Authors

Elif Karahan
Department of Nursing, Faculty of Health Sciences, Bartın University, Turkey

Mediha Didem Koçoğlu Ağca
Department of Nursing, Graduate School of Education, Bartın University, Turkey

Sevim Çelik
Department of Nursing, Faculty of Health Sciences, Bartın University, Turkey

Corresponding author

Elif Karahan
Department of Nursing, Faculty of Health Sciences, Bartın University, Turkey

Evaluation of pain levels and pain management in patients after elective total knee replacement surgery

Abstract

Objective: The aim of this study was to evaluate early pain management outcomes in patients undergoing total knee arthroplasty.

Materials and methods: This descriptive cross-sectional study was conducted between 1 March and 30 September 2022. The sample consisted of 112 patients who underwent total knee replacement surgery. Data was collected during face-to-face interviews in the first 24 to 48 hours after surgery, using a patient information form and the revised American Pain Society patient outcome questionnaire (APS-POQ-R). One-way analysis of variance (ANOVA), independent-samples t test, Kruskal-Wallis test and Mann-Whitney test were used in statistical analyses. Ethical approval, institutional approval and written informed consent from the patients were obtained.

Results: The mean age of the patients was 65.11 (±7.108) years, and 92.9 per cent of the patients were female. All patients received combined opioid and nonopioid analgesic and cold application therapy for pain management. In the 24 hours after surgery, the mean mildest pain score was 1.29 (±0.79), the mean most severe pain score was 9.25 (±1.086) and the mean perceived percentage of time in severe pain was 70.54 per cent (±13.546). The highest emotional effect caused by pain was anxiety with a score of 4.55 (±2.543). The patient level of satisfaction with the results of pain treatment was 8.87 (±1.663) points. It was determined that female patients and patients under 65 years of age had more severe pain and experienced more sleep and emotional effects (p<0.05).

Conclusion: It was observed that patients experienced pain and related anxiety in the early period after total knee arthroplasty. We recommend the use of other nonpharmacological methods along with cold application for effective management of pain and that health professionals should be supported with in-service training in order to better encourage patients.

Keywords: total knee replacement, pain, pain management, nursing

Introduction

Knee replacement surgery, total knee arthroplasty (TKA), is one of the most common orthopaedic surgeries performed today. TKA surgery is performed for the surgical treatment of osteoarthritis, especially in elderly individuals. It has been reported that 60 per cent of TKA patients experience severe post-operative pain and 30 per cent experience moderate post-operative pain[1,2]. In 2020, the International Association for the Study of Pain revised the definition of pain as 'an unpleasant sensory and emotional experience associated with or similar to actual or potential tissue damage'[3]. It is known that pain arising from

a certain location in the body may be a warning sign indicating a condition that threatens the organism[4,5]. The perception of pain varies between individuals and is influenced by factors including age, gender, education, culture, race, past experiences and genetics[6,7 8].

Post-operative pain is an acute, usually local, pain of relatively short duration that begins with the surgical incision and ends with wound healing[9,10]. Post-operative pain is a condition that can be predicted and prevented. With advancing technology, knowledge about the diagnosis and treatment of pain has increased, and new drugs and new methods have been introduced to monitor and manage pain. Examples include wearable devices, smart infusion pumps, virtual reality applications for pain management and robotic-assisted analgesia[11]. Nevertheless, surgical procedures still play an important role in the development of pain in individuals.

Orthopaedic surgery is thought to be the type of surgery where post-operative pain is most difficult to manage[12,13,14]. If pain cannot be controlled effectively, it causes a range of adverse effects in patients including immobility, sleep problems, prolonged opioid use, depression, anxiety, social isolation, delayed recovery and prolonged hospitalisation[15,16]. Effective pain control is important in preventing these complications.

Pain management interventions are carried out by a multidisciplinary team of health care professionals[17] including nurses. Nurses are of great importance in pain management since they play an active role in patient care not only after surgery but also before and during surgery. What makes the role of the nurse different from that of other team members is that the nurse spends longer time with the patient and, therefore, can learn the patient's previous pain experiences and coping strategies and use them when necessary. At the same time, the nurse is a health professional who educates the patient, implements the planned treatment and monitors the results of the treatments[9,18,19].

Patient satisfaction with post-operative pain control is closely related to the quality of care provided[20]. Studies have shown that the surgical patient group still experiences severe pain[21] and that pain assessment must be performed correctly if pain is to be managed effectively in the post-operative period[22]. However, measurable evaluations of post-operative pain interventions are quite limited in the literature. This study evaluated early pain management outcomes in total knee arthroplasty patients.

Materials and methods

Study design

The study is descriptive and cross-sectional in design.

Sample

The study population consisted of patients who underwent total knee replacement surgery between March and September 2022 in a public hospital in Turkey. A simple random sampling method was used in sample selection. Based on the information that the number of patients in the last year was 157, the number of participants was calculated as 112 when the 95 per cent confidence interval was calculated with 5 per cent. Patients over the age of 18 who had total knee replacement surgery and volunteered to participate were included in the study.

Data collection

Data was collected by face-to-face interviews between March and September 2022. Patients were interviewed when they felt best in the first 24 to 48 hours after surgery. The patient information form created by the researchers and the revised American Pain Society patient outcome questionnaire (APS-POQ-R) were used as data collection tools.

Patient information form

The patient information form includes questions about demographic characteristics such as age, gender, educational status, history of surgery, surgical site, anaesthesia and pharmacological and nonpharmacological methods used for pain relief. These were retrieved from the patient's medical file.

Revised American Pain Society patient outcome questionnaire (APS-POQ-R)

The APS-POQ-R (see supplemental material) was developed by the American Pain Society in 1991 and revised by Gordon et al. in 2010 for use in quality improvement[23]. The questionnaire consists of 12 questions aimed at assessing the patient's pain and satisfaction with the treatment and care provided for pain. Three of the questions have four sub-questions so there are 23 items in total. The items can be grouped into five sub-dimensions:

1. pain severity and its effect on sleep (5 items; 1, 2, 3, 4c, 4d)

2. effect of pain on activity (2 items; 4a, 4b)

3. emotional impact of pain (4 items; 5a, 5b, 5c, 5d)

4. side effects of pain management (4 items; 6a, 6b, 6c, 6d)

5. perception of care (3 items; 7, 8, 9).

The total score of the questionnaire is not used, evaluation uses the mean scores of the sub-dimensions[23,24]. Items 10, 11 and 12 are not included in the sub-dimensions and are evaluated outside the sub-dimensions of the scale. Item 10 addresses information received by patients about pain treatment options and how helpful they were, item 11 addresses use of nonpharmacological methods in pain treatment), and item 12 addresses whether use of nonpharmacological methods were encouraged by health care professionals.

Gordon et al.[23] reported the overall Cronbach's alpha value as 0.86[23]. In this study, the overall Cronbach's alpha value was 0.71.

Data analysis

Data evaluation was performed in the SPSS 26.00 program. In data analysis, descriptive statistical methods in the form of numbers, percentages and averages were used, as well as the Kolmogorow Smirnov test of normality. One way ANOVA test, independent-samples t test, Kruskal-Wallis test and Mann-Whitney test were used for comparisons between variables. Significance level was accepted as $p < 0.05$.

Ethical approach

Written permission was obtained from Bartın University Social and Human Sciences Ethics Committee (Decision No: E-71504618-600-2200022254) and Bartın Provincial Health Directorate for the conduct of the study. Permission to use the scale for the study was obtained from the scale developer. The study's participants were informed, and written informed consent was obtained.

Findings

The demographic and clinical characteristics of participants in the study are shown in Table 1. Of the 112 participants, 92.9 per cent were female, 50.9 per cent had primary school education and the mean age was 65.11 (±7.108) years.

Nearly all participants (99.1%) were anaesthetised with spinal anaesthesia. All patients received combined opioid and nonopioid analgesics as pharmacologic treatment in the post-operative, 24-hour period. Cold compress and elevation methods were used as nonpharmacological treatments.

Table 1: Demographic and clinical characteristics of the participants

Variable		Number of participants (%)
Age (in years)	Range: 46–85	
	Mean (SD): 65.11 (±7.108)	
	under 65 years old	56 (50.0%)
	65 years and older	56 (50.0%)
Gender	female	104 (92.9%)
	male	8 (7.1%)
Education	illiterate	52 (46.4%)
	primary school	57 (50.9%)
	middle school-high school	3 (2.7%)
Surgical site	right knee	55 (49.1%)
	left knee	57 (50.9%)
Applied anaesthesia	spinal	111 (99.1%)
	general	1 (0.9%)
Pharmacological treatment	opioid and nonopioid	112 (100%)
Nonpharmacological treatment	cold compress and elevation	110 (98.2%)
	cold compress	2 (1.8%)
History of surgery	yes	92 (82.1%)
	no	20 (17.9%)
Gonarthrosis experience	yes	43 (38.4%)
	no	69 (61.6%)

The majority of participants (82.1%) had a history of surgery, and 38.4 per cent had total knee arthroplasty.

The pain experiences and pain management results of the patients in the first 24 hours after surgery are shown in Table 2. The mean score for the least pain was 1.29 (±0.790) and the mean score for the worst pain was 9.25 (±1.086) where 0 indicated no pain and 10 indicated worst pain possible. The mean perceived amount of time in severe pain was 70.54 (±13.546) on a scale from 0 to 100 per cent of the time. When the effect of pain on sleep was evaluated, it was found that the mean score for effect on falling asleep was 3.63 (±3.269) and for effect on staying asleep was 3.61 (±3.261) where 0 indicated does not interfere and 10 indicated completely interferes.

When the effect of pain on activity was evaluated, it was found that the mean score for effect on activities in bed was 9.34 (±0.973) and for effect on activities out of bed was 8.21 (±1.363) where 0 indicated does not interfere and 10 indicated completely interferes. Regarding the emotional inpact of pain, anxiety had the highest mean score of 4.55 (±2.543) where 0 indicated did not experience the emotion at all and 10 indicated extreme emotion was experienced. Nausea was the side effect with the highest mean score of 4.96 (±4.658) where 0 indicated no side effect experienced and 10 indicated severe side effect experienced.

In relation to perception of care the mean score for pain relief was 8.71 (±0.801), on a scale from 0 (no relief) to 100 per cent (complete relief); the mean score for permission to participate in pain treatment decisions was 9.34 (±1.443), where 0 indicated not at all and 10 indicated very much so; and the mean score for satisfaction with pain treatment results was 8.87 (±1.663), where 0 indicated extremely dissatisfied and 10 indicated extremely satisfied.

Table 3 shows the distribution of responses to items 10, 11 and 12 that were not included in a sub-dimension. Nearly all participants (93.8%) stated that they received

Table 2: Scores for items in the five sub-dimensions

Sub-dimension	Item	Minimum	Maximum	Mean (X)	Standard deviation (SD)
Pain severity and its effect on sleep	least pain	0	3	1.29	0.790
	worst pain	5	10	9.25	1.086
	time in severe pain	40	90	70.54	13.546
	effect on falling asleep	0	10	3.63	3.269
	effect on staying asleep	0	10	3.61	3.261
Effect of pain on activity	effect on activities in bed	6	10	9.34	0.973
	effect on activities out of bed	3	10	8.21	1.363
Emotional impact of pain	anxious	0	10	4.55	2.543
	depressed	0	10	1.09	1.631
	frightened	0	10	1.58	1.844
	helpless	0	8	1.37	1.693
Side effects of pain management	nausea	0	10	4.96	4.658
	drowsiness	0	10	2.81	2.086
	itching	0	2	0.09	0.393
	dizziness	0	10	2.27	3.587
Perception of care	pain relief	7	10	8.71	0.801
	permission to participate in pain management decisions	4	10	9.34	1.443
	satisfaction with pain treatment outcomes	2	10	8.87	1.663

information about pain treatment, and the mean score for the helpfulness of the information was 8.62 (±1.47) where 0 indicated not at all helpful and 10 indicated extremely helpful. All participants used nonpharmacological pain relief methods; the most frequently used were cold application, walking, relaxation exercises, breathing exercises, distraction, prayer and massage. Nearly all participants (92%) reported that a nurse or doctor often encouraged them to use nonpharmacological pain relief.

Table 4 shows the effect of independent variables on the five sub-dimensions. It was found that women were significantly more affected by pain than men in terms of pain severity and effects on sleep, emotional impact of pain and side effects of medication, and women's perception of care was significantly lower than men's (p<0.05). It was also observed that partaicipants under 65 years of age were significantly more affected by pain than participants 65 years and older in terms of pain severity and effects on sleep, and emotional impact of pain (p<0.05). Education level and gonarthrosis experience were not found to have a significant effect on any of the sub-dimensions.

Discussion

Post-operative pain management is an important aspect of providing quality health care, and monitoring patient-related outcomes is a recommended quality improvement practice. There are a limited number of studies in the literature in which measurable evaluations of patients' pain experience after total knee arthroplasty were made. This descriptive and cross-sectional study evaluated patients' pain levels and pain management outcomes in the early post-operative period. In addition, the effect of independent variables on participants pain levels was examined.

The mean scores for the sub-dimensions of pain severity and its effect on sleep and side effects of pain management found in this study were consistent with the study by Özdemir[7]. More specifically, while the mean score for least pain (1.29) was similar to those of other studies[25–27], the average score for worst pain (9.25) was found to be high. This indicates that the participants in this study experienced severe pain.

Table 3: Distribution of responses to APS-POQ-R items 10, 11 and 12

Item	Response	Number of participants (%) (or score range, mean and standard deviation)
Received information about pain management	yes	105 (93.8%)
	no	7 (6.3%)
	helpfulness of the information received	Score range: 4–10 Mean (SD): 8.62 (1.47)
Use of nonpharmacological methods	yes	112 (100%0
	no	0 (0%)
	cold application	111 (99.1%)
	walking	100 (89.3%)
	relaxation exercises	93 (83.0%)
	breathing exercises	79 (70.5%)
	diversion of attention	68 (60.7%)
	prayer	47 (42.0%)
	massage	5 (4.5%)
Encouragement to use nonpharmacological methods	frequently	103 (92.0%)
	sometimes	7 (6.3%)
	never	2 (1.8%)

Table 4: The effect of independent variables on sub-dimensions

Variable		Pain severity and its effect on sleep			Effect of pain on activity			Emotional impact of pain			Side effects of pain management			Perception of care		
		X	SD		X	SD		X	SD		X	SD		X	SD	
Gender	female	5.08	1.52	**p=0.01**	17.5	1.90	p=0.73	9.01	6.21	**p=0.00**	10.6	7.32	**p=0.00**	8.92	0.92	**p=0.02**
	male	3.52	1.18	t=2.82	17.7	1.75	M-U=387.0	3.00	2.00	M-U=140.5	3.87	3.83	M-U=169.0	9.58	0.68	M-U=221.0
Age group (in years)	<65	5.29	1.59	**p=0.03**	17.6	2.05	p=0.22	10.2	7.23	**p=0.01**	10.4	6.98	p=0.41	8.86	0.94	p=0.07
	≥65	4.65	1.45	t=2.23	17.4	1.70	M-U=1365.5	6.89	4.43	M-U=1137.5	9.78	7.71	M-U=1428.5	9.07	0.90	M-U=1267.5
Education level	illiterate	4.79	1.48		17.6	1.55		7.90	5.90		9.17	8.00		8.94	1.55	
	primary school	5.06	1.62	p=0.23	17.3	2.15	p=0.21	9.24	6.59	p=0.59	11.2	6.67	p=0.13	8.97	0.83	p=0.90
	middle and high school	6.26	0.46	f=1.48	19.0	0.00	x2k-w=3.115	8.00	3.00	x2k-w =1.024	6.33	4.93	x2k-w =4.086	9.33	0.33	x2k-w =0.210
Gonarthrosis experience	yes	4.76	5.10	p=0.26 t=1.12	17.4	1.80	p=0.60 M-U=1398.0	7.44	6.11	p=0.08 M-U=1192.5	12.4	7.26	p=0.05 M-U=1014.5	9.03	0.82	p=0.18 M-U=1264.0
	no	5.10	1.49		17.5	1.94		9.30	6.20		8.66	7.03		8.93	0.98	

t = independent-samples t test, f = One way ANOVA test, X 2K-W = Kruskal-Wallis test, M-U = Mann–Whitney test

The mean score for the sub-dimension of emotional impact of pain in our study was lower than that reported by Özdemir[7] and Keskin[24]. However, the results of this study in relation to the most commonly experienced emotion and side effects of pain management are consistent with other studies. In this study, it was found that the most common emotional effect caused by pain was anxiety. Similarly, Polanco-Garcia et al.[25] found that the most common negative effect in patients after orthopaedic surgery was anxiety, with a rate of 58.5 per cent. Özdemir[7] also concluded that the most common emotional effect was anxiety.

Nausea was found to be the side effect with the highest mean score in our study. Nausea was also found to be the most common side effect in the study by Özdemir[7]. In the study by Polanco-Garcia et al.[25] the rate of nausea in patients was reported to be 36.4 per cent.

The mean score for satisfaction with pain treatment in the sub-dimension of perception of care in our study was 8.87 (± 1.663), which is consistent with the results of Özdemir[7]. In contrast to this, 93.8 per cent of participants in our study reported being informed about pain treatment while Polanco-Garcia et al.[25] reported a rate of 63.3 per cent.

In our study, all participants used nonpharmacological pain relief methods while the rate was only 69.7 percent in the study by Özdemir[7], 62 per cent did in the study by Gordon et al.[23] and 48.9 per cent in the study by Zoega et al.[27]. The most frequently used nonpharmacological method was cold application (99.1%). In the literature, cold application (39.4%) and deep breathing (21.6%) are the most common nonpharmacological methods used to relieve post-operative pain[7,27]. Cold application is a widely preferred method for reducing oedema and relieving pain in orthopaedic surgery.

Most participants (92%) in our study reported that the health care team often encouraged them to use nonpharmacological treatment. This is higher than the rates of 10.1 per cent[7] and 27.7 per cent[27] reported in other studies. Keast et al.[28] also found that the communication between the health care team and patients affected patient participation in nonpharmacological treatment.

In our study, it was found that gender had a significant relationship with pain severity and its effect on sleep, the emotional impact of pain and side effects of medication. It was observed that the mean scores of items in these sub-dimensions were significantly higher in female participants than in male participants and, accordingly, the women's perception of care was lower than the men's. This is consistent with research by Özdemir[7]. Our study also found a significant correlation between age and both pain severity and its effect on sleep and the emotional impact of pain – participants under 65 years of age were found to have significantly higher mean scores for these sub-dimensions than participants aged 65 years and older.

Similarly, Liu et al.[29] reported that female gender and younger age were positively correlated with pain severity[29]. These results support the idea that the perception of pain may differ according to age and gender.

Limitations and strengths

The study was conducted in a single health facility and cold application was encouraged more than other nonpharmacological pain relief methods. These limit the generalisability of the research results. A strength of the study was the data collection form which provided not only data about participant pain levels but also data about the effect of pain on sleep, activity and emotional state, and data about side effects of pain management and participant perceptions of care.

Conclusions and recommendations

Evaluation of pain levels and pain management of patients in the post-operative period directly affects the quality of care given to patients. In the post-operative period, opioid and nonopioid analgesia and pain medications have an important place in pain control but they may also cause various side effects. In this sense, the application of nonpharmacological methods is extremely important. However, the literature reveals that these methods are used in a limited way. Health professionals should be supported with in-service training in order to overcome the lack of knowledge about nonpharmacological methods and to better encourage patients to use nonpharmacological methods.

Declaration of conflicting interests

All of the authors declare that they have all participated in the design, execution and analysis of the paper, and that they have approved the final version. Additionally, there are no conflicts of interest in connection with this paper, and the material described is not under publication or consideration for publication elsewhere.

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