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Assessment of postoperative pain intensity after laparoscopic cholecystectomy: Comparative analysis of three rating scales in terms of scores and patient preferences

Metin Leblebici[1], Berna Dincer[2], Cemile Savcı[3], Filiz Soyhan[4], Orhan Alimoğlu[5]

ABSTRACT

Objective: To compare three rating scales in assessment of postoperative pain intensity after laparoscopic cholecystectomy

Methods: A total 102 patients who underwent elective laparoscopic cholecystectomy surgery were participated on a voluntary basis in this cross-sectional questionnaire survey. The questionnaire form elicited items on sociodemographic characteristics of patients, pain characteristics and the pain intensity assessment via three scales including Visual Analogue Scale (VAS), Numerical Rating Scale (NRS), Verbal Descriptor Scale (VDS).

Results: Mean(SD) VAS, VDS and NRS scores were 4.7(1.3), 2.8(0.7) and 4.5(1.2), respectively. VDS (67.6%) was the most commonly preferred scale by patients, as followed by VAS (23.5%) and NRS (8.8%). Positive significant correlations were noted between each scale (r: ranged from 0.809 between VAS and VDS to 0.865 between VDS and NRS, p<0.001 for each). There was a high level of inter-scale concordance overall (Cronbach's alpha: 0.910), including VAS x VDS (Cronbach's alpha: 0.820), VAS x NRS (Cronbach's alpha=0.906) and VDS x NRS (Cronbach's alpha=0.868).

Conclusion: In conclusion, our findings demonstrate that all three scales (VAS, NRS, VDS) provide reliable and valid data with strong correlations and a high level of inter-scale concordance in assessing postoperative pain intensity in laparoscopic cholecystectomy patients. However, VDS appears to be the best scale in assessing pain intensity after laparoscopic cholecystectomy surgery with respect to patient preference rates as well as its strong correlation with other scales, particularly the NRS.

Keywords: *Postoperative pain intensity; VAS; NRS; VDS; patient preference; laparoscopic cholecystectomy*

Introduction

Early recognition and appropriate management of postoperative pain has been associated with earlier mobilization, shortened hospital stay, reduced cost and high patient satisfaction (1-4). In this regard, pain scales are important tools for accurate pain assessment by providing objectively interpreted data on subjective pain intensity, which is the common outcome domain for acute pain that is targeted in pain treatment, and therefore guiding treatment decisions for effective postoperative pain relief (3,5-11).

In the assessment of pain intensity, the most commonly used measures include Visual Analogue Scale (VAS), Numerical Rating Scale (NRS), Verbal Descriptor Scale (VDS) and Faces Pain Scale-Revised (FPS-R) (5,11,12). However, each scale has important strengths and drawbacks and none is considered the measure of choice for use in all clinical settings and patient populations (11-14).

The pain assessment has been more extensively studied in the oncology setting or in terms of chronic pain with limited data on utility of pain scales in surgical patients (5). Besides, while the cultural background is considered amongst the determinants of pain behavior or expression (15), only limited data are available on the utility of pain

[1] Department of General Surgery, Istanbul Medeniyet University Faculty of Medicine, Istanbul, Turkey drleblebici@yahoo.com, ORCID: 0000-0002-1403-7643

[2] Deparment of Internal Medicine Nursing, Health Science Faculty İstanbul Medeniyet University Istanbul, Turkey., berna.dincer@medeniyet.edu.tr, ORCİD: 0000-0001-7284-7495

[3] Department of Nursing, Faculty of Health Sciences, Istanbul Medeniyet University, Istanbul, Turkey., cemile.savci@medeniyet.edu.tr, ORCİD: 0000-0002-5612-9335

[4] Registry Nurse, İstanbul Bağcılar Research and Training Hospital, Department of Surgery, İstanbul, Turkey, filizsoyhann@gmail.com, ORCID:0000-0002-7064-785X

[5] Department of General Surgery, Istanbul Medeniyet University Faculty of Medicine, Istanbul, Turkey orhanalimoglu@gmail.com, ORCID: 0000-0003-2130-2529

scales in assessment of pain intensity among Turkish people (10,16).

This study was therefore designed to comparatively assess the utility of three scales (VAS, VDS and NRS) in assessment of postoperative pain intensity among laparoscopic cholecystectomy patients in terms of scale scores and patient preferences**.**

Methods

Study population

A total 102 patients who underwent elective laparoscopic cholecystectomy surgery were participated on a voluntary basis in this cross-sectional questionnaire survey and were interviewed via face-to-face method.

Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study which was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the institutional ethics committee.

The questionnaire form

The questionnaire form elicited items on sociodemographic characteristics of patients (age, gender, educational status, marital status, occupational status), body mass index (BMI, kg/m^2), comorbidities, pain characteristics (type, location, time of onset, intervals between episodes, triggers, relievers), pain intensity scales (VAS, NRS, VDS) and patient preference regarding the scales. The correlation between scale scores and inter-scale consistency were also recorded.

Pain intensity instruments

The same analgesic treatment (tramadol and paracetamol) was administered in all patients postoperatively. None of the patients developed complications and all were discharged on the postoperative day 1. Pain intensity was assesses based on VAS, NRS and VDS scores.

The pain VAS is a self-administered unidimensional measure of pain intensity, which has been widely used in diverse adult populations. It is a continuous 100 mm scale anchored by 2 verbal descriptors for pain intensity, including "no pain" (score of 0) and "worst imaginable pain" (score of 100 [100-mm scale]). Participants are asked to make a mark on the line that represented their pain intensity, and pain intensity level was scored by measuring the distance from the "no pain" end to the patient's mark. VAS provides a range of scores from 0 –100 with higher scores indicating greater pain intensity (17,18).

NRS is a 10 point scale that uses 11 numbers (0 through 10; 0: no pain, 1-2: mild pain, 3-4: moderate pain, 5-6: severe pain, 7-8: very severe pain, 9-10: worst imaginable pain) to measure pain intensity. Participants are instructed to select the number that best reflected the intensity of pain, with higher numbers indicating greater pain intensity (19,20).

VDS is a continuous scale anchored by 4 verbal descriptors for pain intensity, including no pain, mild pain, disturbing pain, severe pain, extreme pain and worst imaginable pain. The scores 0, 2, 4, 6, 8, and 10 were assigned to each of the verbal descriptors, with "none" scored as 0 to "worst pain" scored 10, with higher numbers associated with more intense adjectives Participants are asked to pick the word that best described their pain intensity, and their VDS intensity score is the number associated with the word they chose (21).

Statistical analysis

Statistical analysis was made using MedCalc Statistical Software version 12.7.7 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2013). Chi-square ($\chi 2$) test and Correlation between non-normally distributed variables was analyzed using Spearman Rho correlation analysis. Concordance between scales was analyzed via Cronbach alpha coefficient. Data were expressed as mean (standard deviation, SD), minimum-maximum and percent (%) where appropriate. $p<0.05$ was considered statistically significant.

Results

Patient demographics and postoperative pain characteristics

Mean patient age was 53.5 (SD 13.3) years and females composed 65.7% of study population. Most of patients were housewives (50.0%) and primary school graduates (61.8%). Comorbid disease was evident in 58.8% of patients (Table 1).

Most of patients reported aching type of postoperative pain (64.7%) that was abdominal (83.3%) or at suture site (64.7%) and started in the immediate postoperative period (95.1%) (Table 1).

Median duration of a pain episode was 120 min (ranged 10 to 480 min), while the median time between consecutive pain episodes was 4 hours (ranged 1to 8 hour) (Table 1).

Most of the patients reported that walking (52.0%) was the leading pain trigger, while sleeping (63.7%) was associated with the pain-relief (Table 1).

Scale scores and patient preference

Mean(SD) VAS, VDS and NRS scores were 4.7(1.3), 2.8(0.7) and 4.5(1.2), respectively. VDS (67.6%) was the most commonly preferred scale by patients, as followed by VAS (23.5%) and NRS (8.8%) (Table 2).

Correlation between scale scores

Positive significant correlations were noted between each scale (r: ranged from 0.809 between VAS and VDS to 0.865 between VDS and NRS, p<0.001 for each) (Table 3).

Concordance between scales

There was a high level of inter-scale concordance overall (Cronbach's alpha: 0.910), including VAS x VDS (Cronbach's alpha: 0.820), VAS x NRS (Cronbach's alpha=0.906) and VDS x NRS (Cronbach's alpha=0.868) (Table 4).

Discussion

Our findings revealed that the three scales (VAS, VDS and NRS) were significantly correlated with each other in terms of measuring the postoperative pain intensity along with a high inter-scale concordance, whereas VDS was the most commonly preferred scale by patients, as followed by the VAS and NRS.

Our findings are consistent with past reports indicated VAS (22-24), NRS (5,19,20) and VDS (5,12,25) as reliable and valid tools commonly used in research and clinical practice, as well as the presence of significant correlations between VAS, VDS and NRS scales in measuring postoperative pain intensity in scheduled surgery patients (5,12,26,27).

In the current study, the strongest correlation was between VDS and NRS scales, which seems notable given that NRS and VDS are considered two simple and easy to understand scales to describe pain with low error rates particularly in assessing the recalled rather than the actual postoperative pain (5,28,29). In this regard, identification of the VDS as the most preferred scale by postoperative patients in assessing pain intensity after laparoscopic cholecystectomy surgery in the current study seems to be in agreement with consideration of VDS as an easy to administer and score tool (5). Likewise, VDS has also been reported as the most preferred pain intensity assessment tool by patients in different surgical settings and to also reflect pain interference besides the intensity (10,25,28,30), while superiority of VDS over VAS has been emphasized particularly in elderly patients and those with lower educational attainment (30,31).

Verbal scales are considered to enable patient to self-express themselves better and to improve the confidential relationship with healthcare professional, particularly in assessment of immediate postoperative pain (10,32). This seems notable given that majority of our patients reported the onset of pain immediately following surgery.

NRS was the least preferred pain intensity scale in our cohort. This seems consistent with previously suggested impact of culture and ethnicity on pain perception and expression (34,35), with a higher preference for the NRS in studies from the developed Western countries (12,30,31), whereas higher preference for non-numerical scales (FPS-R and VDS) in Eastern or developing countries including the Turkey (5,11,16,36,37).

In fact given that only less than 10% of our patients had higher educational attainment, our findings also emphasize the non-numerical scales (FPS-R and VRS) rather than VAS and NRS to be more commonly preferred by less educated participants and to be associated with higher rates of correct responses, especially among the older participants (11,16,38).

In a past study on psychometric analyses of postoperative pain scales (NRS, VAS, VDS), authors suggested that the NRS was the preferred pain intensity scale with low error rates, and higher validity than the other scales regardless of the patient age (30). Authors also reported the favorable profile of the VDS with low error rates and good validity, while VAS was associated with difficulties among the elderly with high rates of error and low validity (30). In fact, the degree of conceptual difficulty in completing the pain scale was reported to be highest for VAS, followed by NRS, VDS, and then FPS-R (12,26,33). Accordingly, VAS is considered to be a time-consuming scale necessitating abstract thinking that complicates the understanding and completion of the scale by patients and adapting to the numbers, particularly the elderly patients resulting in an inability to express their pain sufficiently (5,12,26,28,30,39). Likewise, in a past study on comparison of VAS, NRS and VDS in 64 intensive care unit patients from Turkey, VAS was considered to be the least preferred and the most difficult scale by the patients (10).

In another study from Turkey in 621 patients during the early postoperative period, authors compared FPRS, VAS, NRS, VDS, thermometer pain scale (TPS), McGill Pain Questionnaire (MPQ), Short-form McGill Pain Questionnaire (SFMPQ), and Brief Pain Inventory (BPI) (16). Authors indicated the patient preference for pain scales as follows: 97.4% FPS, 88.6% NRS, 84.1% VDS, 78.1% TPS, 60.1% SFMPQ, 37.0% BPI, 11.4% VAS, and 10.5% MPQ (16). Authors also noted that while NRS, TPS, FPS, and VDS revealed similar level of pain, the level of pain determined by the VAS did not correlate with other scales (16).

In fact, the words used in VDS has been considered challenging in terms of not necessarily expressing the actual patient experience or having the same meaning for each participant, alongside the heterogeneity of the length of intervals between words in the scale (5,40). In addition, lack of congruence between the NRS and the VDS using numbers has also been suggested (5). However, our findings revealed significant positive correlations between pain intensity scores obtained on each scale as well as high level of concordance between VDS and both VAS and NRS. Accordingly, our findings support the past studies suggested using a combination of the NRS and VRS to avoid the risk

of low reliability of the verbal scale (10,30) and use of VAS should in combination with one of these scales (16).

The major strength of the current study seems to be the inclusion of patients who underwent the same surgical operation and similar analgesic treatment as well as the application of three scales in a random order (VAS, VDS and NRS) not based on the degree of conceptual difficulty. However, certain limitations to this study should be considered. First, lack of cognitive function assessment prior to scales is an important limitation, particularly for elderly patients. Second, lack of data on FPS-R-based pain intensity scoring is another limitation which otherwise would extend the knowledge achieved in the current study.

In conclusion, our findings demonstrate that all three scales (VAS, NRS and VDS) provide reliable and valid data with strong correlations and a high level of inter-scale concordance in assessing postoperative pain intensity in laparoscopic cholecystectomy patients. However, VDS appears to be the best scale in assessing pain intensity after laparoscopic cholecystectomy surgery with respect to patient preference rates as well as its strong correlation with other scales, particularly with the NRS. Our findings emphasize the potential utility of non-numerical pain intensity scales as primary measure particularly in patients with lower educational attainment, whereas strongly suggest to consider patient characteristics when selecting scales and to use NRS in combination with the VRS, given their strong correlation. Future larger scale studies in different surgical settings are necessary to better understand the utility of pain intensity scales in assessment of postoperative pain with regards to differences in cultural and educational background.

Conflict of interest

Authors declare that they have no conflict of interest

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TABLES (1-4)

Table 1. Patient demographics and postoperative pain characteristics

Patient characteristics		
Age, mean(SD, min-max)		53.5(13.3,18-80)
Gender, n(%)		
Male		35(34.3)
Female		67(65.7)
BMI (kg/m^2)		29.4±5.5
Marital status, n(%)		
Married		78(76.5)
Single		23(22.5)
Occupational status		**N**
Employed		33(32.4)
Housewife		51(50.0)
Retired		13(12.7)
Unemployed		5(4.9)
Educational status		
Illiterate		14(13.7)
Primary education		63(61.8)
Secondary education		16(15.7)
Higher education		9(8.8)
Comorbidity, n(%)		60(58.8)
Pain characteristics		
Type of pain, n(%)		
Cramping		2(2.0)
Stabbing		16(15.7)
Compressing		5(4.9)
Shooting		3(2.9)
Aching		66(64.7)
Burning		10(9.8)
Location of pain, n(%)		
Right shoulder		19(18.6)
Abdominal		85(83.3)
Suture site		66(64.7)
Onset of pain, n(%)		
Immediate postoperative		97(95.1)
First postoperative hour		5(4.9)
Duration of pain (min)	Mean(SD)	118.3 (79.8)
	Median (min-max)	120(10-480)
Time between pain episodes (hour), mean(SD, min-max)		4.2(2.0, 1.0-8.0)
Factors triggering pain, n(%)		
Walking		53(52.0)
Coughing		13(12.7)
Moving		36(35.3)
Factors relieving pain, n(%)		
Sleeping		65(63.7)
Immobility		27(26.5)
Analgesics		10(9.8)

Table 2. Scale scores and patient preference

	Scale Scores		**Patient preference**
	Mean(SD)	**Median (min-max)**	**n(%)**
Visual Analog Scale (VAS)	4.7(1.3)	5(1-8)	24(23.5)
Verbal Descriptor Scale (VDS)	2.8(0.7)	3(1-4)	69(67.6)
Numeric Rating Scale (NRS)	4.5(1.2)	5(1-8)	9(8.8)

Table 3. Correlation between scale scores

		Visual Analog Scale	Verbal Descriptor Scale	Numeric Rating Scale
Visual Analog Scale	r	1.00	0.809	0.822
	p	-	**<0.001**	**<0.001**
Verbal Descriptor Scale	r	0.809.	1.00	0.865
	p	**<0.001**	-	**<0.001**
Numeric Rating Scale	r	0.822	0.865	1.00
	p	**<0.001**	**<0.001**	-

Spearman correlation analysis r: correlation coefficient

Table 4. Inter-scale concordance

	Cronbach's alpha
Visual Analog Scale x Verbal Descriptor Scale x Numeric Rating Scale	0.910
Visual Analog Scale x Verbal Descriptor Scale	0.820
Visual Analog Scale x Numeric Rating Scale	0.906
Verbal Descriptor Scale x Numeric Rating Scale	0.868