*Vietnam Journal of Community Medicine, Vol. 65, English version, 2024, 226-233*

# POSTOPERATIVE PAIN MANAGEMENT AND RELATED FACTORS AMONG PATIENTS UNDERGOING ORTHOPEDIC SURGERY: A SINGLE CENTER OBSERVATIONAL STUDY

Pham Duy Quang[1*], Bui Dinh Hoan[2], Le Duc Thang[3]

[1]*Nguyen Tat Thanh University - 298A Nguyen Tat Thanh, Ward 13, Dist 4, Ho Chi Minh City, Vietnam*
[2]*University of Medicine and Pharmacy at Ho Chi Minh City - 217 Hong Bang , Ward 11, Dist 5, Ho Chi Minh City, Vietnam*
[3]*Hospital for Traumatology and Orthopaedics - 929 Tran Hung Dao, Ward 1, Dist 5, Ho Chi Minh City, Vietnam*

Received: 18/11/2024
Revised: 29/11/2024; Accepted: 06/12/2024

## ABSTRACT

**Background:** Postoperative inadequate analgesia is common and is associated with poor clinical outcomes. Perioperative pain management after orthopaedics surgery is still challenging. Moreover, the factors associated with severe pain that influence postsurgical pain control according to an acute pain protocol may underestimated and undermanaged, besides in the absence of reports representing Vietnam.

**Objective:** This study aimed to identify the points pain score via the VAS and perioperative predictors of poor postoperative pain control in patients undergoing orthopaedics surgery.

**Method:** The cross-sectional study was performed on patients in the Hospital for Traumatology and Orthopaedics HCMC from December 2023 to June 2024.

**Results:** A total of 615 patients were included in this study. The means of VAS for the before and after orthopaedics surgery were 47.9±19.4 and 40.6±20.9, respectively, with statistically significant differences between the two assessment times ($P < 0.05$). Spinal surgery (OR = 4.63, 95%CI: 2.53-8.48) and ASA III/IV (OR = 2.78; 95%CI: 1.52-5.10) were statistically associated with severe pain ($P < 0.05$).

**Conclusion:** In conclusion, there is an improved significantly between severe pain points by VAS between the first two interviews. Furthermore, we suggest that tightening management patients in ASA III/IV status and providing proper caring based on operative sites are promising approaches to reduce the severe postoperative pain rate.

***Keywords:*** VAS, NRS, postoperative pain management, orthopedic surgery.

## 1. INTRODUCTION

Presentations needing surgery are common; over 300 million surgical procedures are performed around the world. Orthopedic surgical volumes have increased substantially in the number of hospital admissions per year[1,2]. Postoperative pain caused by previous surgical procedures is a type of acute pain that is present in a surgical patient; approximately 75% of patients experience moderate, severe, or extreme pain after surgery[3]. Inadequate pain management leads to increased complications and negatively affects the quality of recovery and physiological changes, prolongs hospital stay, and increases the risk of developing persistent pain. For this reason, pain management is one part of the postoperative period. Although these guidelines recommend regional anesthesia and multimodal analgesics to reduce the need for perioperative opioids, realistic goals for pain control are hardly achievable and some patients with severe pain need to be prescribed more appropriately. Hence, this study aimed to measure the outcome score of postoperative pain in the PACU facilitates and identify the factors that influence conventional analgesic methods for anesthesia.

*Corresponding author
**Email:** duyquanghmu@gmail.com **Phone:** (+84) 973417748 **Https:**//doi.org/10.52163/yhc.v65i13.1882

## 2. SUBJECTS AND RESEARCH METHODS

### 2.1. Population characteristics, study design and time of implementation

This research was a cross-sectional study.

- *Inclusion criteria:* All patients who were admitted under the direct care of the orthopaedic team at the Department of Anesthesiology, Hospital for Traumatology, and Orthopaedics HCMC were eligible for this study. The study was done from December 2023 to June 2024.

- *Exclusion criteria:* Patients with unstable haemodynamic status, unconscious patients and using local anaesthetic infiltration only for anesthesia were also excluded from the study.

Sample size:

$$n = Z^2_{1-\alpha/2} \frac{p(1 - p)}{d^2}$$

n = the desired sample size from a large population size.

α: Level of significance, choose α = 0.05

$Z_{1-\alpha/2}$= two-tailed Z-score confidence level (1.96).

p = Population proportion (0.41).

d = Absolude error (0.05)

The sample size was calculated according to a study done at University Hospital Maastricht, The Netherlands, by Michael Sommer. The prevalence of moderate to severe pain of postoperative pain was found to be 41%.4 So, setting the prevalence at 41% and the allowable error of 5% of prevalence, the sample size was calculated as 372. By adding a 10% loss of follow-up and missing data, the final estimated sample size N = 409. Consequently, we recruited 615 patients for the research.

- *Sampling selection:* The participants were recruited by using the convenience sampling method.

### 2.2. Materials and data analysis

#### *2.2.1. Data collection techniques*

Intraoperative and recovery data were collected from two sources. The primary data source was the responses of sampled respondents eligible for the investigator and from their medical records. While conducting research, nurse anesthesia students (third-year, final year) collect data from face-to-face assessments.

The medical information records were extracted for each patient: demographic characteristics (age, gender, height, weight and body mass index) and perioperative variables (procedure type, blood pressure, heart rate) were recorded and analyzed. Intraoperative anaesthetic care was standardized in terms of the kind of anesthesia (general, spinal, blocks). The patients were administered (1) 1000g/100ml paracetamol, (2) non-steroidal anti-inflammatory drugs (NSAIDs): diclofenac 75mg intramuscularly (IM), if no contraindications were present, (3) 100mg tramadol (IM/IV); (4) 2.5-10mg of morphine (IM/IV) for pain relief, pediatric doses are based on the child's age or weight and combination of 1-5 mg of midazolam and 25-50 mcg fentanyl IV for pre-medication.

#### *2.2.2. Research tools and measurement methods*

Physical status defined by the American Society of Anesthesiologists (ASA) was simplified to denotes preoperative risk classification based on comorbidity from ASA I (healthy) to ASA VI (brain-dead).5 No patient in our study was graded as moribund and brain-dead;

For each patient, pain severity was recorded on a 100mm visual analogue scale (VAS) and a numerical rating scale (NRS) was chosen because of its widely used and accepted reliability and validity. VAS is used on a scale of 0 to 100 where 0 = no pain and 100 = worst imaginable pain for average pain level, pain at its worst and experiencing now. With eleven-point NRS, patients were subsequently stratified into the following groups: no pain (0), mild pain (1 to 3), moderate pain (4 to 6) or severe pain (7 to 10).6,7 The final assessment was performed 01 hours after the start of the first dose of the pain relief medication at the post-anesthesia care unit (PACU).

The data were analyzed using a statistical software program (R version 4.4.2, the R Foundation for Statistical Computing, Vienna, Austria). Data were presented as mean±standard deviation (mean±SD) if normally distributed and median±interquartile range if not, or n (%). Normally distributed data, including continuous variables, were analyzed using Student's t-test for parametric tests and Wilcoxon rank sum test for non-parametric tests. Categorical variables were analyzed using the Chi-square test and Fisher's exact test. $P < 0.05$ was considered to be significant in all tests.

### 2.3. Ethics Statement

This study was conducted according to the guidelines of the Declaration of Helsinki. This observational study was performed without pharmacological intervention, and standardized postoperative pain therapy was applied. Participants' personal information is kept confidential.

## 3. RESULTS

During the study period, we screened 615 patients who underwent surgery and were found to be eligible.

**Table 1. Clinical characteristics of the patients (N=615)**

| Characteristics | | n | % |
|---|---|---|---|
| Gender | Male | 343 | 55.8 |
| | Female | 272 | 44.2 |
| Age (years); mean ± SD | | 45.1±21.0 (2-101) | |
| Age categories | ≤ 15 years | 46 | 7.5 |
| | 16-59 years | 394 | 64.1 |
| | ≥ 60 years | 175 | 28.4 |
| ASA physical status | ASA-I | 142 | 23.1 |
| | ASA-II | 400 | 65.0 |
| | ASA-III | 72 | 11.7 |
| | ASA-IV | 1 | 0.2 |
| Body mass index, kg/m$^2$ (BMI) | Overweight/ Obesity ( ≥ 25) | 120 | 19.5 |
| | Normal weight (18.5-24.9) | 451 | 73.3 |
| | Underweight (< 18.5) | 44 | 7.2 |
| Operation site | Lower limb | 300 | 48.8 |
| | Upper limb | 213 | 34.6 |
| | Spine | 66 | 10.7 |
| | Not specified (clavicle, pelvis, complex wound) | 36 | 5.9 |
| Type of anesthesia* (N=665) | General anesthesia | 103 | 15.5 |
| | Inhalation anesthesia | 94 | 14.1 |
| | Total intravenous anesthesia | 9 | 1.4 |
| | Regional anesthesia | 562 | 84.5 |
| | Extremity peripheral nerve blocks | 297 | 44.7 |
| | Spinal anesthesia | 265 | 39.8 |
| Nature surgery | Emergency | 39 | 6.3 |
| | Elective | 576 | 93.7 |
| Opioid usage | Yes | 93 | 15.1 |
| | No | 522 | 84.9 |
| Sedative premedication | Yes | 254 | 41.3 |
| | No | 361 | 58.7 |
| Pain on NRS | No to mild pain | 241 | 39.2 |
| | Moderate pain | 299 | 48.6 |
| | Severe pain | 75 | 12.2 |

**The patient undergoes a general anaesthetic after complete failure in major regional blocks.*

The majority (55.8%, n =343/615) of the respondents were male. The study showed that the most common range belonged to the age group of 16-59 years (64.1%) and the mean age of 45.1±21.0 years (range, 2–101 years). Of these, 142 patients were ASA I (23.1%), 400 (65.0%) patients with ASA classification II, 72 (11.7%) ASA III, and 1 (0.2%) with ASA classification IV. The most common anesthesia procedure is regional anesthesia, accounting for 84.5%. Specifically, most cases of extremity peripheral nerve blocks are 44.7%, being the most frequent and 39.8% in spinal anesthesia . There were 213 upper limbs, 300 lower limbs, 66 vertebral disc disease and vertebral fractures, and 36 admissions were not specified. Overall, the rate of elective surgery was high (93.7%) and 6.3% emergency operation. According to BMI, 7.2% and 19.5% of patients were malnourished and overweight/ obese, respectively. Severe pain was reported by 75 (12.2%) patients.

**Table 2. Vital sign, VAS score in PACU (n=615)**

| Variable | | Preoperative period | Postoperative perioid | p-value* |
|---|---|---|---|---|
| Blood pressure (mmHg) | Systole | 140.0 (130.0-160.0) | 126.0 (120.0-137.0) | < 0.001 |
| | Diastole | 80.0 (75.0-90.0) | 75.0 (70.0-80.0) | < 0.001 |
| Heart rate (beats/min) | | 82.0 (75.0-93.0) | 78.0 (70.0-85.0) | < 0.001 |
| Mean arterial pressure, mmHg | | 103.0 (93.3-113.3) | 93.3 (86.7-100.0) | < 0.001 |
| VAS score (mm) | | 47.9±19.4 | 40.6±20.9 | < 0.001 |

*Values are presented as mean ± SD or median (25$^{th}$–75$^{th}$ percentile); *Group comparisons by Wilcoxon rank sum test.*

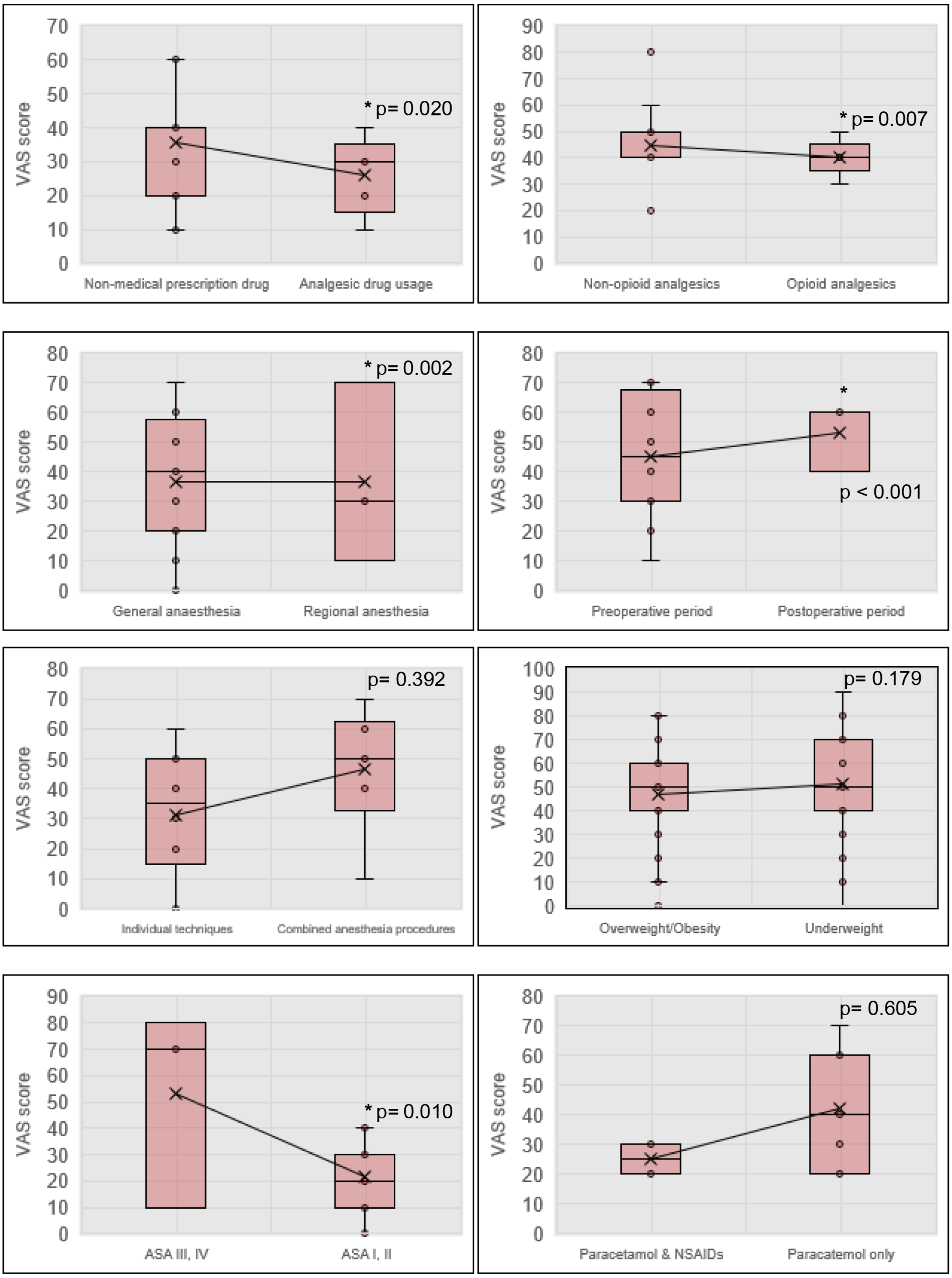
As can be seen from Table 2, vital signs (pulse, blood pressure) and VAS score in perioperative pain management. The estimated means (±SD) for pain levels on the VAS are 47.9±19.4 and 40.6±20.9. There was a clinically meaningful difference observed in the assessment of vital signs with median (IQR) between the preoperative period and postoperative period groups (P < 0.001).

**Table 3. P-values for patient data of factors associated with postoperative pain assessed with NRS**

| Characteristics | | Severe pain (N=75) | | | | Odds Ratio (95% CI) | p-value* |
|---|---|---|---|---|---|---|---|
| | | Yes | | No | | | |
| | | n | % | n | % | | |
| Gender | Female | 38 | 14.0 | 234 | 86.0 | 1.34 (0.83-2.18) | 0.231 |
| | Male | 37 | 10.8 | 306 | 89.2 | | |
| Age categories | 16-59 years | 46 | 11.7 | 348 | 88.3 | Reference | |
| | ≤ 15 years | 3 | 6.5 | 43 | 93.5 | 0.53 (0.16-1.78) | 0.294** |
| | ≥ 60 years | 26 | 14.9 | 149 | 85.1 | 1.32 (0.79-2.22) | 0.293 |
| Body mass index | Normal weight | 54 | 12.0 | 397 | 88.0 | Reference | |
| | Underweight | 8 | 18.2 | 36 | 81.8 | 1.63 (0.72-3.71) | 0.236 |
| | Overweight/ Obesity | 13 | 10.8 | 107 | 89.2 | 1.12 (0.59-2.13) | 0.730 |
| Location of surgery site | Extremity | 50 | 9.7 | 463 | 91.3 | Reference | |
| | Spine | 22 | 33.3 | 44 | 66.7 | 4.63 (2.53-8.48) | < 0.001 |
| | Not specified | 3 | 8.3 | 33 | 91.7 | 0.84 (0.25-2.85) | 1.000** |
| Nature surgery | Emergency | 2 | 5.1 | 37 | 94.9 | 2.68 (0.63-11.42) | 0.210** |
| | Elective | 73 | 12.7 | 503 | 87.3 | | |
| Opioid usage | Yes | 13 | 14.0 | 80 | 86.0 | 1.21 (0.63-2.30) | 0.569 |
| | No | 62 | 11.9 | 460 | 88.1 | | |
| Sedative | No | 45 | 12.5 | 316 | 87.5 | 1.06 (0.65-1.74) | 0.807 |
| | Yes | 30 | 11.8 | 224 | 88.2 | | |
| ASA | III, IV | 18 | 24.7 | 55 | 75.3 | 2.78 (1.52-5.10) | < 0.001 |
| | I, II | 57 | 10.5 | 485 | 89.5 | | |

**Chi-squared test; **Fisher's exact test*

Associations between ASA III/IV showed that strongest among patients with NRS ≥ 7 points, 2.78 times more likely to ASA I/II compared to patients with NRS < 7 (OR = 2.78, 95% CI = 1.52-5.10, p-value <0.001). Similarly, severe postoperative pain and location of surgery site were associated with patients in spinal surgery 4.63 times more likely to have severe pain compared to patients with upper extremity surgery (OR = 4.63, 95% CI= 2.53-8.48, p-value = <0.001).




**Group comparisons by Wilcoxon rank sum test*

**Figure 1. Comparison of VAS scores on pain in PACU between the two groups with box plot (Horizontal line in box represents the median, the upper and lower borders of the box the 75th and 25th percentiles, and the vertical line the minimum and maximum scores).**

Comparison of VAS score on pain of the non-medical prescription drug group and the analgesic drug usage group, general anesthesia and regional anesthesia, ASA I/II and ASA III/IV, preoperative period and postoperative period, individual techniques and combined anesthesia procedures, non-opioid analgesics and opioid analgesics group is shown in Figure 1. The difference in the VAS scores on pain between the two groups was a significant difference ($P < 0.05$). The general and regional anesthesia, overweight/obesity and underweight, combining paracetamol with an NSAID and monotherapy with paracetamol were similar between the 2 groups ($P > 0.05$).

# 4. DISCUSSION

## 4.1. Description of participants

Of these patients, 343 (55.8%) were male, and the mean age of 45.1±21.0 years. Our findings were consistent with other studies showing a higher likelihood to occur among younger males (1.26:1). This is lower than a study done at a tertiary hospital in Nepal, where the male admission outnumbered females with a ratio of 1.82:1 and upper/lower limb fractures contributed to highest numbers of orthopaedic admissions.8 Our study was similar to a previous study in which upper/lower extremity surgeries were among the most common procedures performed in the population (83.4%). Debridement, external fixation, and amputation are the most common and important interventions in orthopaedic procedures. On average, 88.1% of cases are diagnosed at ASA I and II. Interestingly, the number of patients with ASA greater than II was higher (25.6%) among Singapore patients.9 This could suggest that patients in general hospitals have more comorbid diseases than those in specialized hospitals. Of interest, a figure as high as 84.5% of patients who had orthopedic surgery had regional anesthesia. Another study conducted by Yuqing Zeng reported that nerve block is a common anesthesia method utilized in orthopedic surgery. This technique provides numerous benefits, such as lowering the risk of nausea and vomiting, enhanced pain relief, expeditious recovery and earlier discharge.10 Regional anesthesia (neuraxial anesthesia, peripheral nerve blocks) were used in most the cases. Recent studies with large populations show that serious morbidity related to regional anesthesia is extremely rare, although the potential for serious damage (neuraxial or major peripheral nerve).

## 4.2. Pain scores

In the present study, for patients who had orthopedic surgery, the means of VAS scores before the operation was 47.9±19.4 and in the PACU was 40.6±20.9. Our study showed that 12.2% of our patients reported severe postoperative pain. Our study chose to use pain scores ≥ 7 as our cutoff for severe pain instead of moderate-severe pain in a previous study. This is higher than a study done by P. S. Myles et al. at three hospitals in Australia (Alfred, Royal Women's, and Shepparton Hospitals), the median pain VAS scores reduced from 26 (13–47) to 20 (11–36), P = 0.002. Furthermore, initial data suggest that VAS ≤ 33 signifies acceptable pain control after surgery[11]. The ASA published a practice for clinicians to use a validated pain assessment tool (VAS, NRS,…) to track responses to postoperative pain treatments and, since then, adjust treatment plans accordingly with strong recommendations[12]. A study by Donald D. Price found that the consistency between results using the VAS and the NRS is not at all surprising since both are based on the same principle of using perceived length to represent pain intensity[6]. Generally, the choice of anaesthetic approach and pain control improves the quality of postoperative analgesia in our study. Patients who have better recovery profiles significantly correlated with lower pain scores.

In addition, it was found through an analysis that pain intensity in regional anesthesia was lower than in general anesthesia ($p < 0.002$). Similarly, Jason Ju In Chan et al. demonstrated in a study that patients who had general anesthesia had increased moderate-severe postoperative pain compared with regional anesthesia ($P < 0.001$)[9]. Regional anesthesia is an integral component of successful orthopedic surgery. A technique that is both anesthetic and analgesic, was effective in the early postoperative period for systemic analgesia in terms of pain relief. Patients with higher pain scores and needing initiated analgesia are significantly associated with inadequate regional anesthesia. Of all these, single-shot spinal is the most widely practice mode of anesthesia in both elective and emergency situations in our study. While dealing with inadequate block, one should be the priority the systemic anesthesia (I.V. or inhalation) helps considerably. Briefly, neuraxial anesthesia is commonly used for surgery, while peripheral nerve blocks are often used for perioperative analgesia. In recent years, anesthesiologists in Vietnam have adhered to less use of neuraxial blocks in favour of ultrasound-guided peripheral nerve blocks in orthopedic surgery. These procedures, when performed either as single shot or as continuous infusion, are particularly suited for surgery on the upper and lower limb, and for some procedures on the trunk in appropriate situations. A meta-analysis study by Daniel Bainbridge showed that when general anesthesia works, patients can undergo surgical procedures safely and painlessly. Although it is increasingly safe, general anesthesia has risks and perioperative complications[13]. In our hospital, general anesthesia in multi-trauma patients controls the respiratory system during surgery and in postoperative resuscitation or after complete failure in regional blocks with time for surgery over 4 hours.

In Figure 1, postoperative opioid prescribing (morphine, tramadol) has been shown to decrease pain in patients and can be used effectively in the perioperative setting ($p = 0.007$). Additionally, only intravenous acetaminophen (also commonly known as paracetamol in Vietnam) or NSAIDs/acetaminophen and opioids/acetaminophen analgesic combinations are commonly prescribed methods after surgery in our hospital. In an attempt to minimize pain, our doctor team administers the analgesic drug before the onset of pain. Sometimes, tramadol is also used as a monotherapy or combination therapy analgesic in postoperative pain treatment. Besides that, IV/IM tramadol has been used in combination with morphine instead of monotherapy after orthopaedic surgery to achieve better painkillers and fewer side effects.

### 4.3. Associated factors of postoperative pain among orthopedic surgery patients

Based on the results, associations among patients with ASA III/IV status have NRS ≥ 7 points compared to patients with ASA I/II (OR = 2.78, 95%CI: 1.52-5.10, p <0.001). Similar findings in another study conducted by G. L. Ansell reported that ASA III patients did experience significantly more moderate to severe pain than ASA I/II patients group[14]. In our clinical practice, patients with comorbidities should be assessed before admission, notably those with impaired liver and renal function, careful use of drugs to bring all medications and prescriptions, and reduced dosing. Maybe for that reason, it will increase the pain level in this group.

In addition, we also found a statistically significant difference between spine surgery regarding the operation site and the pain intensity (OR = 4.63, 95%CI: 2.53-8.48). Our findings were consistent with other studies showing that the patients scheduled for surgery, those who underwent spine surgeries, were 2.65 times more likely (p = 0.039) to report moderate-severe pain postoperatively[9]. Spine surgery is commonly associated with significant trauma to surrounding muscles and damage to tissues and other essential structures. As technology and surgeon experience evolved, surgery techniques are becoming minimally invasive. Our anesthesia teams adjust analgesia regimens and enhance recovery strategies adequately. The modern analgesic strategy is based on multimodal approaches with the involvement of less aggressive regional techniques that modulate the surgical response. Neuraxial techniques can be an alternative to general anesthesia as a primary anesthesia method, and using neuraxial and peripheral regional anesthesia techniques provides both visceral and somatic analgesia for particular patients and surgical procedures.

The VAS scores and sedated patients were not significantly different between these two groups (P > 0.05). Patients received sedation during surgery under regional anesthesia, which plays a central role in facilitating patient anxiolysis. However, the analgesic effects of benzodiazepine (midazolam) have been highlighted, and it may be considered that benzodiazepines do not have pain relief effects. Moreover, there was no significant difference between other demographic characteristics such as age categories, gender, nature of surgical status and pain intensity (P > 0.05). When comparing the postoperative pain across age categories, it was found that patients with age categories over 60 had more pain as compared to patients in the remaining groups. Some have observed higher pain scores in older people (OR = 1.32, 95%CI: 0.79-2.22; P = 0.293 > 0.05). In elderly patients, pain management is still challenging. Jason Ju In Chan et al. found that older patients were less likely to report moderate-severe pain postoperatively (p < 0.001). In similar lines, Jacqueline F. M. van Dijk et al. reported that postoperative pain decreases with increasing age[9,12]. A possible explanation based on our experience could be to use careful drug choice, dose adjustments and close monitoring for older adults. Paradoxically, the treatment of children's pain presents a considerable simplicity. The reason could be the proportion of the pediatric population who received anesthesia was low, and this group received more attention and more aggressive treatment. There was also no association between preoperative pain intensity and BMI in our study (P > 0.05). Our findings were inconsistent with other studies showing that the obesity group are disproportionately affected by the pain intensity. A study by Karen C Nielsen et al., obesity is associated with higher block failure and complication rates in surgical regional anesthesia[15]. Proper management of postoperative pain for obese patients represents a challenge for the anesthesiologist performing regional anesthesia, even if highly experienced. In our practice, our specialized treatment unit and application blocks with ultrasound guidance may aid our practitioner with direct visualization and a high incidence of efficacy.

This study had some limitations. One major restriction of our research was a single-centre study so it is possible that our investigation might not be representative of Vietnam hospitals in general, and bias might have occurred. Second, we did not assess pain scores at 6, 12, 24, and 48 hours after surgery, which have been reported in previous studies.

Funding: This research is funded by Nguyen Tat Thanh University, Ho Chi Minh City, Vietnam.

## 5. CONCLUSION

The prevalence of moderate to severe postoperative pain and its functional interference is high in Vietnamese patients undergoing orthopedic surgery. ASA categories and operation site (spine) were found to be significant factors for pain severity. However, we recommend multimodal analgesics associating surgical factors with the use of one-shot ultrasound guidance for regional anesthesia, and combined analgesic regimens (acetaminophen or NSAIDs with opioids) have led to improvements in patient care in the postoperative period.

## REFERENCES

[1] Meara JG, Leather AJM, Hagander L, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. The Lancet. 2015;386(9993):569-624. doi:10.1016/S0140-6736(15)60160-X

[2] Erivan R, Chaput T, Villatte G, Ollivier M, Descamps S, Boisgard S. Ten-year epidemiologi-

cal study in an orthopaedic and trauma surgery centre: Are there risks involved in increasing scheduled arthroplasty volume without increasing resources? Orthopaedics & Traumatology: Surgery & Research. 2018;104(8):1283-1289. doi:10.1016/j.otsr.2018.08.009

[3] Gan TJ, Habib AS, Miller TE, White W, Apfelbaum JL. Incidence, patient satisfaction, and perceptions of post-surgical pain: results from a US national survey. Curr Med Res Opin. 2014;30(1):149-160. doi:10.1185/03007995.2013.860019

[4] Sommer M, de Rijke JM, van Kleef M, et al. The prevalence of postoperative pain in a sample of 1490 surgical inpatients. Eur J Anaesthesiol. 2008;25(4):267-274. doi:10.1017/S0265021507003031

[5] Doyle DJ, Hendrix JM, Garmon EH. American Society of Anesthesiologists Classification. In: StatPearls. StatPearls Publishing; 2023. Accessed November 28, 2023. http://www.ncbi.nlm.nih.gov/books/NBK441940/

[6] Price DD, Bush FM, Long S, Harkins SW. A comparison of pain measurement characteristics of mechanical visual analogue and simple numerical rating scales. Pain. 1994;56(2):217-226. doi:10.1016/0304-3959(94)90097-3

[7] Breivik H, Borchgrevink PC, Allen SM, et al. Assessment of pain. British Journal of Anaesthesia. 2008;101(1):17-24. doi:10.1093/bja/aen103

[8] Mishra BN, Jha A, Gupta Y. Epidemiology of Orthopaedic Admissions at A Teaching Hospital of Eastern Nepal. Journal of Nobel Medical College. 2017;6(1):56-62. doi:10.3126/jonmc.v6i1.18088

[9] Chan JJI, Thong SY, Tan MGE. Factors affecting postoperative pain and delay in discharge from the post-anaesthesia care unit: A descriptive correlational study. Proceedings of Singapore Healthcare. 2018;27(2):118-124. doi:10.1177/2010105817738794

[10] Zeng Y, Wan J, Ren H, Lu J, Zhong F, Deng S. The influences of anesthesia methods on some complications after orthopedic surgery: a Bayesian network meta-analysis. BMC Anesthesiol. 2019;19(1):49. doi:10.1186/s12871-019-0701-2

[11] Myles PS, Myles DB, Galagher W, et al. Measuring acute postoperative pain using the visual analog scale: the minimal clinically important difference and patient acceptable symptom state. Br J Anaesth. 2017;118(3):424-429. doi:10.1093/bja/aew466

[12] Chou R, Gordon DB, Leon-Casasola OA de, et al. Management of Postoperative Pain: A Clinical Practice Guideline From the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. The Journal of Pain. 2016;17(2):131-157. doi:10.1016/j.jpain.2015.12.008

[13] Bainbridge D, Martin J, Arango M, Cheng D, Evidence-based Peri-operative Clinical Outcomes Research (EPiCOR) Group. Perioperative and anaesthetic-related mortality in developed and developing countries: a systematic review and meta-analysis. Lancet. 2012;380(9847):1075-1081. doi:10.1016/S0140-6736(12)60990-8

[14] Ansell GL, Montgomery JE. Outcome of ASA III patients undergoing day case surgery. British Journal of Anaesthesia. 2004;92(1):71-74. doi:10.1093/bja/aeh012

[15] Nielsen KC, Guller U, Steele SM, Klein SM, Greengrass RA, Pietrobon R. Influence of obesity on surgical regional anesthesia in the ambulatory setting: an analysis of 9,038 blocks. Anesthesiology. 2005;102(1):181-187. doi:10.1097/00000542-200501000-00027