J Korean Med Sci 2001; 16: 784-8
ISSN 1011-8934

Nurses' Assessment of Postoperative Pain: Can it be an Alternative to Patients' Self-Reports?

This study was designed to evaluate whether the nurses' assessment of postoperative pain can be an alternative to patients' self-reporting. We examined 187 patients receiving postoperative intravenous patient-controlled analgesia. The nurses assessed the patients' pain with three pain indices (therapeutic efficacy, pain intensity, and facial pain expression) 8 hr after operation. The patients recorded their resting and movement pain using 100-mm visual analog scales immediately following the nurses' assessment. There was an acceptable correlation between overall pain measurement assessed by patients and that assessed by nurses (canonical correlation coefficient=0.72, p=0.0001). The resting pain was more reliably reflected than the movement pain in overall measurement assessed both by nurses and by patients. Among the three pain indices assessed by nurses, the pain intensity most reliably reflected the patients' self-reports. The pain intensity assessed with a simple verbal descriptor scale therefore is believed to be an effective alternative to the patients' self-reports of postoperative pain at rest. However, it mirrored the patients' self-reports during movement less reliably. Therapeutic efficacy and facial pain expression indices were not effective alternatives to patients' self-reporting.

Key Words : *Pain, Postoperative; Health Personnel, Nurse; Pain Measurement*

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Received : 21 June 2001
Accepted : 24 July 2001

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INTRODUCTION

Patients usually cannot express their pain adequately during the immediate postoperative period. In addition, in such stressful situations, it sometimes can impose an additional psychological burden on the patients to understand and mark somewhat complicated pain assessment tools, such as the visual analog scale (VAS) (1-5). It is thus assumed that the more immediate the postoperative period is, the less reliable and valid the VAS becomes. Accordingly, the nurses' role in the evaluation of pain in such situations is indispensable to provide an adequate analgesia.

Several approaches have been made to evaluate the reliability and validity of the nurses' assessment of pain under various clinical situations, only to give controversial results (1, 6-11). Reevaluation of the reliability and validity of the nurses' assessment of pain is thus required considering that in most clinical settings the postoperative pain control including p. r. n. medications is largely dependent on the nurses' observation of the pain. In addition, explanatory power and the appropriateness of the statistical application of the results from the previous studies need to be verified by further investigation.

It is sometimes expedient to use physicians' or nurses' assessment of pain rather than patients' own report when the patients cannot answer for themselves (12). In such situations a simple numerical or verbal pain scale has been preferred to assess patients' pain because of its simplicity and ease of obtaining pain ratings (6, 13). Price and the colleagues (13) pointed out that most physicians in their medical school preferred to use such a simple numerical or verbal pain scale, whereas only 7% of physicians preferred the VAS. In addition, the copious data collection with somewhat intricate pain assessment tools was a great burden to the busy nurses, degrading their motivation and compliance in a way that compromises the overall quality of the measurement process. It could also blur the focus of the investigation and sometimes dropping out critical information (12). From this clinical aspect, we used the simple categorical scales rather than the VAS for the caregivers' pain ratings.

We hypothesized that if nurses' assessment of postoperative pain closely correlated with patients' self-reports after a complete recovery of preoperative mental status, it could be reliably applied to the immediate postoperative period when patients can not express their pain effectively. This study was therefore performed to document how closely the nurses'

observation of postoperative pain would reflect patients' self-reports through the evaluation of the correlation between the pain indices assessed by nurses and the patients' self-reports and to decide which of the pain indices could most effectively reflect the patients' self-reports.

MATERIALS AND METHODS

After approval by our institutional review board, informed consent was obtained at the preanesthetic visit from those patients who had desired to control their postsurgical pain with intravenous (IV) patient-controlled analgesia (PCA). We also explained to the patients how to use the IV-PCA and how to mark the VAS.

Patients with an active psychiatric disorder, mental retardation, or complications that were too severe to allow normal communication, as well as those who could not or did not want to finish the VAS were excluded. Patients with history of taking anticoagulants, bleeding diathesis, severely impaired renal, hepatic, pulmonary, or cardiac function, and hypersensitivity to ketorolac or fentanyl were also excluded.

A total of 187 patients undergoing various surgical procedures (44 Cesarean operation, 39 spine surgery, 32 hysterectomy including radical surgery, 17 fracture surgery, 17 knee replacement surgery, 13 arthroscopic surgery, 8 hip replacement surgery, 8 oophorectomy with or without salpingectomy, 6 abdominal surgery, and 3 others) were included in this study. The patients had ASA physical status of 1 to 3 and an age range from 21 to 68 yr.

The nurses assessed therapeutic efficacy (TE), pain intensity (NP), and facial pain expression (FE) using various categorical scales 8 hr after operation after the patients had completely recovered to their preoperative mental status. They used a verbal descriptor scale to report NP: 1 for mild pain, 2 for discomforting, 3 for distressing, 4 for horrible, and 5 for excruciating pain. A descriptor scale of 1-5, where 1 represented complete relief, 2 lots of relief, 3 moderate relief, 4 slight relief, and 5 no relief, was used to measure TE. A pictorial scale (14) of 1-8 was used to measure FE (Fig. 1). Immediately after their assessments, the nurses explained again to the patients how to mark his or her pain at rest (RP) and during movement (MP) using a 100-mm VAS.

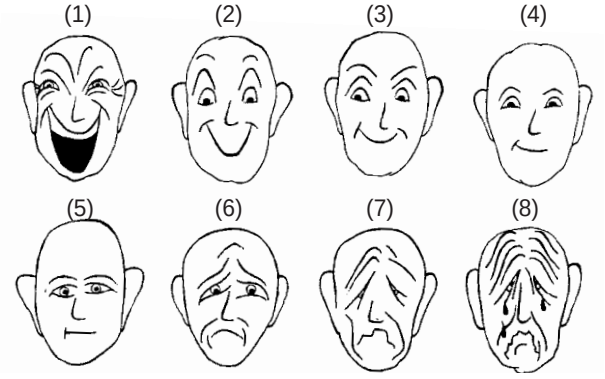

Fig. 1. Facial pain expression scoring system by Frank et al. (14). The numbers in the parentheses represent scores of facial pain expression.

Upon skin closure, IV injection of 4 mg of ondansetron and intramuscular injection of 30 mg of ketorolac were done. In the PACU, 0.5 μg/kg of fentanyl was injected intravenously when the patients recovered orientation and complained of pain. The same doses of fentanyl were additionally injected at 15-min intervals thereafter, up to a maximum dose of 2 μg/kg, until an adequate analgesia was obtained (mild pain for NP, lots of relief for TE, or a score under 6 for FE). After the injection of the loading doses, patients were started on IV PCA using an infuser (0.5 mL/hr of basal rate, 15 min of lockout, and 0.5 mL of bolus; PC1955 and C1079, Baxter, IL, U.S.A.) filled with 60 mL of fluid containing 1,200-1,700 μg of fentanyl, 8 mg of ondansetron, and 150-270 mg of ketorolac. Anesthesiologists in charge carefully determined the dosages of the fentanyl and ketorolac in consideration of patient characteristics and other factors that might influence the choice of pain therapy and postoperative analgesic requirements.

Statistical analysis (15-17)

The SAS program (V6.12, SAS Institute Inc., NC) was used for statistical calculations. Pearson's correlation coefficients between five indices were computed first (Table 1). High values indicated that the factor analysis could be a suitable method for the analysis of the data. The factor analysis revealed that the pain indices assessed by nurses (NP, TE, and FE) showed close interrelationships between them, whereas it showed a different nature from the patients' self-reports (RP and MP) (Fig. 2). We therefore inclusively assigned the NP, TE, and FE as '*nurses*' *assessment*' and the RP and MP as '*patients*' *assessment*' (overall Kaiser's measure of sampling adequacy=0.83, total of proportion=0.82). Standardization of the five pain indices was required before the application of the canonical analysis because of their different types and scales (categorical scale vs. VAS). The standardized pain

Table 1. Pearson's correlation coefficients between the pain

Pain index	RP	MP	NP	TE	FE
RP	1.00	-	-	-	-
MP	0.79*	1.00	-	-	-
NP	0.67*	0.60*	1.00	-	-
TE	0.59*	0.55*	0.72*	1.00	-
FE	0.59*	0.51*	0.62*	0.65*	1.00

*p<0.01. RP and MP=patients' self-reports of pain at rest and during movement, respectively; NP, TE, and FE=pain intensity, therapeutic efficacy, and facial pain expression assessed by nurses, respectively.

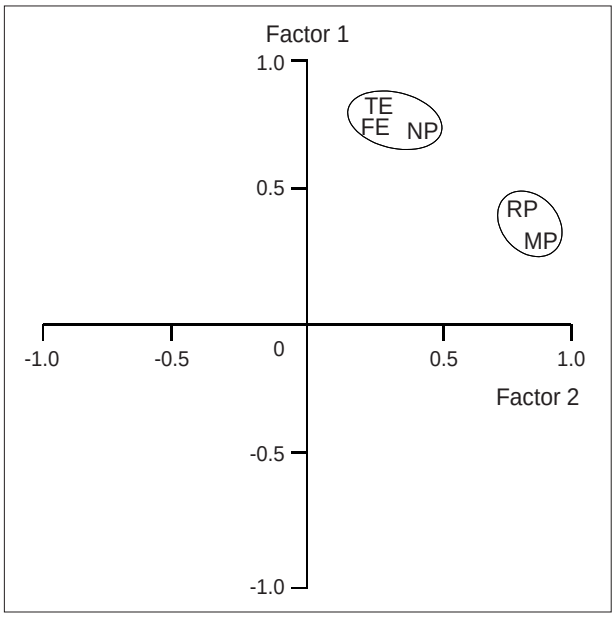

Fig. 2. Factor patterns of the pain indices. The pain indices assessed by nurses (NP, TE, and FE) show close interrelationships between them, whereas they show a different nature from the patients' self-reports (RP and MP). NP, TE, and FE are assigned as '*nurses*' *assessment*' and RP and MP are assigned as '*patients*' *assessment*'. RP and MP=patients' self-reports of the pain at rest and during movement, respectively; NP, TE, and FE=pain intensity, therapeutic efficacy, and facial pain expression assessed by nurses, respectively.

indices were marked with asterisks.

A canonical correlation analysis was primarily applied for the determination of how closely the nurses' assessment of postoperative pain reflected patients' self-reports and which pain index assessed by nurses reflected the patients' self-reports most soundly.

RESULTS

There was an acceptable correlation between the overall pain measurement (first canonical variate) assessed by patients and that assessed by nurses (canonical correlation coefficient =0.72, p=0.0001).

The patients represented their RP more effectively than MP. Among the standardized pain indices assessed by nurses, NP reflected the patients' self-reports most reliably (Table 2).

Three pain indices assessed by nurses had a seemingly similar ability to assess the pain with the patients' self-reports (Table 3). However, by means of considering inclusively with their relative weights within the corresponding group (Table 2), NP most reliably reflected patients' self-reports among the pain indices assessed by nurses. In addition, the RP component was more heavily reflected than the MP component in the overall nurses' assessment (Table 3).

Table 2. Correlations between overall pain assessment (first canonical variate) of a group and each pain index of the corresponding group

Pain index	Canonical correlation coefficient	
	Patients' assessment†	Nurses' assessment‡
RP*	0.77	-
MP*	0.27	-
NP*	-	0.60
TE*	-	0.20
FE*	-	0.33

*Standardized pain index. †,‡Overall pain measurement (first canonical variate) assessed by patients and nurses, respectively. RP and MP=patients' self-reports of pain at rest and during movement, respectively; NP, TE, and FE=pain intensity, therapeutic efficacy, and facial pain expression assessed by nurses, respectively.

Table 3. Correlations between overall pain assessment (first canonical variate) of a group and each pain index of the other group

Pain index	Canonical correlation coefficient	
	Patients' assessment†	Nurses' assessment‡
RP*	-	0.71
MP*	-	0.63
NP*	0.68	-
TE*	0.61	-
FE*	0.59	-

*Standardized pain index. †,‡Overall pain measurement (first canonical variate) assessed by patients and nurses, respectively. RP and MP=patients' self-reports of pain at rest and during movement, respectively; NP, TE, and FE=pain intensity, therapeutic efficacy, and facial pain expression assessed by nurses, respectively.

DISCUSSION

This study showed that the overall pain measurement assessed by nurses had an acceptable correlation with that assessed by patients and that NP most reliably reflected patients' self-reports among the pain indices assessed by nurses (Table 2 and 3) as a potential predictor. These findings are largely in agreement with the report of Bondestam and the colleagues (11). However, many studies (1, 6-10) indicated that nurses could not effectively assess patients' pain under various clinical situations. There are some factors that might influence such a discrepancy. First, the differences in the clinical situations, bases for the methodology, and analgesic strategies might have contributed to the discrepancy. Second, some of the previous studies showed a somewhat low explanatory power for their results. In the study of Choinière and the colleagues (8), the Pearson's correlation coefficients at rest were quite small, 0.33 for the VAS and 0.31 for the verbal descriptor scale. When these coefficients were squared, the nurses' ratings accounted for only 9 to 10% of the variability in the patients' scores. In

the study of Zalon (7), the correlation coefficient between the pain assessed by patients and by nurses was also low (r=0.304) and therefore the nurses' assessment accounted for only 9.25% of the variance. On the other hand, our study showed an acceptable correlation between the overall measurement by patients and that by nurses (Pearson's correlation coefficients=0.51-0.67, $p<0.01$ (Table 1); canonical correlation coefficient=0.72, $p=0.0001$). From these statistical bases, it is assumed that our study had a higher explanatory power than the previous studies (7, 8). Third, in some reports (1, 6), a question arises regarding the application of the statistical analysis techniques. They used a Spearman's correlation analysis for the comparison of their results from pain assessment tools of quite different type and scales. Such a simple correlation only indicates the strength of association between two variables and measures the linear concentration between the two. By using the correlation, it is difficult to analyze the structures of groups that have multivariables as in their studies because the analysis is limited to the linearity. In this study, the non-homogeneous and inconsistent patterns between the principal factors were also noted by a factor analysis. We settled such problems by using a factor analysis. Thereafter, the nature of the relationship between the principal factors could be analyzed and interpreted after the standardization of the principal factors and using a canonical correlation analysis.

Canonical correlation analysis, a widely used technique, can accommodate any metric variables without a strict assumption of normality. In addition, its inherent flexibility in terms of the number and types of variables handled makes it a logical candidate for many of the more complex problems addressed with multivariate analyses.

We applied FE as a postsurgical pain assessment tool under the assumption that it might be particularly useful when the patients were cognitively impaired postoperatively (14, 18, 19). However, it was less effective than NP (Table 2 and 3). It might be very difficult to distinguish pain from emotional expression when the patients were situated in very stressful conditions such as immediate postoperative state. Thus, this scale may include such emotional components as well as pain. TE could not reflect the patients' self-reports reliably either (Table 2 and 3) which is in agreement with the previous reports (7, 8, 20). Further validation of these scales will be required to apply them to the assessment of postoperative pain.

Our results showed that RP was reflected more soundly than MP in both the overall patients' self-reports and nurses' observation (Table 2 and 3). This result was supported by the previous reports (7, 9, 10). Reluctance to exercise actively or cough due to concern about the occurrence of severe pain might lead to such a result. It is therefore necessary to educate patients to press the demand button of PCA to alleviate the MP before active movement.

According to our results, the types of surgery and the dosages of analgesics in the PCA infuser were not significant variables because the patients themselves could administer the analgesics by pressing the demand button if the pain was not adequately controlled. We did not restrict the number and career of nurse evaluators because their age and the length of their service as a nurse did not significantly influence their ability to assess pain (8).

In our study, to achieve high validity and reliability of the results, the patients marked their pain after they had completely recovered their preoperative mental status. Accordingly, our results could not directly reflect all the situations of the immediate postoperative period. However, we assume that nurses could evaluate the patient's pain more closely than the patients during the immediate postoperative period because the patient had not got clearly returned to their preoperative mentality in such situation. We therefore believe that expansive interpretation of our results to the immediate postoperative period is possible.

In conclusion, the overall pain measurement assessed by nurses showed an acceptable correlation with that assessed by patients. The nurses' assessments mirrored the patients' self-reports more reliably at rest than during movement. Among the pain indices assessed by nurses, NP reflected the patients' self-reports more soundly. On the other hand, TE and FE require further validation before their application to assess postoperative pain.

ACKNOWLEDGMENT

We thank all members of the Lab of Statistical Data Analysis of the Hanyang University College of Natural Sciences for their expert technical assistance.

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