,2].

In the current study, the mean VAS score at 0 hours was 6.8 ± 1.2, indicating that a large proportion of patients

experienced moderate to severe pain immediately after surgery. This observation is in line with earlier reports that highlight inadequate pain control in the immediate recovery phase, often due to the waning effects of intraoperative anaesthesia and delayed onset of postoperative analgesics [3,4]. Similar findings have been reported in studies where early postoperative pain remains a significant clinical concern despite advances in perioperative care [5].

A notable decline in pain intensity was observed as early as 2 hours postoperatively, with further reduction at 6 and 12 hours. By 24 hours, the mean VAS score had decreased to 2.1 ± 0.7, indicating that most patients experienced only mild discomfort. This progressive decline suggests that the analgesic regimen used in routine practice was effective in controlling pain over time. Comparable trends have been described in previous studies, where multimodal analgesia resulted in significant improvement in patient comfort within the first postoperative day [6,7].

The distribution of pain severity categories in this study provides additional clinical insight. Initially, the majority of patients reported moderate to severe pain, but this proportion decreased substantially over time, with a corresponding increase in mild pain cases. By 24 hours, no patients reported severe pain, and most were in the mild category. This transition reflects not only the natural course of postoperative recovery but also the effectiveness of timely analgesic administration. Similar shifts in pain categories have been documented in clinical studies assessing postoperative pain trajectories [8,9].

The statistically significant reduction in VAS scores across time intervals ($p < 0.001$) further supports the reliability of these findings. Repeated measures analysis confirmed that the observed changes were not due to random variation but represented a true decline in pain intensity. This aligns with existing literature that emphasises the importance of serial pain assessment in capturing meaningful trends rather than relying on single-point measurements [10].

The use of the Visual Analogue Scale in this study proved to be practical and sensitive for detecting changes in pain intensity. Its ability to quantify subjective pain into measurable values allows for better comparison across time points and between patients. Previous research has consistently shown that VAS is a valid and reliable tool for postoperative pain assessment, with good sensitivity to changes following analgesic interventions [11,12]. In the present study, the consistent decline in VAS scores across all time intervals highlights its utility in monitoring recovery.

Another important observation is the reduction in variability of pain scores over time, as reflected by decreasing SEM values. This suggests that as patients progressed through the postoperative period, their pain experiences became more uniform, likely due to stabilisation of physiological responses and consistent analgesic effects. This trend has also been reported in studies where early variability in pain perception tends to decrease with adequate pain control and recovery progression [13].

Effective postoperative pain management is essential not only for patient comfort but also for improved clinical outcomes. Poorly controlled pain can lead to complications such as impaired respiratory function, delayed mobilisation, and prolonged hospital stay [14]. The findings of this study indicate that routine analgesic protocols, when applied appropriately, can achieve satisfactory pain relief in most patients within the first 24 hours. This supports the continued use of standardised pain management strategies, with periodic assessment to ensure adequacy.

However, it is important to recognise that pain perception is influenced by multiple factors, including individual pain thresholds, psychological status, type of surgery, and cultural background [15]. Although the present study did not specifically analyse these variables, their potential role in shaping pain experience cannot be overlooked. Future studies may explore these factors in greater detail to provide a more comprehensive understanding of postoperative pain.

The results of this study also reinforce the importance of early and regular pain assessment as part of routine postoperative care. Timely identification of patients with higher pain scores allows for prompt intervention, thereby preventing prolonged discomfort and associated complications. This approach is in line with enhanced recovery protocols, which emphasise optimal pain control as a key component of postoperative management [16-19].

Despite the strengths of prospective data collection and uniform assessment intervals, certain limitations should be considered. The study was conducted in a single centre, and the findings may reflect institutional practices and patient characteristics specific to that setting. In addition, variations in surgical procedures and analgesic regimens, although reflective of real-world practice, may have influenced pain outcomes. Nevertheless, the study provides a useful overview of postoperative pain trends under routine clinical conditions.

In summary, the present study demonstrates that postoperative pain is most intense in the immediate recovery period and decreases progressively within the first 24 hours. The Visual Analogue Scale proved to be an effective tool for monitoring pain over time, and the findings highlight the importance of structured pain assessment and timely analgesic intervention. These observations are consistent with existing evidence and

underscore the need for continued emphasis on effective postoperative pain management in clinical practice

CONCLUSION

The present study shows that postoperative pain is most pronounced in the immediate period following surgery and gradually decreases over the first 24 hours. The consistent reduction in VAS scores at successive time intervals indicates that pain control improves steadily with time under routine clinical management. By the end of the first postoperative day, most patients experienced only mild discomfort, and severe pain was no longer observed.

The findings also highlight the usefulness of the Visual Analogue Scale as a simple and reliable method for repeated pain assessment. Regular monitoring using this tool allows clinicians to track changes in pain intensity and make timely decisions regarding analgesic requirements. The observed trend suggests that the standard postoperative analgesic protocol followed in the institution was effective in achieving satisfactory pain relief in the majority of patients.

Overall, careful and continuous assessment of pain, along with appropriate analgesic management, plays a key role in improving patient comfort and supporting early recovery after surgery.

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Conflict of Interest

The authors declare that there are no conflicts of interest related to this study. None of the authors has any financial or personal relationship that could have influenced the work reported in this manuscript.

Ethical Approval

The study was carried out after obtaining approval from the Institutional Ethics Committee of Bhaskar Medical College. The research was conducted in accordance with accepted ethical standards for studies involving human participants

Informed Consent

Written informed consent was obtained from all participants prior to their inclusion in the study. Patients were informed about the purpose of the study, and their participation was entirely voluntary.

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