Factors Related to Sleep Disturbance among Patients with Lower-limb Fracture undergoing Orthopedic Surgery in Vietnam

นิพนธ์ต้นฉบับ

Original Article

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บทคัดย่อ

วัตถุประสงค์: การวิจัยเชิงพรรณนาเพื่อศึกษาปัจจัยที่สัมพันธ์กับการนอนหลับที่แปรปรวนในผู้ป่วยที่มีกระดูกขาช่วงล่างหักและได้รับการรักษาด้วยการผ่าตัด ในประเทศเวียดนาม ปัจจัยที่คัดสรร ได้แก่ ความเจ็บปวด ความรู้สึกไม่สุขสบายจากการจัดวางท่า และความรู้สึกไม่แน่นอน **วิธีการศึกษา:** ตัวอย่างเป็นผู้ป่วยผู้ใหญ่ที่ผ่าตัดกระดูกขาช่วงล่างหัก (กระดูกต้นขา กระดูกหน้าแข้ง และ/หรือกระดูกน่อง) ที่รักษาในโรงพยาบาล ณ หอผู้ป่วยอุบัติเหตุกระดูกและข้อ ทั้งแบบฉุกเฉินและไม่ฉุกเฉิน จำนวน 90 คนเลือกโดยวิธีของธอร์นไดค์ (Thorndike) และสุ่มอย่างง่ายแบบเฉพาะเจาะจง เครื่องมือรวบรวมข้อมูลประกอบ 1) แบบบันทึกข้อมูลส่วนตัวผู้ป่วย 2) แบบประเมินความเจ็บปวดด้วยตัวเลข 3) แบบสอบถามความสุขสบายจากการถูกยึดตรึง 4) แบบสอบถามความรู้สึกไม่แน่นอนเกี่ยวกับความเจ็บป่วยของมิเชล และ 5) แบบสอบถามการการนอนหลับที่แปรปรวน เครื่องมืออันดับที่ 3 - 5 มีค่าสัมประสิทธิ์อัลฟ่าของครอนบาคเท่ากับ 0.86, 0.90 และ 0.89 ตามลำดับ วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนาและสัมประสิทธิ์สหสัมพันธ์ของเพียร์สัน **ผลการศึกษา:** กลุ่มตัวอย่างที่มีกระดูกขาช่วงล่างหักมีการนอนหลับที่แปรปรวนในระดับสูง (44.70 ± 5.80) กลุ่มตัวอย่างทรมานจากอาการความเจ็บปวด (6.37 ± 1.22) ความรู้สึกไม่สุขสบายจากการจัดวางท่า (79.44 ± 14.22) และความรู้สึกไม่แน่นอน (87.84 ± 13.00) ในระดับปานกลาง การนอนหลับที่แปรปรวนสัมพันธ์ทางบวกอย่างมีนัยสำคัญทางสถิติกับความเจ็บปวด ความรู้สึกไม่สุขสบายจากการจัดวางท่า และความรู้สึกไม่แน่นอน (r = 0.52, P < 0.01; r = 0.32, P < 0.01; r = 0.25, P < 0.05 ตามลำดับ) **สรุป:** ผู้ป่วยกระดูกขาช่วงล่างหักชาวเวียดนามมีการนอนหลับที่แปรปรวนในระดับสูง และสัมพันธ์กับความเจ็บปวด ความรู้สึกไม่สบายจากการจัดท่าและความรู้สึกไม่แน่นอน การพยาบาลควรเน้นการลดการนอนหลับที่แปรปรวน ส่วนหนึ่งโดยการให้การพยาบาลหรือการรักษาเพื่อลดความเจ็บปวด ความรู้สึกไม่สบายจากการจัดท่า และความรู้สึกไม่แน่นอน

คำสำคัญ: การนอนหลับที่แปรปรวน, ผู้ป่วยที่มีกระดูกขาช่วงล่างหัก, ความรู้สึกไม่สุขสบายจากการจัดวางท่า, ความรู้สึกไม่แน่นอน

Abstract

Objective: This descriptive correlational study aimed to examine sleep disturbance and its relationships with related factors: pain, position discomfort, and uncertainty among patients with lower-limb fracture undergoing orthopedic surgery from one particular hospital located in Vietnam. **Method:** The sample included adult patients hospitalized at the Traumatology-Orthopedic unit for orthopedic surgery for fracture of femur, tibia, and fibula bones, emergency or non- emergency. A sample of 90 patients, estimated based on Thorndike's approach was recruited by purposive sampling technique. Self-report questionnaires to collect data included 1) the patient's profile record form, 2) Numeric Pain Intensity Scale, 3) Imbilization Comfort Questionnaire, 4) the Mishel Uncertainty in Illness Scale, and 5) Sleep Disturbance Questionnaire. The scales number 3 to 5 yielded Cronbach's alpha coefficients of 0.86, 0.90, and 0.89, respectively. Data were analyzed using descriptive statistics and Pearson's product moment correlation coefficient. **Results:** The participants experienced high sleep disturbance (44.70 ± 5.80). In addition, they also moderately suffered from pain (6.37 ± 1.22), position discomfort (79.44 ± 14.22), and uncertainty (87.84 ± 13.00). Sleep disturbance was significantly positively associated with pain, position discomfort, and uncertainty (r = 0.52, P < 0.01; r = 0.32, P < 0.01; r = 0.25, P < 0.05, respectively). **Conclusion**: Patients with lower-limb fracture undergoing orthopedic surgery in Vietnam faced sleep disturbance, which was associated with pain, position discomfort, and uncertainty. Nursing care should manage sleep disturbance, in part, by alleviating pain discomfort and uncertainty.

Keywords: sleep disturbance, lower-limb fracture patients, orthopedic surgery, Vietnam

Introduction

Lower-limb fracture is the most common incident of accidental injuries, especially traffic accidents.[1] For example, in 2011, in the United States of America, the rate of operating procedures among a population of 10,000 were 9.3 surgery procedures for femur fracture and 6.6 for tibia or fibula fracture.[2] In Asia, especially, in India, during a 4 months period, there were 450 cases with traffic accidents admitted to a tertiary care hospital, 48.2% of them had lower-limb fracture.[3] Similarly, the prevalence of traffic accidents was very high in Vietnam.[4] About 50% of all fractured patients had lower-limb fracture, and up to 28% of them had to undergo orthopedic surgery.[4] Then, these patients suffered from many uncomfortable symptoms including pain, tiredness, anxiety, dizziness, nausea and vomiting, headache, and, importantly, sleep disturbance.[5,6] In general, sleep disturbance is considered as any real or perceived disruption in the sleep

patterns that usually result in altered daytime functions.[7] Most orthopedic surgical patients indicated that sleep disturbance was a significant symptom able to occur on the first night after surgery.[8] In addition, sleep disturbance was also found in the second night (47% of 75 postoperative orthopedic surgery patients)[9] and still existed until the fourth operation day (42% of 125 adult surgical patients).[10] Hence, sleep disturbance is considered as a symptom that patients most commonly complained about after receiving orthopedic surgery.[9]

Sleep is one of the normal daily living activities that helps maintain optimal human health.[11] When individuals get inadequate sleep, they will present various physiological and psychological problems.[12,13] Sleep disturbance is a critical problem for lower-limb fracture patients who undergo orthopedic surgeries. Nurses need to respond and help patients solve this problem in order to maintain quality of their sleep. Studying the factors which cause sleep disturbance can fundamentally help nurses acknowledge and manage these factors to prevent sleep disturbance among these patients.[9,12,14,15] Based on the literature review, factors which potentially affect sleep disturbance are pain, position discomfort, and uncertainty.[9,11,16-21]

Pain has been widely investigated as a cause of sleep disturbance. The study of Lindberg et al.[22] found that 21% to 57% of 123 elective orthopedic patients experienced sleep disturbance caused by pain. Similarly, Chouchou et al.[23] found that most patients with orthopedic surgery, suffered from sleep disturbance produced by pain during the night. Moreover, Büyükyilmaz et al.[9] reported that pain was one of the important factors affecting sleep among patients in the postoperative orthopedic period. Thus, sleep disturbance of patients with lower-limb fracture undergoing orthopedic surgery tends to occur by pain as well.

In addition, position discomfort is a factor involving patients' sleep disturbance after orthopedic surgery. These hospitalized patients often complain of sleep disturbance caused by an inability to lay comfortably.[11] During the postoperative period, most orthopedic patients do not sleep well from their inappropriate positions in bed because of pain from the site of operation.[20] In addition, immobilization of extremities to facilitate the bone healing and having some devices attached to the bones (such as external fixators or internal fixators) make patients unable to take comfortable positions in bed and this results in sleep problems.[20,24] Obviously, uncomfortable position or position discomfort can disturb the sleep of patients with lower-limb fracture undergoing orthopedic surgery.

In addition, sleep disturbance can be produced by uncertainty. Commonly, unexpected musculoskeletal limb fracture surgery can trigger uncertainty because it is an acute injury, which needs immediate orthopedic surgery. The patients cannot prepare and have insufficient information. This makes them unaware of the consequences, which result in anxiety and uncertainty.[25] In addition, Chetty and colleagues[26] indicated that most patients perceived the surgery information to be very useful for them. Moreover, Vietnamese patients often complain that they are unsatisfied with information from health care providers; and that results in increased uncertainty.[27] Furthermore, Wong et al. [25] found that providing adequate education to patients with fractured limbs undergoing unexpected orthopedic surgery reported that this helped to reduce the level of uncertainty and this improved their sleep outcomes. Therefore, uncertainty is considered as an important factor related to sleep disturbance among patients with lower-limb fracture undergoing orthopedic surgery.

In summary, sleep disturbance mostly occurs in patients with lower-limb fracture undergoing orthopedic surgery. Focusing on the factors which relate to sleep disturbance, there are three potential factors including pain, position discomfort, and uncertainty. Nurses need to help identify and eliminate the factors which interrupt sleep of their patients. This will be useful in promoting quality of sleep. But in Vietnam, there has been no research which focuses specifically on how much these factors are related to sleep disturbance among patients with lower-limb fracture undergoing orthopedic surgery. Thus, this research aimed to study factors relating to sleep disturbance among patients with lower-limb fracture undergoing orthopedic surgery in order to determine the knowledge about sleep disturbance and its related factors. The finding could be helpful for Vietnamese health care professionals, especially nurses to improve the quality of care and enhance the quality of life for patients and their family.

In accordance with study objectives, we **hypothesized** that among patients with lower-limb fracture undergoing orthopedic surgery in Vietnam, pain, position discomfort, and uncertainty were positively associated with sleep disturbance.

Methods

A descriptive correlational design was employed in this study. Data collection was performed at the Traumatology-Orthopedic unit of Nghe An General Friendship Hospital in central Vietnam from August to September, 2015.

The sample of this study consisted of adult patients who were hospitalized at the Traumatology- Orthopedic unit and received either emergency or non-emergency orthopedic surgery for fracture of femur, tibia, or fibula bones at Nghe An General Friendship Hospital. Based on the formula postulated by Thorndike,[30] 90 patients were needed and included in the sample by the purposive sampling technique. The inclusion criteria for these participants included 1) age of 18 years or older, 2) being on the second postoperative day after receiving orthopedic surgery for lower-limb fracture, 3) being able to communicate and capable of answering questionnaires in Vietnamese language, 4) being willing to participate voluntarily in the study, 5) having no serious pre- or postoperative complications, and 6) no experience of receiving any surgeries in the past.

Instruments

Five research instruments were used in this study, including the Patient's Profile Record Form, Numeric Pain Intensity Scale (NPIS), Immobilization Comfort Questionnaire (ICQ), the Mishel Uncertainty in Illness Scale (MUIS), and Sleep Disturbance Questionnaire (SDQ).

The patient's profile record form

This instrument was developed by the researcher based on the literature review, consisting of two parts, demographic and clinical characteristic information. The demographic characteristics included age, gender, educational level, marital status, occupation, and income. The income was divided based on Vietnam General Statistics Office.[31] The clinical data encompassed diagnosis, cause of injury, X- ray results, organs involving orthopedic surgery, type of orthopedic surgery, medications used during the postoperative days, and co-morbidity. In addition, patients were asked whether they had ever experienced sleep disturbance in the past; if so, we further asked about when it happened, the cause(s), and how they solved such sleep disturbance. This instrument was translated into Vietnamese language by the researcher and tested its validity by using the back-translation technique by three English teachers, from Vinh Medical University, who were bilingual experts on English and Vietnamese.

Numeric Pain Intensity Scale (NPIS)

This instrument is popular and useful in measuring pain intensity in surgical patients.[32] The scale includes a horizontal line of 10 equal units. The participants were asked to place a mark on the line indicating where the current pain they had experienced lies. The left anchor (score of zero) represented "none" or "no pain," whereas the right anchor (score of ten) represented "worst possible pain." Higher scores indicated greater pain intensity. The pain levels as recommended by McCaffery and Beebe[33] were categorized as mild (score of 0.5 - 3.4 points), moderate (3.5 - 6.4 points), and severe (6.5 – 10 points). High test-retest reliability had been observed with reliability coefficients of 0.79 to 0.92.[34] For construct validity, the NPIS was shown to be highly correlated with the visual analogue scale for pain with a correlation coefficient of 0.94.[35]

Immobilization Comfort Questionnaire (ICQ)

The immobilization comfort questionnaire was developed from the general comfort questionnaire by Kolcaba.[36] This instrument was translated into Vietnamese language by the researcher with the process described above.

The ICQ included 20 items of which each statement on the questionnaire had Likert-type scoring with values ranging from 1 - 6, indicating responses of "strongly disagree" to "strongly agree." The response pattern of 10 positive and 10 negative items on the questionnaire was designed to be in a mix. Accordingly, for the positive items, the highest score (6 points) indicated highest comfort, the lowest score (1 point) indicated the lowest comfort, and vice versa for the negative items. To calculate the score of the total questionnaire, the positive item scores were reverse-coded and added to the negative item scores. Finally, to all negative items, 1 point represented highest comfort or lowest discomfort and 6 points represented lowest comfort or highest discomfort.[36] The possible range of total score of the ICQ was 20 to 120 points. The total score was classified into 3 levels, including low, moderate, and high levels of immobilization discomfort by dividing the difference of maximum and minimum scores by three.[37] In our study, the ICQ had a high internal consistency reliability with a Cronbach's alpha coefficient of 0.86.

The Mishel Uncertainty in Illness Scale (MUIS)

The Mishel uncertainty in illness scale (MUIS) was used in this study to measure uncertainty. It was originally developed by Mishel[38] and was back-translated to Vietnamese by Loi.[27] The scale had been used to examine uncertainty in patients with post myocardial infarction and coronary artery bypass surgery. This instrument had 28 items. The items on the MUIS were graded on 5-point Likert-type scales ranging from "strongly disagree" to "strongly agree." The total scores ranged from 28 to 140, where higher scores indicated higher levels of uncertainty. The uncertainty total score was divided into 3 levels, low, moderate, and high with corresponding score ranges of 28 - 64, 65 - 102, and 103 - 140, respectively, as recommended by Polit and Hungler.[37] In our study, the MUIS was found to have high internal consistency reliability with a Cronbach's alpha coefficient of 0.90.

Sleep Disturbance Questionnaire (SDQ)

The SDQ was developed by Espie and colleagues.[39] It was applied and translated into Vietnamese language by the researcher in order to investigate sleep disturbance of the participants. The validity was tested by back-translation technique as mentioned above. This instrument had 12 items and categorized into four subscales, namely 1) physical tension (items 1, 5, 9), 2) sleep incompatible behavior (items 3, 7, 11), 3) anxious effort to sleep (items 4, 8, 12), and 4) general cognitive intrusion (items 2, 6, 10). Each item in the questionnaire was rated on a 5-point Liker-type scale from "1-never true" to "5-very often true" to indicate how characteristic the item is of the subject's typical sleep pattern. The possible range of total scores was 12 to 60. In categorizing the total score into 3 levels, including low, moderate, and high, this study used the method recommended by Polit and Hungler.[37] The internal consistency reliability found in this study was high with Cronbach's alpha coefficient of 0.89.

Data collection procedures

A human subject's approval was obtained from the Ethical Approval Committee, Faculty of Nursing, Burapha University, Thailand (IRB No. 02-07-2558). After the Director of the Hospital in Vietnam granted allowance, the process of data collection begun. Patients with lower-limb fracture undergoing orthopedic surgery that met the study criteria and agreed to participate in the study signed a consent form. Then, the researcher made an appointment with them when they were available after surgery, individually. At the appointment, the participants were given questionnaires and the researcher explained how to complete it. It took about 40 minutes to complete the set of questionnaires.

Data analysis

Descriptive statistics were employed to describe the sample' characteristics, pain, position discomfort, uncertainty, and sleep disturbance of patients with lower-limb fracture undergoing orthopedic surgery. Prior to data analysis, the testing of the normality of data and the assumptions related to Pearson's Product Moment Correlation Coefficient were also examined. All of these assumptions were met. The alpha level (type-I error) for significance was set at 0.05. Pearson's Product Moment Correlation Coefficient was used to examine the correlation between selected factors and sleep disturbance.

Results

Participants' demographic characteristics

Completed questionnaires were obtained from 90 patients in total (Table 1). Participants' mean age was 34.09 years (±10.09) with a range of 19 - 56 years. There were more male (57.80%) than female (42.20%) participants. It was found that 36.70% of participants completed high school and 37.80% of participants completed a bachelor degree. Most participants were married (67.80%) and employed (65.60%). The majority of participants (35.60%) earned more than 250 USD (5000000 Vietnamese Dong) per month, followed by 200 to 249.9 USD (4000000 to 5000000 Vietnamese Dong) per month (27.80%).

Participants' clinical characteristics

All participants were injured by traffic accidents (Table 2). The most common part of bone fracture was femur (43.30%), followed by tibia (31.10%). In addition, internal fixation was the major type of orthopedic surgery (72.20%).

Notably, 83.30% of the participants had not co-morbidity (Table 2). Only 16.70% reported their co-morbidity such as hypertension (60%) and diabetes (40%). All participants had never experienced sleep disturbance in the past. Common medications ordered by doctors for patients needing pain relief, included Paracetamol (Acetaminophen) and non-steroidal anti-inflammation drugs (NSAIDs).

Table 1 Participants' demographic characteristics (N = 90).

Characteristics	Number	%
Age (years)		
18-35	58	64.40
36-55	30	33.30
> 55	2	2.30
Mean = 34.09, SD = 10.09, range = 19 – 56		
Gender		
Male	52	57.80
Female	38	42.20
Educational level		
No formal education	1	1.10
Primary school	1	1.10
Secondary school	21	23.30
High school	33	36.70
Bachelor	34	37.80
Marital status		
Single	27	30.00
Married	61	67.80
Divorced/separated	2	2.20
Occupation		
Unemployed	24	26.70
Employed	59	65.60
Student	7	7.70
Income (USD or Vietnamese Dong/ month)		
< 150 USD (< 3000000 VND)	20	22.20
150 – 199.9 USD (3000000 - < 4000000 VND)	13	14.40
200 – 249.9 USD (4000000 - < 5000000 VND)	25	27.80
≥ 250 USD (≥ 5000000 VND)	32	35.60

Table 2 Participants' clinical characteristics (N = 90).

Clinical characteristics	Number	%
Cause of injury		
Traffic accident	90	100.00
Organs involving orthopedic surgery		
Femur	39	43.30
Tibia	28	31.10
Tibia and Fibula	23	25.60
Type of orthopedic surgery		
External Fixation	25	27.80
Internal Fixation	65	72.20
Co-morbidity		
No	75	83.30
Yes	15	16.70
Hypertension	9	60.00
Diabetes	6	40.00
Experience sleep disturbance in the past		
No	90	100.0
Pain medications		
Acetaminophen	53	58.90
Non-steroidal anti-inflammation drug (NSAIDs)	37	41.10

Descriptions of sleep disturbance, pain, position discomfort, and uncertainty of the participants

The sleep disturbance of the participants was high (44.70 ± 5.80). In addition, there were three very important items (from 12 items) reflecting their sleep disturbance: "My body is full of tension" (26.70%), "I find it physically hard to "let go" and relax my body" (22.20%), and "I can't get into a comfortable position in bed" (17. 80%). Moreover, they did not comment on any other factors which were not assessed by the questionnaire.

In addition, the study also found that the participants had moderate pain, position discomfort, and uncertainty (6.37 ± 1.22, 79.44 ± 14.22, 87.84 ± 13, respectively) after receiving orthopedic surgery (Table 3).

Table 3 Sleep disturbance, pain, position discomfort, and uncertainty of the participants (N = 90).

Variables	Mean	SD	Range	Possible score	Level
Sleep disturbance	44.70	5.80	25 - 55	12 - 60	high
Pain	6.37	1.22	4- 9	0 - 10	moderate
Position discomfort	79.44	14.22	48 – 101	20 – 120	moderate
Uncertainty	87.84	13.00	65 – 124	28 – 140	moderate

Relationships between sleep disturbance and selected factors

Each factor, namely pain, position discomfort, and uncertainty, relating to sleep disturbance, was in linearity.[51] Therefore, the relationships between sleep disturbance and these factors based on the Pearson's Product Moment Correlation Coefficient were achieved. The results revealed that sleep disturbance positively related to pain strongly (r = 0.52, P < 0.01), to position discomfort moderately (r = 0.32, P < 0.01), and to uncertainty weakly (r = 0.25, P < 0.05) (Table 4).

Table 4 Correlation coefficients of selected factors and sleep disturbance (N = 90).

Selected Factors	Sleep Disturbance *(r)*
Pain	0.52**
Position discomfort	0.32**
Uncertainty	0.25*

* P < 0.05, ** P < 0.01

Discussions and Conclusion

As expected and consistent with other studies, we found that the total sleep disturbance of the participants was high (44.70 ± 5.80 of a possible total score of 60). In the context of lower-limb fracture patients, postoperative sleep disturbance could be explained as a consequence of surgery, especially

pain. Pain on the first day after orthopedic surgery was acute pain, and these participants were suffering from moderate pain caused by tissue injury from bone fractures and skin incisions, due to surgery. Tissue injury stimulates pain receptors and increases the release of substances that repeatedly stimulate nociceptors, which further cause pain signals. Pain signals enter the brain stem where they join the pain pathways that travel from the spinal cord to the brain. One central place where these signals travel to is the thalamus, especially the posterior hypothalamus. Stimulating the posterior hypothalamus produces a state of wakefulness.[40] Also, inserting catheter, or having some kind of tube such as Foley' tube or drain system retained on the first day after the orthopedic surgery could cause pain and discomfort. In addition, after receiving orthopedic surgery, patients with lower-limb fracture need to have their legs immobilized in order to facilitate the bone healing. Therefore, all these uncomfortable procedures may involve sleep disturbance of patients.

Since most participants in this study were young adults (64.40%), they probably had not experienced much sleep disturbance in the past. Therefore, they might not be able to manage or cope with this problem. This could also be a reason for a high level of perceived sleep disturbance by these patients with lower-limb fracture undergoing orthopedic surgery in Vietnam. The results are consistent with the study of Buyukyilmaz et al.[9] They conducted the study regarding evaluation of night time pain characteristics and quality of sleep in postoperative orthopedic patients (N = 75). The study indicated that the level of sleep disturbance of these patients was also high. Similarly, these findings were consistent with those of Yilmaz et al.[28] who found that the patients in postoperative periods had high disturbed sleep levels. In addition, Tranmer et al.[8] showed that most orthopedic surgical patients reported that sleep disturbance was a significant symptom occurring on the first night after surgery.

In terms of factors relating to sleep disturbance, pain was strongly related to sleep disturbance (r = 0.52, P < 0.01). In exploring the causes of pain, Pasero and McCaffery[41] asserted that the pain is seen so frequently after orthopedic surgical interventions, as a result of the nature of the surgical procedures, and skin incisions, which help repair muscle and skeletal tissue. Therefore, the problem of acute pain after orthopedic surgery will present itself, unless appropriate pain management is implemented.[40] This is the reason why many guidelines on effective acute pain management recommend providing a continuous opioid drug administration for these patients.[40,42] In contrast to these recommendations, the participants of this study received only paracetamol 500 mg tablet for oral administration and nonsteroidal anti-inflammatory drugs via oral or intramuscular injection administration every 4 hours after surgery. These pain medications were not sufficient to relieve their pain. Therefore, ineffective strategies for pain management may have contributed to the pain severity in this setting. This finding reflected that the moderate pain of patients with lower-limb fracture undergoing orthopedic surgery in Vietnam was similar to reports from the previous study of Büyükyilmaz et al.[9] indicating that orthopedic patients in the post operation reported their pain to be moderate (6.39 ± 1.62). Sommer et al.[43] also indicated that there were 20% to 71% of patients undergoing orthopedic surgical procedures on lower extremities who suffered from moderate to severe pain during the first four postoperative days.

When the patients feel pain, the pain impulse can stimulate reticular formation and interfere with the reticular activating system which works by waking up a human being.[40] In addition, Cremeans-Smith et al.[44] described in their study that pain caused to disturbed sleep via mechanisms including delayed sleep onset, increased the number of awakenings due to pain, and fewer hours of sleep per night. They also concluded that higher levels of pain produced higher levels of sleep disturbance. Furthermore, a statistically significant correlation was found between patients' pain severity and sleep disturbance (r = 0.24, P < 0.05) in a study by Büyükyilmaz and colleagues.[9] Thus, pain of Vietnamese patients with lower-limb fracture undergoing orthopedic surgery was related to their sleep disturbance.

In terms of position discomfort, we found the participants who suffered from moderate discomfort (79.44 ± 14.22), had results moderately positively related to sleep disturbance (r = 0.32, P < 0.01). This was because they were unable to take an appropriate position in bed due to the site of operation and pain. They explained that they had difficulty changing their positions because of pain. Importantly, after receiving orthopedic surgery, patients with lower-limb fracture needed to have their legs immobilized in order to facilitate the bone healing. Internal fixation, as the major type of orthopedic surgery, was used in fixing fractured bones in most patients (72.20%) in our study. They had to immobilize their fractured

limbs to prevent movement of plates and screws. Thus, this made them unable to take a comfortable position in bed.[20] All these circumstances supported the moderate level of position discomfort of patients with lower-limb fracture undergoing orthopedic surgery. The study of Bruen[45] confirmed that when the patients were in an uncomfortable position, this would lead to muscular tension. In addition, muscular tension results in reducing quality of sleep or interfering with sleep cycles. The finding was consistent with the previous study of Lane and East[20] who confirmed that higher levels of position discomfort produced higher levels of sleep disturbance. Thus, position discomfort was also an important factor that produced sleep disturbance in Vietnamese patients undergoing orthopedic surgery.

Finally, the result revealed that the participants experienced moderate uncertainty after receiving orthopedic surgery (87.84 ± 13.00). Similar to the study of Calvin and Lane[46], they reported that all orthopedic- surgery patients faced a moderate level of uncertainty. In addition, this current study showed that uncertainty of patients with lower-limb fracture undergoing orthopedic surgery was positively correlated with sleep disturbance (r = 0.25, P < 0.05). Uncertainty is the most common symptom in patients with lower-limb fracture undergoing orthopedic surgery. It can be explained by several reasons. First, all participants got injured by traffic accidents and needed to receive orthopedic surgeries unexpectedly. In addition, most of them got admitted to a hospital for the first time. This incident created uncertainty in these patients.[46] In addition, Vietnamese patients often complained that they were unsatisfied with information from health care providers, and that could further increase uncertainty.[27] With a limited but hectic time of about five hours from admission to operation and a high nurse workload, insufficient information and communication with healthcare providers was evident and unclear situations were perceived by the patients. Moreover, ambiguity about symptoms, diagnosis, treatment process, relationship with health care providers, and unclear planning for the patients' future can be considered as important reasons for uncertainty in these lower-limb fracture patients.[47] The study of Flemme et al. demonstrated the impact of uncertainty on psychological stress.[48] This also indicated that a significant association was found between uncertainty and increased anxiety. Luc Staner confirmed that anxiety is an experience of everyday life.[49] It typically functions as an internal alarm bell that warns the person of potential danger and, in mild degrees, anxiety is serviceable to the individual. In anxiety, however, the individual is submitted to false alarms that may be intense, frequent, or even continuous. These false alarms may lead to a state of dysfunctional arousal that often leads to sleep-wake difficulties. Moreover, the study of Johnson and colleagues indicated that uncertainty can increase pain.[50] All of these results were congruent with the result from the study of Wong et al.[21] They studied 148 patients with fractured limbs who were undergoing unexpected orthopedic surgery and summarized that reducing the level of uncertainty will improve the sleep outcome for patients.

In conclusion, this study found that patients with lower-limb fracture undergoing orthopedic surgery experienced a high level of sleep disturbance. Sleep disturbance had a strongly positive relationship with pain and moderately positive relationship with position discomfort. Sleep disturbance also had a weak but positive relationship with uncertainty. Thus, nurses need to prevent sleep disturbance by alleviating pain, position discomfort, and uncertainty effectively.

The findings of this current study suggest some practical points. First, nurses and physicians should acknowledge the existence of sleep disturbance among patients with lower-limb fracture undergoing orthopedic surgery. They should try to reduce pain by appropriate pain assessment and management, position discomfort by proper orthopedic positioning and uncertainty by efficiently providing information needed by the patients.

For education, nursing schools in Vietnam could improve nursing courses by adding concepts and nursing theories, especially middle-range theories involving these factors for a better understanding. Nursing schools could stimulate their students to be more concerned in improving practice skills on preventing and managing pain, position discomfort, and uncertainty. Short-courses in training for practicing nurses should also be in place.

For nursing administration, our results reflected that Vietnamese patients with lower-limb fracture undergoing orthopedic surgery needed help to prevent and manage pain, position discomfort, and uncertainty effectively to promote their quality of sleep. Administrators should have concrete policies to encourage knowledge and skills of their nurses, by providing funds to attend short-course trainings.

The current study had some limitations. Since it was conducted only in one hospital, generalizing our findings to

other levels of hospital is limited. It is thus recommended more studies in Vietnamese patients with lower-limb fracture undergoing orthopedic surgery in more types of hospital. In addition, since the fracture was found more frequent in the elderly, more studies in more aged patients are needed.

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