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Original Article

Intraoperative Anxiety and Its Associated Factors Among Patients Undergoing Conscious Surgery for Closed-Leg Fracture

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Abstract

Background: Patients undergoing open reduction and internal fixation surgery frequently opt for spinal anesthesia, which preserves intraoperative consciousness. This conscious state may trigger significant anxiety during surgical procedures. Despite the clinical relevance of this phenomenon, intraoperative anxiety among conscious patients remains under-recognized in Chinese surgical populations. Many scholars have conducted extensive research on preoperative and postoperative anxiety levels. However, a study on the level of intraoperative anxiety and its' related factors is still lacking. This knowledge gap motivated the current investigation.

Objectives: To examine the level of intraoperative anxiety and the relationship between gender, age, waiting time, surgical time and intraoperative anxiety among patients with closed-leg fracture undergoing conscious surgery.

Methods: A total of 112 participants were recruited during February 2025 to April 2025 by selecting samples as per the inclusion criteria and using random sampling. Research instruments include the demographic questionnaire and the Visual Analog Scale for Anxiety (VAS-A). Data were analyzed using descriptive statistics, the independent *t* test, and the Pearson correlation coefficient.

Results: The mean (SD) intraoperative anxiety was 6.3 (2.2), which indicates a clinically-relevant level of anxiety. There was a significant difference in the experience of intraoperative anxiety between female and male patients (t = -3.92, P < .001). Age, waiting time, and surgical time had a positive correlation with intraoperative anxiety among the patients undergoing conscious surgery (r = 0.221, P < .05; r = 0.307, r = 0.346, P < .001, respectively).

Conclusions: The findings provide a reference for healthcare providers to better understand the factors contributing to intraoperative anxiety of patients with closed-leg fracture undergoing conscious surgery, allowing for early identification of high-risk individuals, and targeted interventions, thereby preventing and alleviating intraoperative anxiety, reducing anxiety-related physiological response, minimizing complication risk, and promoting postoperative recovery.

Keywords: Age, Conscious surgery, Gender, Intraoperative anxiety, Surgical time, Waiting time

Citation: Zhang X, Samartkit N, Masingboon K. Intraoperative anxiety and its associated factors among patients undergoing conscious surgery for closed-leg fracture. *Res Med J*. 2026;49(3): e276243. doi:10.33165/rmj.2026.e276243

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Received: 27 June 2025
Revised: 25 July 2025
Accepted: 29 July 2025
Published Online: 26 January 2026

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Introduction

Bone fractures are a public health problem worldwide, and may cause serious disease and economic burden.[1] According to the National Bureau of Statistics of China, more than 250 000 people were injured in traffic accidents in 2020.[2] Moreover, electric scooters are popular in urban areas of China, which are associated with many orthopedic injuries.[3] Closed-leg fractures were a prevalent clinical condition, which accounted for just over 1 in 4 trauma fracture patients.[4] Meanwhile, fractures often lead to loss of basic functional capabilities, requiring patients to need extensive support for daily living activities.[5] A fracture frequently imposes significant practical demands, emotional distress, and potential safety risks. These consequences may lead to a remarkable psychological burden, as 4 out of 5 traumatic fracture patients experience psychological disorders (anxiety, depression, fear), severely undermining recovery.[6]

Early surgical intervention is an effective treatment for most closed-leg fractures.[7] The procedure aims to provide anatomical restoration and immediate stability, thereby facilitating earlier mobilization for leg fractures.[8, 9] However, surgery is also a strong stimulus, which can affect the physical and mental health of the patient.[10] More than 80% of traumatic fracture patients have different degrees of psychological disorder, manifested as anxiety, depression, fear, and other negative emotions.[6] Anxiety has been reported in 60%-80% of adult patients who undergo surgery.[11] Mitchell[12] reported that approximately three-quarters of patients experienced anxiety during surgery. Anxiety is experienced at different levels of severity during the intraoperative period. Haugen et al[13] reported that 1 in 3 patients felt anxiety in the intraoperative period. Developments in anesthesiology have led to the increased use of local anesthesia, whereby the patient is conscious during the surgery.

In this research study 'conscious surgery' refers to the use of local anesthesia technology to cause reversible loss of sensation and muscle contraction in a limited area of the body without changing the patient's level of consciousness. The benefits of conscious surgery include decreased operative time, less postoperative opioid use, decreased recovery time, and better patient satisfaction.[14] A growing number of published studies have highlighted the advantages of conscious sedation over general anesthesia, including decreased blood loss, fewer medical complications, and better postoperative pain control.[15] Most of these studies have suggested that local anesthesia is associated with improved perioperative outcome, and they make the case that local anesthesia is superior to general anesthesia (other factors being equal) since there tends to be a lower risk of perioperative complications, rates of nausea and vomiting, reduced blood loss, and reduced length of hospital stay, thereby reducing the hospital-related cost and caseload burden.[16-18]

However, conscious surgery can cause a range of fear and anxiety.[19] Usually, undergoing conscious surgery, the patient is alert, and can experience everything that is perceptible or imagined during the procedure.[20] Patients who have undergone surgery with spinal anesthesia have often described the operating room as a scary, bizarre, and frightening place. Those patients reported feeling agitated, anxious, and concerned while in the operating room.[21] The unfamiliar environment of the operating room, the alarms of the monitoring devices, and the noises related to surgical instruments are important causes of intraoperative anxiety.[13, 22] Additionally, external interventions such as wound dressings, traction, and patient restrained to restricted mobility may further exacerbate discomfort.[23] Many patients undergoing conscious surgery have reported anxiety related to the narrow operating table, low light conditions, and unsettling noises

from drilling, sawing, and/or cutting.[24] In addition, excessive anxiety in the surgery patient can have negative consequences on anesthesia.

Anxiety may lead to an increase in the levels of stress hormones, resulting in increased arterial blood pressure, heart rate, and high systemic catecholamine levels.[25] Physiological effects of anxiety can require higher dosages of medication during anesthesia.[26] Intraoperative anxiety may exacerbate pain perception and decrease the tolerance to pain.[27] Furthermore, empirical evidence has confirmed that anxiety adversely affects wound healing, and the associated physiological changes may cause an increased risk of infection and prolonged wound-healing time.[28] Therefore, interventions to reduce intraoperative anxiety can help maintain normal blood pressure, heart rate, and respiratory rate, and decrease the need for post-surgery sedative drugs.[29] In addition, alleviating the intraoperative anxiety of patients may reduce the occurrence of postoperative complications and even shorten the postoperative recovery time.[18]

Among orthopedic and trauma patients, intraoperative anxiety was associated with multiple factors. Evidence has demonstrated that gender differences may significantly influence a patient's anxiety level during the intraoperative period. Studies have found that female patients exhibit higher anxiety scores than their male counterparts.[5, 22, 30] Studies have found a significant relationship between age and intraoperative anxiety; young adults typically exhibit heightened fear of the unknown due to limited experience in managing major stressful events. The actual anxiety level depends on individual psychological resilience, social support, financial status, and occupational characteristics.[31] Some studies have found that the greater life experience and coping strategies of older patients helped to moderate the anxiety effects.[32] By contrast, other studies have found that elderly patients had the highest anxiety level among patients. Moreover, lengthy preanesthetic waiting time induced a higher level of intraoperative anxiety.[33] As surgery time increases, anxiety increases in patients undergoing orthopedic surgeries under spinal anesthesia.[34] Consequently, enhancing operative efficiency and minimizing waiting time and surgical time should be effective strategies to mitigate a patient's anxiety level during surgery.[11, 35]

Many scholars have conducted extensive research on the preoperative and postoperative anxiety levels of different surgical populations. However, the research on the related factors of intraoperative anxiety and the degree of anxiety of patients is still lacking. Healthcare professionals need to understand patient anxiety, and should be able to implement strategies to reduce the anxiety, including techniques that improve the patient's overall surgical experience and ensure a smooth procedure. This study examined conscious patient intraoperative anxiety and its related factors as a basis for developing effective interventions to relieve anxiety and promote postoperative recovery of patients undergoing conscious surgery.

This study aimed to describe the level of intraoperative anxiety in patients with closed-leg fracture undergoing conscious surgery, and examine the relationships between gender, age, waiting time, and surgical time with intraoperative anxiety in patients with closed-leg fracture undergoing conscious surgery.

Methods

Study Design, Setting, and Participants

A descriptive-comparative correlational research design was used in this study, conducted at the Second Affiliated Hospital of Wenzhou Medical University in Wenzhou, China. The study sample comprised the patients who had a closed-leg fracture, and were admitted

in the orthopedic ward. In addition, participants were scheduled for open reduction and internal fixation surgery in an awake state, at the Second Affiliated Hospital of Wenzhou Medical University in Wenzhou, China. The sample was recruited by random sampling, using the following inclusion criteria: 1) age at least 18 years; 2) diagnosed with one leg fracture, including fracture femur, fracture tibia, fracture fibula, or fracture both bones; 3) no injury in other organs; 4) no history of anesthesia and surgery; and 5) normal hearing and writing skills. Patients requiring intraoperative conversion to general anesthesia or deep sedation were excluded. The sample size in this study was calculated by using the G*Power 3.0.10 program for correlational research design. The researchers specified a medium-effect size ($d = 0.30$), a power of 0.90, and $\alpha = .05$, which generated a prescribed sample size of at least 112 participants. The researchers added 10% for incomplete questionnaires, thus yielding a total sample size of 123 participants.

Instruments

Two questionnaires were used for collecting data: 1) the demographic questionnaire (developed by the researchers) included general information (gender, age, highest educational level, marital status, religion, occupation, annual family income, living place, and healthcare payment scheme), and health information (surgical history, disease history, fracture site, surgery type, anesthesia method, waiting time, and surgical time); and 2) the Visual Analog Scale for Anxiety (VAS-A) was used to measure the intraoperative anxiety level. VAS-A is easy for the average patient to understand, and can be a valid method for measuring subjective feelings that yield interval-level data.[36] VAS-A comprises a 10-cm line, on which the participants mark their current degree of anxiety, with the left end of the line being labelled 0 (no anxiety), and the right end being labelled 10 (maximum anxiety). The participants were asked to indicate how anxious they were feeling by marking the appropriate place on the line.[37] VAS-A is routinely employed for anxiety assessment in China, with validated and extensive application in measuring intraoperative anxiety.[38, 39] VAS-A was validated by comparing it with Corah's Dental Anxiety Scale (CDAS) and Spielberger's State Trait Anxiety Inventory (STAI). The result showed that VAS-A score was significantly correlated to CDAS ($P < .0001$), STAI-Y1 ($P < .0001$), and STAI-Y2 ($P < .002$), which confirmed that VAS-A is a reliable indicator of preoperative anxiety and may detect patients with depressive symptoms also. VAS-A scores around 5 cm are effective indicators of the threshold for a clinically meaningful level of preoperative anxiety.[40]

Data Collection

The information for this research was collected from the orthopedic ward and operating theatre. The orthopedic ward nurse searched the registration information to identify patients who met the inclusion criteria. Patients with closed-leg fracture were asked for their verbal consent to participate in the study. Those who agreed were referred to the researchers. The researchers met and informed participants (and any accompanying family members) of the purpose of the study, ethical issues, and human protections of the study. A signed written consent form was then obtained. On average, the study site has a daily caseload of 10 closed-leg fracture patients who are scheduled for open reduction and internal fixation surgery. The data for this study were collected from February 2025 to April 2025.

Statistical Analysis

This study used IBM SPSS 26.0 software (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp; 2019) to analyze the data. Descriptive statistics were used to describe

the demographic data. A *t* test was used to examine the relationship between gender and intraoperative anxiety. Pearson product moment correlation was used to examine the relationship between age, waiting time, surgical time, and intraoperative anxiety.

Results

Demographic Characteristics

More than half of the participants were male (56.9%), while 43.1% were female. The mean (SD) age of the participants was 54.1 (12.2) (range 22-76 years). The largest proportion of participants (56.1%) fell within the 41-59 years age group. Among these participants, nearly half had completed junior/senior high school (48.0%), followed by a bachelor's degree or higher (19.5%). Almost all the participants were married (96.8%), and nearly three-quarters of the participants were employed (73.2%) (Table 1).

Health Information

The most common site of fracture among the participants was tibial fracture (65.1%), while 1 in 5 patients presented with a femoral fracture (19.5%). The method in all cases was intraspinal anesthesia, and nearly all had combined spinal and epidural anesthesia (95.9%). The mean (SD) wait time was 37.4 (15.2) minutes (range 9-60 minutes), with over half waiting more than half an hour (56.9%). The mean (SD) of surgical time was 102 (36.8) minutes. The surgery time for one-third of cases was between 91-120 minutes (35.0%), and 61-90 minutes for one-fourth of cases (26.8%). The majority (71.5%) of the participants were otherwise healthy at the time of surgery, while 28.5% had comorbidities (hypertension, diabetes, hyperlipidemia, hepatitis B, osteoporosis) (Table 2).

Table 1. Demographic Characteristics of the Patients With Closed-Leg Fracture Undergoing Conscious Surgery

Characteristic	No. (%)
Gender	
Male	70 (56.9)
Female	53 (43.1)
Age, y	
20-40 (early adulthood)	16 (13.0)
41-60 (middle adulthood)	69 (56.1)
> 60 (elderly)	38 (30.9)
Educational attainment	
None	22 (17.9)
Primary school	18 (14.6)
Junior/senior high school	59 (48.0)
Bachelor's degree or higher	24 (19.5)
Marital status	
Single	1 (0.8)
Married	119 (96.8)
Widowed	3 (2.4)

Table 1. Demographic Characteristics of the Patients With Closed-Leg Fracture Undergoing Conscious Surgery (Continued)

Characteristic	No. (%)
Occupation	
Unemployed	33 (26.8)
No occupation	7 (5.7)
Retired	26 (21.1)
Employed	90 (73.2)
Government staff	7 (5.7)
Healthcare personnel	2 (1.6)
Commercial staff	36 (29.3)
Farmer	7 (5.7)
Laborer	38 (30.9)

Table 2. Health Information of the Patients With Closed-Leg Fracture Undergoing Conscious Surgery

Characteristic	No. (%)
Fracture site	
Femoral fracture	24 (19.5)
Tibial fracture	80 (65.1)
Fracture in both bones (tibia and fibula)	19 (15.4)
Anesthesia method	
Combined spinal and epidural anesthesia	118 (95.9)
Spinal Anesthesia	2 (1.6)
Epidural Anesthesia	3 (2.4)
Waiting time, min	
≤ 30	53 (43.1)
> 30	70 (56.9)
Surgical time, min	
50-60	13 (10.6)
61-90	33 (26.8)
91-120	43 (35.0)
121-150	25 (20.3)
151-180	4 (3.2)
> 180	5 (4.1)
Comorbidities	
No comorbidity	88 (71.5)
Had comorbidities*	35 (28.5)

* Hypertension, diabetes, hyperlipidemia, hepatitis B, osteoporosis.

The VAS-A scores of the participants, which ranged from 0 to 10, were a mean (SD) of 6.3 (2.2). This mean score indicated a clinically-relevant level of anxiety.

The mean (SD) score of intraoperative anxiety of male patients with closed-leg fracture undergoing conscious surgery was 5.6 (2.2). For female patients, the mean (SD) score was 7.1 (1.9). The mean of intraoperative anxiety was different among age groups of the patients with closed-leg fracture undergoing conscious surgery. For those aged 20-40 years, the mean (SD) score was 6.1 (2.4); 41-60 years had a mean (SD) score of 6.0 (2.3), and for those age over 60 years, the mean (SD) score was 6.6 (1.9). Moreover, the mean (SD) score of intraoperative anxiety was 5.4 (2.2) when the waiting time was less than 30 minutes, which was much lower compared to those with a wait time exceeding 30 minutes (mean [SD], 6.8 [1.9] minutes). Based on the analysis of the surgical time, the mean (SD) score of intraoperative anxiety was 5.1 (2.3) at 50-60 minutes, 5.4 (1.9) at 61-90 minutes, 6.2 (2.1) at 91-120 minutes, 8.0 (1.4) at 121-150 minutes, 7.3 (0.9) at 151-180 minutes, and 6.2 (2.9) at more than 180 minutes (Table 3).

The analysis indicated that intraoperative anxiety was significantly higher in female patients compared with their male counterparts (mean [SD], 7.1 [1.9] vs 5.6 [2.2]; ($P < .001$).

This study found that age had a positive correlation with intraoperative anxiety among the patients with closed-leg fracture undergoing conscious surgery ($r = 0.221$, $P < .05$). Waiting time and surgical time had a moderate positive correlation with intraoperative anxiety among the patients with closed-leg fracture undergoing conscious surgery ($r = 0.307$, $P < .001$; $r = 0.346$, $P < .001$) respectively (Table 4).

Table 3. Intraoperative Anxiety Scores for Patients With Closed-Leg Fracture Undergoing Conscious Surgery by Gender, Age, Wait Time, and Surgical Time

Variable	No. (%)	Intraoperative Anxiety Score, Mean (SD)
Gender		
Male	70 (56.9)	5.6 (2.2)
Female	53 (43.1)	7.1 (1.9)
Age, y		
20-40	16 (13.0)	6.1 (2.4)
41-60	69 (56.1)	6.0 (2.2)
> 60	38 (30.9)	6.6 (1.9)
Waiting time, min		
≤ 30	53 (43.1)	5.4 (2.2)
> 30	70 (56.9)	6.8 (1.9)
Surgical time, min		
50-60	13 (10.6)	5.1 (2.3)
61-90	33 (26.8)	5.4 (1.9)
91-120	43 (35.0)	6.2 (2.1)
121-150	25 (20.3)	8 (1.4)
151-180	4 (3.2)	7.3 (0.9)
> 180	5 (4.1)	6.2 (2.9)

Table 4. Correlation Coefficients Between Age, Waiting Time, Surgical Time and Intraoperative Anxiety Among the Patients With Closed-Leg Fracture Undergoing Conscious Surgery

Variable	Correlation Coefficients	*P* Value
Age	0.221	< .050
Waiting time	0.307	< .001
Surgical time	0.346	< .001

Discussion

The present study found a significant positive correlation between age and intraoperative anxiety, and the mean of the participants' age was 54.1 years, with their mean (SD) score of the level of intraoperative anxiety of 6.3 (2.2). This was comparable with Turan et al,[39] which found the mean score of participants' age was 43.8 years and mean (SD) score of the level of intraoperative anxiety was 5.2 (1.64). These results aligned with the finding of greater intraoperative anxiety among elderly patients compared with middle-age and younger adults.[36, 37] Potential contributing factors include the decline in physiological function and greater concern regarding postoperative care compared to younger people.[41] There is also an age-related decline in decision-making capacity and reduced ability to acquire and process health information.[42, 43] In addition, the higher anxiety level among elderly patients may be due to progressive cognitive decline, heightened concern about anesthesia risks (particularly for those with multiple comorbidities), difficulty in functional recovery (such as fear of losing independence, becoming care-dependent, and requiring nursing home admission), and mortality-related apprehension.[42, 43] These compounding factors create a unique anxiety profile that differs substantially from younger patient populations.

Furthermore, the level of intraoperative anxiety in this study was higher than the studies by Turan et al.[39] That discrepancy could be explained by the fact that gender is a significant determinant of intraoperative anxiety. In the present study, females constituted 43.1% of participants, which was distinctly higher than the proportions reported in the studies by Turan et al[39] (10.6%), This differential distribution might partially account for the observed elevation in intraoperative anxiety scores.[41, 42]

Moreover, this research found a significant difference in the intraoperative anxiety score between males and females, in that females had more intraoperative anxiety than their male counterparts. This finding was highly consistent with previous research, which found a significant difference in intraoperative anxiety between males and females, ie, that female patients reported a significantly higher intraoperative anxiety level when undergoing conscious surgery, compared with males.[5, 44] This finding could be explained by differing norms for emotional expression, ie, which might lead females to report anxiety more candidly or to be more susceptible to the influence of health threat information.[45]

The elevated intraoperative anxiety observed in female patients could be explained through Lazarus and Folkman's transactional model of stress. For example, female patients predominantly appraise surgery as dually threatening. This threat perception intensifies as fracture-induced limitations in activities of daily living (ADL) trigger systemic household care breakdown, with depleting coping resources as well as role realignment deficits during

the critical 3-month postfracture rehabilitation window.[46] These dynamics culminate in heightened intraoperative anxiety.

This gender disparity may correlate with both biological and psychosocial mechanisms. Biologically, hormonal modulation of the hypothalamic-pituitary-adrenal (HPA) axis and neurobiological dimorphism in pain processing potentially heighten a female patient's sensitivity to surgical stress and anticipatory pain. Psychosocially, gender-specific emotional expression norms may facilitate greater openness in reporting anxiety among women, alongside heightened vulnerability to health-threatening information.

This study found that waiting time had a positive and moderate correlation with intraoperative anxiety (r = 0.307, P < .001). This result was consistent with the study by Putri et al,[47] which investigated the relationship between waiting time and anxiety level in patients receiving spinal anesthesia prior to cesarean section. That study found that patients with a waiting time exceeding 30 minutes exhibited significantly higher anxiety.[47] In addition, it has been found that the longer the waiting time in the operating room, the higher the level of patient anxiety.[48] Some studies have found that the environment of the preoperative waiting area could exacerbate patient anxiety. Accordingly, some hospitals have modified the healthcare environment to reduce stress, eg, by playing relaxing music or popular television programs in waiting rooms.[49]

Moreover, this study found a positive correlation between surgical time and intraoperative anxiety, which indicates that prolonged surgical time may significantly impact patient intraoperative anxiety. This result aligned conclusively with the established literature: Häggström et al,[43] empirically validated that extended surgical time significantly amplifies intraoperative anxiety, particularly during regional anesthesia. Comparing with other studies in orthopedic surgery patients, the mean surgical time in this study (mean [SD], 102 [36.8] minutes), was somewhat longer than the finding in the studies by Turan et al[39] of 45 minutes (SD 33.0) and Kaur et al[34] of 79 minutes (SD 12.9). Consequently the participants' level of intraoperative anxiety in this study (mean [SD], 6.8 [1.4]) was higher than Turan et al[39] (mean [SD], 5.2 [1.6]) and Kaur et al[34] in which VAS-A was 4-5. This has suggested that prolonged surgical time is a contributing factor to intraoperative anxiety. Furthermore, this study found that patients with a surgical time ranging from 121 to 150 minutes had the highest level of intraoperative anxiety (mean [SD], 8.0 [1.4]). This result was consistent with the study by Novy et al,[49] which found that 71.4% of patients whose surgery lasted more than 2 hours showed medium-to-high anxiety during surgery.

Many researchers have explored the effectiveness of interventions for reducing the occurrence of intraoperative anxiety for patients undergoing conscious surgery. One study found that listening to instrumental music during lower leg fracture surgery caused a reduction in anxiety.[51] Another study found that wearing virtual reality (VR) goggles can create an immersive environment to distract patients from various stress factors.[52] Investigation found that the use of VR/music on serum cortisol and adrenocorticotropic hormone (ACTH) levels in knee replacement surgery under combined spinal epidural anesthesia could ameliorate intraoperative anxiety.[41] Although these interventions effectively mitigate anxiety in patients during both the preanesthetic waiting period and intraoperative phases, optimizing workflow efficiency to minimize waiting times and surgical duration should remain a priority.

The findings of this study provide a reference for healthcare providers to better understand the factors contributing to intraoperative anxiety of patients with closed-leg fracture undergoing conscious surgery, allowing for early identification of high-risk

individuals and targeted interventions. Additionally, the results should assist medical staff in tailoring intraoperative nursing strategies based on individual patient differences, thereby preventing and alleviating intraoperative anxiety, reducing anxiety-related physiological responses, minimizing complication risks, and promoting postoperative recovery.

Conclusions

This study found that the patients undergoing conscious surgery for closed-leg fracture had clinically-relevant levels of intraoperative anxiety. In addition, females had higher intraoperative anxiety than their male counterparts. Age, waiting time, and surgical time had a positive correlation with intraoperative anxiety among these participants.

Additional Information

Acknowledgments: We express profound gratitude to all research participants whose generous cooperation and time investment formed the cornerstone of this clinical investigation. Moreover, we also extend our professional gratitude to the medical teams at the Oujiangkou operating theatre and orthopedic ward of the Second Affiliated Hospital of Wenzhou Medical University for their support of the data collection process. This work was conducted as part of a master's thesis in Nursing Science at the Faculty of Nursing, Burapha University, Chon Buri, Thailand.

Ethics Approval: The protocol for this study received ethical approval from the Institutional Review Boards of Burapha University (G-HS129/2567 on 10 January 2025) and the Second Affiliated Hospital of Wenzhou Medical University (2024-K-377-02 on 21 January 2025). Prior to participation, all candidates received comprehensive verbal and written information, including research objectives, study procedures, and voluntary participation rights (including withdrawal without penalty before data collection commencement). Written informed consent was obtained from all participants. Participant confidentiality and anonymity were rigorously maintained throughout the research process, including secure data storage.

Clinical Trial Consideration: This study does not report on a clinical trial.

Financial Support: No financial support was provided for this study.

Conflict of Interest: The authors declare no conflict of interest.

Author Contributions:
Conceptualization: All authors
Formal Analysis: All authors
Methodology: Xue Zhang, Niphawan Samartkit
Investigation: Xue Zhang
Writing – Original Draft: Xue Zhang, Niphawan Samartkit
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