Original Research Article

# Assessment of Post-operative Pain in Rural Patients: A Comparative Study of Numerical and Visual Analog Scales

**Shikha Agrawal[1], Pranchil Pandey[2], Vaibhav Agrawal[3], Ramesh Agrawal[4]**

[1]Assistant Professor, Department of Anaesthesia, N.S.C, Government Medical College, Khandwa, Madhya Pradesh, India
[2]Senior Resident, Department of Anaesthesia, Shyam Shah Medical College, Rewa, Madhya Pradesh, India
[3]Associate Professor, Department of Medicine, NKP Salve Institute of Medical Science, Nagpur, Maharashtra, India
[4]Assistant Professor, Department of Microbiology, N.S.C, Government Medical College, Khandwa Madhya Pradesh, India

**Abstract**

**Background and Objectives:** Visual analog scales (VAS) and numeric analog scales (NAS) are crucial tools for assessing post-operative pain intensity in the fields of anesthesia and pain medicine. These scales rely on an individual's cognitive and emotional abilities to provide subjective pain ratings. The documentation of pain scores is essential for comparative and analytical purposes in research articles. This study aimed to investigate the influence of literacy on post-operative pain scores measured by VAS and NAS, and to assess the agreement between these two scales.

**Materials & Methods:** This study was conducted in the anesthesia department of a tertiary care hospital, following the appropriate guidelines for research ethics. Pain assessments were carried out using two types of scales, namely the Visual Analog Scale (VAS) and Numeric Analog Scale (NAS), at two specific time points: within five minutes and within 24 hours after the surgical intervention. The collected data from these time points were then subjected to statistical analysis, employing methods such as percentages, chi-square test, and regression analysis.

**Results**: In this study, a total of 135 participants were included, with the majority being males (55.5%) and falling within the age group of less than 30 years (40.7%). The mean age was $35.60\pm16.4$ years. About 40.7% of the participants were illiterate. A large proportion of the participants were able to rate their pain using both the Visual Analog Scale (VAS) and the Numeric Analog Scale (NAS), with 78.5% and 77.1% respectively. No significant associations were found between pain ratings and factors such as surgery type, duration, anesthesia nature, as well as age, sex, and literacy levels ($p > 0.05$).

**Conclusion:** Irrespective of the literacy status, both the Visual Analog Scale (VAS) and Numeric Analog Scale (NAS) can serve as interchangeable post-operative pain assessment tools in the context of the Indian rural population.

**Keywords:** Numerical Analog Scale, Visual Analog Scale, Pain Assessment, Post-Operative, Rural.

## Introduction

The International Association for the Study of Pain defines pain as "an unpleasant sensory and emotional experience resulting from actual or potential tissue damage, or described in terms of such damage" [1]. It is important to note that no single method has been universally proven to accurately assess pain in all patients, highlighting the necessity for at least two equally reliable methods for pain assessment [2]. Postoperative pain is an immediate reaction to surgical trauma, manifesting through various autonomic, hormonal, metabolic, physiological, and behavioral changes [2, 3]. The Visual Analog Scale (VAS) is commonly employed to assess the intensity of pain, and it is often assumed by authors and readers that a statistically significant disparity in VAS scores corresponds to a clinically meaningful decrease in pain [4]. International studies indicate that a significant percentage of individuals, ranging from 7% to 11%, may encounter difficulties or confusion when attempting to complete the visual analog scale (VAS) [5]. In India, data from the government indicates that the overall literacy rate stands at 74%, with a higher prevalence of illiteracy among females, affecting 35% of the population [6]. Notably, the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) has recently conducted a review recommending specific methods for interpreting the clinical significance of treatment outcomes in chronic pain trials. However, as of now, there are no specific recommendations available for assessing the clinical importance of outcomes in acute postoperative pain [7]. Rural areas tend to have even lower literacy rates compared to urban areas. Despite the availability of recommended guidelines for pain assessment, there is a limited amount of data on the use of pain scales in patient populations characterized by a high prevalence of illiteracy, such as in India. Developing a pain assessment scale that is more suitable for the Indian population with high illiteracy rates would be a valuable tool in the effective management of postoperative pain [8]. The objective of this study was to assess the influence of literacy on the ability to express pain using both the Visual Analog Scale (VAS) and Numeric Analog Scale (NAS) rating scales.

## Material & Methods

This cross-sectional study was conducted among post-operative patients who were admitted to a tertiary care hospital in rural India. The study included patients undergoing surgical procedures across different departments, including surgery, obstetrics and gynecology, ENT, orthopedics, and others. Prior to their participation, informed consent was obtained from all patients.

## Study population

Out of the 170 patients who underwent surgery during the study period, a total of 135 patients fulfilled the inclusion criteria and provided their consent to participate in the study.

The inclusion criteria for this study comprised of patients aged 18 years or older, specifically focusing on rural individuals who had undergone a surgical procedure within 24 hours. Additionally, patients who willingly provided consent for participation in the study were considered eligible. Furthermore, the study included patients who were capable of cooperating and had normal mental status. On the other hand, the following exclusion criteria were applied: patients under the age of 18, urban patients, and individuals with unstable hemodynamic status or unconscious patients who were

unable to actively participate in the assessment.

**Anaesthetic care:** Our study enrolled adult patients undergoing various surgical procedures with different types of anesthesia (general, spinal, epidural, and blocks) who met the inclusion criteria. Standardized postoperative pain control protocols were implemented, including the administration of injection paracetamol 1000mg every 8 hours and injection tramadol 50 mg every 8 hours for all patients.

Data collection included information on age, gender, socio-demographic factors, and procedural characteristics. Patients were educated on the use of the Visual Analog Scale (VAS) and Numeric Analog Scale (NAS) for pain evaluation. The VAS consisted of a ruler marked from 0 to 10, where 0 represented no pain and 10 indicated the worst pain imaginable. Similarly, the NAS ranged from 0 to 100, with 0 representing no pain and 100 representing the most severe pain imaginable.

Patients were asked to rate their pain intensity using both the VAS and NAS scales exactly 24 hours after the completion of surgery. The readings on both scales were obtained consecutively, with a time gap of no more than five minutes between measurements.

**Statistical analysis:** The collected data was analyzed using SPSS software, specifically Version 22. To assess the influence of age, sex, and literacy on the ability to rate pain using the NAS and VAS scales, multivariate analysis was conducted. The ability to rate pain was categorized as a binary variable, with responses coded as either yes or no. Binary logistic regression analysis was performed to examine the relationship between the variables.

Statistical measures such as percentages, proportions, tests of significance (Chi-square), and correlation coefficients were obtained to determine the associations and relationships between the variables in the study. These measures provided valuable insights into the patterns and significance of the data.

## Results

The study included a total of 135 patients. Among them, the majority were male, accounting for 75 individuals (55.5% of the total). The age distribution of the patients revealed that the largest proportion, 40.7%, belonged to the age group below 30 years. The mean age of the patients was calculated as 35.60±16.4 years. Among the participants, 55 patients (40.7%) were found to be illiterate.

In terms of pain assessment, a total of 106 patients (78.5% of the total) were able to rate their pain using both the visual analog scale and the numeric analog scale. Specifically, 104 patients (77.1%) successfully completed the numeric analog scale. A detailed description of these findings is presented in Table 2.

The analysis revealed that there was no significant association between the type of surgery, duration of surgery, and type of anesthesia with the pain rating on both the visual analog scale (VAS) and numeric analog scale (NAS). This information is presented in Table 1, indicating that these factors did not have a significant impact on the patients' pain ratings on either scale.

### Table 1: Surgical characteristics and ability to rate pain on VAS and NAS

| Surgical characteristics | Able to rate on VAS | Unable to rate on VAS | *P* value | Able to rate on NAS | Unable to rate on NAS | P value |
|---|---|---|---|---|---|---|
| **Type of surgery** | | | | | | |
| General surgery | 43 | 15 | 0.829 | 43 | 15 | 0.356 |

| OBG | 26 | 13 | | 26 | 13 | |
|---|---|---|---|---|---|---|
| Orthopaedics | 18 | 7 | | 18 | 7 | |
| Others | 10 | 3 | | 10 | 3 | |
| **Duration** | | | | | | |
| <30 minutes | 12 | 7 | 0.701 | 12 | 7 | 0.574 |
| 30 minutes-2 hours | 75 | 22 | | 76 | 25 | |
| >2 hours | 12 | 7 | | 13 | 2 | |
| **Typeof anesthesia** | | | | | | |
| General | 22 | 10 | 0.595 | 24 | 7 | 0.136 |
| Spinal | 59 | 21 | | 57 | 24 | |
| Epidural | 8 | 2 | | 8 | 2 | |
| Local | 4 | 2 | | 5 | 3 | |
| Block | 5 | 2 | | 4 | 1 | |

**Table 2: Baseline characteristics and ability to rate pain on VAS and NAS**

| Variables | | Numbers | Percentages |
|---|---|---|---|
| Age in years | <30 years | 55 | 40.7 |
| | 30-49 years | 38 | 28.2 |
| | 50-69 years | 37 | 27.4 |
| | ≥70 years | 05 | 3.7 |
| Gender | Male | 75 | 55.5 |
| | Female | 60 | 44.5 |
| Educational status | Illiterate | 55 | 40.7 |
| | Primary | 42 | 31.2 |
| | Secondary | 16 | 11.8 |
| | Intermediate | 11 | 8.1 |
| | Graduate | 11 | 8.1 |
| Socioeconomic status | Upper | 8 | 5.9 |
| | Middle | 48 | 35.5 |
| | Lower | 79 | 58.5 |
| Ability to rate pain on VAS | Yes | 106 | 78.5 |
| | No | 29 | 21.5 |
| Ability to rate pain on NAS | Yes | 104 | 77.1 |
| | No | 31 | 22.9 |

**Table 3: Multivariate logistic regression analysis of baseline characteristics and ability to rate pain on VAS and NAS**

| Characteristic | B | | SE | | P value | |
|---|---|---|---|---|---|---|
| | VAS | NAS | VAS | NAS | VAS | NAS |
| Age | 0.019 | 0.016 | 0.044 | 0.045 | 0.643 | 0.714 |
| Sex | -0.002 | -0.069 | 0.081 | 0.082 | 0.962 | 0.403 |
| Literacy | -0.030 | 0.004 | 0.030 | 0.031 | 0.324 | 0.873 |

The ability of age, sex, and literacy to rate pain on the visual analog scale (VAS) showed correlation coefficients of 0.643, 0.962, and 0.324, respectively. On the numeric analog scale (NAS), the correlation coefficients were 0.714, 0.403, and 0.873 for age, sex, and literacy,

respectively. However, these correlations were not statistically significant, as indicated in Table 3. A correlation coefficient of 0.75 was considered to represent a moderate correlation, while a value less than 0.5 indicated a weak correlation between the variables.

To visually compare the pain ratings on the VAS and NAS scales, a scatter plot was created, as shown in Figure 1.
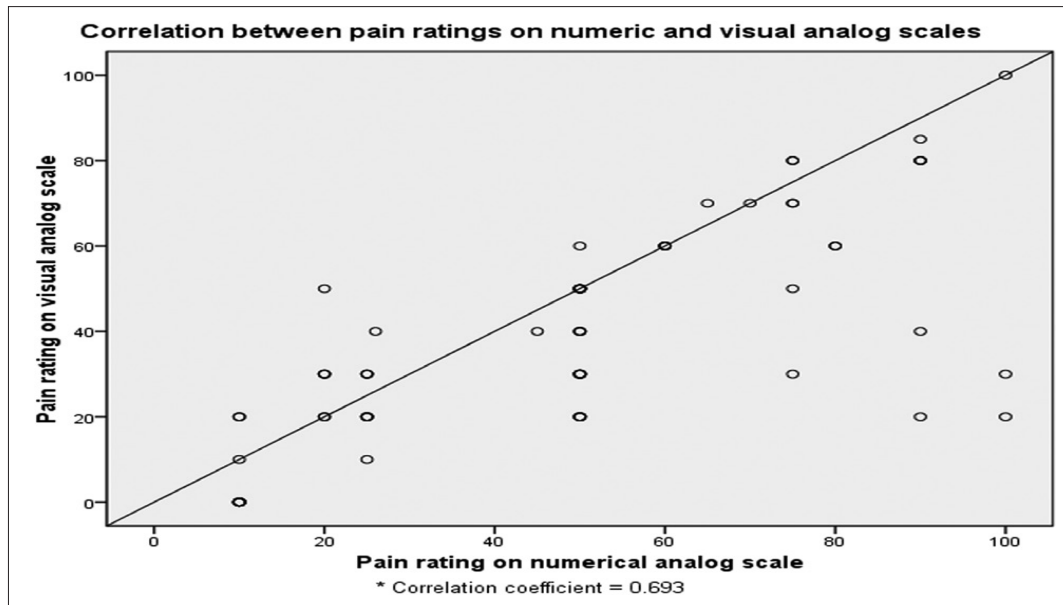


**Figure 1: Correlation between pain ratings on numeric and visual analog scales**

## Discussion

Accurate assessment of pain is crucial for effective pain management, particularly in post-surgical patients. The findings of this study provide valuable insights that can guide healthcare professionals in selecting appropriate analgesic therapies. The use of accurate evaluation tools is essential for reliable pain assessment.

Various scales have been developed to quantifiably measure pain, with classifications including behavioral and subjective measures. Additionally, there are non-subjective and biological measures available. The accuracy of pain assessment relies on the collaborative efforts of both the individual experiencing pain and the healthcare provider. It is important to consider these factors in order to ensure accurate and comprehensive pain evaluation. [9].

Among the various measures of pain, the visual analog scale (VAS) and numeric analog scale (NAS) are commonly used in pain research. The VAS is a simple and widely employed scale that assesses pain intensity using a 10 cm line, with anchor points representing "no pain" and the "worst pain ever felt." The scale under consideration is widely acknowledged and renowned for its high sensitivity, reliability, and extensive use within clinical settings. The NAS is also a straightforward method of pain assessment, where individuals rate their current pain level on a scale ranging from 0 to 100, with 0 indicating no pain and 100 representing the worst pain imaginable. These scales provide valuable tools for evaluating pain in both research and clinical contexts [10-13].

In the present study, a higher proportion of male participants was observed, and the mean

age of the participants was determined to be 37.64±17.4 years. These findings are consistent with previous studies conducted by Bloomington MN et al [14] and Gagliese L et al [15], which also reported similar patterns of male preponderance and comparable mean age ranges.

In our study, a majority of the participants (78%) rated their pain using the visual analog scale. This finding is in concordance with a study conducted by Yim KH et al [16], which also reported a high rate of pain rating using the visual analog scale.

In the present study, no significant association was found between the literacy status of participants and their ability to rate pain using either the visual analog or numerical scales. This suggests that these pain assessment tools can be effectively utilized in the illiterate population. Furthermore, no significant differences were observed in the ability to rate pain based on other demographic characteristics such as age, sex, and socioeconomic status. These findings are consistent with previous studies conducted by Holgate et al. [17], Chung et al. [18], and Fadaizadeh et al. [19].

In our study, a significant proportion of patients (77.2%) completed the numeric analog scale, which is in line with the findings reported by Connelly MA et al. [20].

We also found that the majority of patients in our study belonged to the low socio-economic class, which is consistent with similar findings reported by Mudgalkar N et al. [21].

Regarding the ability to rate pain on the numeric analog scale, we did not observe any significant associations with age, sex, or literacy status (p-value > 0.05). These findings are comparable to those reported by Jaywant SS et al. [22] and Myles PS et al. [23].

The current study revealed a moderate correlation between pain scores obtained from the visual analog scale (VAS) and numeric analog scale (NAS). International studies focusing on post-operative pain intensity have consistently demonstrated a good correlation between these two scales, with correlation coefficients ranging from 0.71 to 0.99. It is important to note that the observed differences in correlation coefficients can be attributed to variations in the socio-demographic characteristics of the study populations [24,25].

One notable strength of this study is its novelty, as it is the first of its kind conducted in the Indian population, specifically examining the impact of literacy on pain rating using VAS and NAS. These findings emphasize that education should not serve as a barrier in the assessment and management of pain.

The visual analog scale (VAS) and numeric analog scale (NAS) have proven to be valuable tools for assessing pain in the Indian rural population. These scales are user-friendly and even illiterate patients can easily rate their pain using them. Additionally, there is a moderate correlation between the VAS and NAS, suggesting that both scales can be used interchangeably regardless of the literacy status of the patients. This highlights the versatility and effectiveness of these assessment tools in pain management among diverse populations.

## Conclusion

The visual analog scale (VAS) and numeric analog scale (NAS) have proven to be valuable tools for assessing pain in the Indian rural population. These scales are user-friendly and even illiterate patients can easily rate their pain using them. Additionally, there is a moderate correlation between the VAS and NAS, suggesting that both scales can be used interchangeably regardless of the literacy status of the patients. This highlights

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