Cross-Correlation Among Visual Analog, Observational, and Behavioral Pain Scales of Oncological Patients Undergoing Major Abdominal Surgery

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Purpose: *To determine the perception of postoperative pain intensity between nurses and oncology patients undergoing major abdominal surgery.*

Design: *A prospective cross-correlation study with 173 oncology patients undergoing major abdominal surgery, such as hepatectomy or pancreatectomy.*

Methods: *Postoperative pain intensity was evaluated by clinical pain assessment tools such as critical-care pain observation tool (CPOT) and behavioral pain scale (BPS) recorded by the researcher, whereas the visual analog scale was completed by patients. Demographic and clinical data were recorded.*

Findings: *The Cronbach's α for CPOT and BPS was* $\alpha = 0.738$ *for each. There was a significant correlation between CPOT and BPS* ($\rho = 0.796$, $P < .001$), *whereas the visual analog scale was correlated with CPOT and BPS* ($\rho = 0.351$, $P < .001$ *and* $\rho = 0.352$, $P < .001$, *respectively), showing that nurses did not underestimate patients' pain levels.*

Conclusions: *The management of postoperative pain intensity after major abdominal surgery requires clinical comprehension by nurses to achieve the reduction or suppression of pain.*

Keywords: *pain perception, oncological nurses, patient, surgery trauma, pain.*

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PAIN RELIEF IS A MAJOR nursing intervention, which requires skills and knowledge, knowledge about pain concepts and methods of treating pain, and a record of pain level data. Pain relief also requires empathy and an effort by the nurse to understand and communicate what the patient experiences.[1] Although pain is a personal subjective experience where nurses are called on to cope with the symptom itself, they often have difficulty in recognizing, measuring, and evaluating it.[2]

However, pain assessment consists of many components, such as the recognition of the presence of pain (screening), the assessment of its intensity, its duration, quality, and location. Pain recognition and assessment is the primary step for the design of an individualized nursing care plan.[1,3] The tools, which are used for pain assessment, aim to determine the location, intensity, quality, duration and relieving of pain, and its relieving factors. These tools are personalized for each individual,[2] and it requires appropriate training of health professionals in their use.[4,5]

Objective pain assessment by nurses requires a clinical judgment without the influence of their personal experiences, opinions, and culture.[6] Modern studies showed that nurses' personal perception and belief seem to influence the assessment of patient's pain, as well the administration of analgesics.[7] In addition, cultural differences may affect the expression and perception of pain,[8] as well as the opinions on pain control and analgesic consumption.[7]

Evaluation of pain levels usually occurs with the Numeric Rating Scale (NRS) or the visual analog scale (VAS); however, pain in critically ill patients who cannot communicate verbally is often unidentified and untreated. In critically ill patients, the most valid and reliable behavioral tools for pain assessment are the critical-care pain observation tool (CPOT) and the behavioral pain scale (BPS).[9]

Pain assessment and an immediate response by health care professionals using analgesics or other means will help reduce or even suppress pain. The immediate response to pain has been found in the international literature as positively correlated with the rapid recovery of patients.[10,11]

Patients who undergo surgery experience acute postoperative pain, but less than half report adequate postoperative pain relief because there is a gap in the assessment of pain by health professionals in Greece.[12] The aim of this study was to record the perception of postoperative pain intensity between oncology patients undergoing major abdominal surgery and nurses by completing CPOT, BPS, and VAS pain scales and cross correlations between the tools mentioned. Specifically, the purpose of this study was to investigate if nurses underestimated patients' pain levels undergoing major abdominal surgery in Greece.

Design and Methods

A prospective correlation clinical trial was carried out at a large Oncological Hospital in Athens, Greece, between May 2012 and March 2015. All surgical operations were performed by the same surgical team specialized in hepatobiliary and pancreatic oncology surgery.

The study was approved by the Scientific Committee of the Oncological Hospital where it was conducted (approval number 4051/448) and the Ethical Committee of Department of Nursing of the National and Kapodistrian University of Athens, Greece (approval number 87). Moreover, the trial was registered in clinicaltrials.gov (Registration Number NCT02524925). A written informed consent was provided, ensuring full respect of patients' confidentiality of information throughout the study. Patients maintained their right to withdraw at any time of the study and data were kept by the researcher.

All included participants were oncological patients eligible for surgical treatment and underwent pancreatoduodenectomy or hepatectomy. Patients aged 30 to 92 years with an American Society of Anesthesiologists (Physical Status classification system) I-III[13] were included in the study. The presence of chronic pain, kidney disease, neuropathy, and systemic or chronic treatment with analgesics were all criteria of exclusion because of possible interference with pain physiological mechanisms. Demographic data such as gender and age were recorded, as well as body height, body weight, and body mass index (BMI).

All scales were completed on the day of the surgery and 6 hours after the surgery. VAS 0 to 10 was used to evaluate pain levels on the day of surgery, specifically 6 hours after the operation. Operationally, VAS is a horizontal line, usually 10 cm in length, anchored by word descriptors at each end. For pain severity, the scale is most frequently ranged between "no pain" (score of 0) and "pain as bad as it could be" (score of 10).[14]

Furthermore, on the day of operation, pain levels were evaluated by the CPOT.[15] CPOT is an observation scale, which ranges from 0 to 8. For CPOT reliability and validity were $k = 0.52$ to 0.88, with incidence rate ratio ranging from moderate to high.[15]

In addition, on the day of surgery, pain levels were assessed by BPS,[2] which is a behavioral-observation scale and ranges 0 to 1 "no pain," 2 to 4 "aching," 5 to 7 "moderate pain," and 8 to 10 "severe pain." For BPS as determined by standardized Cronbach's $\alpha = 0.89$ with good agreement percentages (80%) reliability and validity ($k = 0.52$ to 1; ICC = 0.80 to 0.93).[9]

The scales, which are observational, were completed by the researcher. The researcher has completed seminars and university lessons on pain assessment and management. Postoperative pain was evaluated by clinical pain assessment tools based on the variation in patients' vital signs and behavioral reactions (CPOT and BPS), recorded by the researcher. The VAS was completed by the patients.

The Greek versions of BPS and CPOT had already been validated in previous studies.[16] In addition, Cronbach's α was calculated. Cronbach's α evaluates the scale reliability and the scale's internal consistency. Values, which are calculated $\alpha > 0.7$, are satisfactory.[17] The Cronbach's α estimation for the CPOT and BPS was $\alpha = 0.738$ in the present study.

Statistical analysis was carried out by SPSS 22 (IMB SPSS Software, Chicago, IL) after conducting Kolmogorov-Smirnov test of normality. Comparisons were made using the χ^2 and Mann-Whitney tests. Correlations were made using Spearman's ρ test. The data are expressed as the mean $\pm$ SD, at a significance level .05.

Findings

Demographic and Anthropometric Baseline Data

Of a total of 203 patients assessed against eligibility criteria, 173 patients who underwent pancreatectomy or hepatectomy were accepted to participate and included in the study (96 males and 77 females). The demographic data of the two groups are shown in Table 1, as well as age, gender, BMI, type of surgery, and pain level rates. The patients who received analgesics are shown in Table 2.

Bi-variate Correlation Between Pain Levels and Demographic Data

A positive correlation was observed between the scales CPOT and BPS ($\rho = 0.796$, $P < .001$), whereas the VAS was positively correlated with CPOT and BPS ($\rho = 0.351$, $P < .001$ and $\rho = 0.352$, $P < .001$, respectively; Table 3). Higher pain scores in CPOT and BPS correlated with higher pain scores with the VAS. As well, higher scores in CPOT correlated with higher scores in BPS.

Patients' age was negatively correlated with the three pain scales CPOT, BPS, and VAS ($\rho = -0.25$, $P = .001$; $\rho = -0.29$, $P < .001$; and $\rho = -0.17$, $P = .019$, respectively), whereas BMI and gender were not correlated with the pain scales ($P > .05$), at a significant level .01. Higher pain scores were observed in younger patients ($\rho = -0.17$, $P = .019$).

Discussion

The present study observes and evaluates pain intensity of patients who underwent either hepatectomy or pancreatectomy. It was a prospective study with cross correlations. The study focused on the assessment of pain levels, as well as the most objective assessment of pain by nurses, after major abdominal surgery, using specialized tools. The benefit from this study reflects a better assessment of pain by using more objective tools. The results of this study showed that the perception of pain, which was estimated with pain scales CPOT, BPS, and VAS, between oncology patients and nurses was positively correlated.

Table 1. Demographic Data of Patients

Age, mean (SD)	62.27 (11.51)
Gender (N)	
Male	96
Female	77
BMI, mean (SD)	27.13 (4.57)
Body height (cm)	169.04 (9.18)
Body weight (kg)	77.65 (14.91)
Kind of surgery	
Hepatectomy (N)	88
Pancreatectomy (N)	85
Pain scale	
BPS scale, mean (SD)	2.03 (1.85)
CPOT scale, mean (SD)	1.76 (1.37)
VAS scale, mean (SD)	5.97 (3.04)

BMI, body mass index; BPS, behavioral pain scale; CPOT, critical-care pain observation tool; VAS, visual analog scale.

Initially, the CPOT and BPS were used by nurses to objectively assess pain through clinical and behavioral findings and VAS to subjectively assess the patient's pain, showing moderate correlation in patients who underwent major abdominal surgery. Similarly, in the international study of Severgnini et al[10] where patients underwent craniotomy and were hospitalized in an intensive care unit, pain scales correlated positively with each other (BPS $r = 0.56$, $P < .0001$; CPOT $r = 0.48$, $P < .0001$).

Meanwhile, the study of Ahlers et al[11] evaluated pain intensity in intensive care unit–treated patients with the pain scales NRS, BPS, and VAS. A high correlation between the NRS and VAS ($r = 0.84$, $P < .001$) was observed in responsive patients. However, high patient pain levels as scored by patients (NRS greater than or equal to 4) were underestimated by nurses.

Table 2. Analgesics Administrated to Patients

No Analgesia	8
Morphine	23
Pethidine	15
Paracetamol (IV)	16
Epidural analgesia	7
Pethidine-paracetamol (IV)	41
Morphine-paracetamol (IV)	5
Propoxyphene-paracetamol (IV)	19
Propoxyphene-parecoxibe	1
Parecoxibe	1

IV, intravenous.

Furthermore, in the present study, the age of the patients was negatively correlated with all pain scales. Young patients particularly experienced higher pain levels than the elderly. Similar results were seen by Petrini et al,[18] they observed that the elderly patients had lower levels of pain compared with younger patients.

An additional finding in our study was that the patients' BMI was not correlated with the pain levels experienced by patients ($P > .05$), which is a result consistent with international studies.[19,20] Sangha et al[19] showed that BMI did not interact with pain levels in patients after hysterectomy, neither on the day of surgery nor in the follow-up 3 months after surgery (odds ratio = 1, 0, 95% confidence interval of 0.97 to 1.03, $P = .88$ for 1 BMI growth unit).

The pain scales' good response of the severely ill patients at the postoperative care level after major abdominal surgery, resulting in improved nurses' ability to assess pain levels more objectively is important.[11,18]

Study Limitations

The results of this study cannot be generalized for the entire population of oncological patients who undergo pancreatectomy or hepatectomy because the participants of the present study were all recruited from one single center.

Implication for Nursing Education, Practice, and Research

Future research could attempt to find associations between pain scales and other indexes easily assessed in blood serum such as hormones, neuropeptides, or inflammatory biomarkers. This would allow clinicians to provide better hospitalized conditions to the patients who they evaluate and who could not verbally communicate.

Conclusions

The experience of "suffering" is shaped by each individual in a particular way. The perception of pain, as well as the culture and the values of

Table 3. Bi-variate Correlation Between Pain Levels and Demographic Data

Spearman ρ	CPOT	BPS	VAS
CPOT		ρ = 0.796, ***P* < .001**	
VAS	ρ = 0.351, ***P* < .001**	ρ = 0.352, ***P* < .001**	
Age	ρ = −0.25, ***P* = .001**	ρ = −0.29, ***P* < .001**	ρ = −0.17, ***P* = .019**
BMI	ρ = 0.18, *P* = .87	ρ = −0.001, *P* = .99	ρ = −0.05, *P* = .48
Gender	ρ = −0.082, *P* = .28	ρ = −.021, *P* = .78	ρ = 0.039, *P* = .6

BMI, body mass index; BPS, behavioral pain scale; CPOT, critical-care pain observation tool; VAS, visual analog scale. Bold treatment indicates statistical significance at *P*=.05.

patients and nurses, could influence the evaluation of pain levels.[21] The effort of health care professionals to objectify pain has led to the development of pain scales that allows the rating of pain intensity and its best assessment.[22]

Postoperative patients' pain management after major abdominal surgery requires a clinically critical nursing care plan, so as to achieve the appropriate analgesic medication administration or alternative methods to reduce or suppress the pain.

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