Determination of Clinically Meaningful Levels of Pain Reduction in Patients Experiencing Acute Postoperative Pain

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ABSTRACT

Assessment is an essential, but challenging, component of any pain management plan. Nurses who care for postoperative patients quantify and document pain by use of unidimensional scales such as the numeric rating scale, the visual analogue scale, or a verbal descriptor scale. Improvements in pain ratings on these scales are viewed as a welcome result by nurses and doctors. Pain, however, is a multidimensional phenomenon. Furthermore, pain is subjective, and therefore no objective measure of pain exists that captures every aspect of the pain experience. Given that clinical decisions are made on the basis of existing scales, it is important to know how much reduction in pain is clinically meaningful from the patient’s perspective. The aim of this study was to investigate this issue by comparing levels of postsurgical pain reduction measured by a numeric rating scale (NRS) with the patients’ verbal descriptions of how meaningful they consider their pain reduction to be. A convenience sample of 150 postoperative patients was obtained. The patients’ postoperative pain intensity levels before and after analgesia were measured and compared with their verbal descriptions of what constitutes a clinically meaningful pain reduction. The results of the study showed a significant correlation between the percentage of reduction in pain severity and the patients’ descriptive ratings of pain improvement. A more accurate predictor was found by converting the changes on the NRS to percentages. An important implication of this study is the need to include a scale in pain assessment instruments for assessing the level of clinical meaningfulness of pain reduction from the patient’s perspective.

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Acute pain after surgery is a universal phenomenon and results from the insult caused by surgery to the nociceptors at the operative site (Carr & Goudas, 1999). The clinical management of postoperative pain necessitates careful assessment (Ravaud et al., 2004). The ongoing task of monitoring and assessment of the postsurgical patient’s pain falls on the nursing staff. Accuracy in pain assessment is important to apply appropriate treatment and adequate relief of pain and suffering (McCaffery & Pasero, 1999; Schafheutle, Cantrill & Noyce, 2001). Such is the importance of pain assessment that pain is now regarded by health care professionals as the fifth vital sign (Merboth & Barnason, 2000). In many hospitals and clinics, a pain care professionals as the fifth vital sign (Merboth & Barnason, 2000). In many hospitals and clinics, a pain intensity scale is included on the nursing observation charts.

Postoperative pain assessment most commonly involves the determination of pain intensity by the patient through the use of a unidimensional scale such as the numeric rating scale (NRS), the visual analogue scale (VAS), or a verbal rating scale (VRS) (Coll, Ameen, & Mead, 2004). Pain, however, is multidimensional and involves sensory-discriminatory, motivational-affective, and cognitive-evaluative processes (Melzack & Wall, 1965). Therefore, measurements of pain intensity alone may not give a true picture of what the patient is experiencing. Observed reductions in pain intensity may suggest to the nurses that the patient is experiencing less pain, whereas such nurse-perceived improvements may be of no meaningful significance from the patient’s perspective. Nevertheless, the use of unidimensional pain assessment scales will probably remain the main tools for assessing pain because of their ease of administration (Aubrun, Paqueron, Langeron, Coriat, & Riou, 2003).

Several studies have attempted to determine how much change in pain levels constitutes a clinically significant change. A study by Todd and Funk (1996) compared physician-assigned VAS pain scores with the patients’ reports of improvement. They found that a reduction of 18 mm on a 100-mm VAS correlated with the patients’ reports of feeling “a little bit better.” However, using physicians to assign the pain scores is problematic because it has been shown in numerous studies that both doctors and nurses tend to underestimate patients’ pain (Grossman, Sheidler, Swedeen, Mucenski, & Piantadosi, 1991; Sloman, Rosen, Rom, & Shir, 2005).

A study by Farrar, Portenoy, Berlin, Kinman, and Strom (2000), on cancer-related breakthrough pain, attempted to determine clinically important differences in pain outcome measures by examining how much pain relief is required to forgo additional rescue analgesic treatment for episodes of breakthrough pain. Their methods were to compare the cutoff point for pain reduction on various scales whereby no further analgesia would be required. A 33% reduction on percentage based scales was found to be the best cutoff point.

Farrar, Young, LaMoreaux, Werth, and Poole (2001) compared chronic pain scores on an 11-point pain intensity NRS with a 7-point patient global impression of change scale. They reported that an average reduction in pain intensity of 2 points on the NRS is clinically significant.

Cepeda, Aficano, Polo, Alcala, and Carr (2003) investigated pain reduction in ambulatory patients with acute postoperative pain using repeated measurements every 10 minutes on an NRS and a VRS during titration of intravenous analgesia that was stopped when pain intensity was reduced to 4/10 on the NRS. They found that the relationship between the two scales depended on the baseline pain intensity level. Patients with moderate pain required a 20.1% reduction to achieve minimal improvement, 34.7% for much improvement, and 45% for very much improvement.

A study by Forouzanfar, Weber, Kessler, and van Kleef (2003) investigated the degree of pain reduction that can be defined as “successful” in patients with complex regional pain syndrome type 1. Patients rated their pain on a VAS before treatment and again at 6 months, 1 year, and 2 years after treatment. At the same time periods they rated their pain reduction on a Global Perceived Effect scale. They found that patients reported their treatment as “successful” when there was a relative pain reduction of 50% or more and an absolute pain reduction of at least 3 cm on the VAS.

Some studies have used “expert opinion” as an approach to identifying levels of clinically significant improvement (van Walraven, Mahon, Moher, Bohm, & Laupacis, 1999). This approach may be useful when dealing with a specific clinical condition, such as asthma, in which symptoms can be more objectively observed. However, it is axiomatic to say that pain is a highly personal and subjective experience, meaning that only the patient can be relied on to accurately indicate his or her pain levels. A golden dictum in nursing is that “pain is whatever the experiencing person says it is, existing whenever he says it does” (McCaffery, 1968).

The ideal for which the nurse should strive is to reduce patients’ postoperative pain to optimal levels for maximizing their functional capacity, and for patients to perceive that they are receiving attentive analgesic care. When this is not possible, any reduction in pain intensity is a welcome outcome. It would therefore be useful to know how much reduction in pain intensity on the NRS or VAS correlates with the patient’s perception of a meaningful reduction.

The present study compared the amount of reduction in pain intensity on the NRS with the patient’s choice of words on a VRS describing pain reduction in
clinically meaningful terms. Patients’ satisfaction with their pain reduction was also compared with the post-treatment results on the above scales (Table 1).

**THE STUDY**

**Aim**
The aim of the study was to determine what constitutes a clinically meaningful reduction in postsurgical pain levels on the NRS.

**Research Question**
How do patients’ descriptive ratings of postsurgical pain reduction compare with their numeric ratings of pain intensity and their satisfaction with the level of pain relief?

**Study Design**
A one-group pretest–posttest design was used to investigate postsurgical patients’ perceptions of meaningfulness in pain reduction after intervention with analgesic medication. A pilot study of 20 subjects showed that the instruments for data collection and the procedure described below were appropriate for the purpose of this study. That is, the instruments were comprehensible to patients and easily administered. The data collection procedure was uncomplicated and involved only a few minutes.

**Sample and Setting**
A convenience sample of 150 adult patients with acute postoperative pain was obtained from surgical wards within a large teaching hospital in Jerusalem, Israel.

According to Cohen (1988), to perform an analysis of variance between three sets of data (responses on the three scales) one would require a minimum of 53 responses for each set of data to achieve a power of 0.8 at an alpha level of 0.05 and a medium effect size of 0.06. A sample size of 150 subjects was adequate to meet these criteria.

**Data Collection**
Data were collected by three registered nurses experienced in pain management. To ensure consistency between the data collectors in administering the instruments, a pilot study of 12 patients was conducted. Following this, the researchers met and uniformity in the data collection procedure was established. The following instruments were used to collect the data: (1) NRS for pain severity (NRS-P), (2) VRS for the amount of perceived relief in pain levels (VRS-PR), and (3) NRS of satisfaction with the level of pain relief (NRS-S). These instruments are depicted in Table 1.

Demographic data and personal background information relating to culture, ethnicity, religion, and language were also collected by questionnaire as a statistical control in the event that these operate as extraneous variables.

**Procedure**
Within 48 hours after surgery, patients who were receiving medication for pain were approached by one of the nurse pain specialists who explained the purpose of the study. Each patient participating in the study completed a demographic/cultural questionnaire. Patients were then asked to rank their level of pain severity on the NRS-P immediately before a nurse administering a scheduled analgesic medication for pain. Approximately 1 hour after receiving the analgesia, the patient was asked to again fill in the NRS-P along with the additional measurements of the patients’ perceptions of how much pain relief they had obtained (VRS-PR) and how satisfied they were with their level of pain relief (VAS-S).

**Ethical Considerations**
The study was approved by the hospital ethics committee. Approval was also obtained from the charge nurses of the various wards. The purpose and methods of the study were explained to all participants. It was made clear to patients that they were under no obligation to participate in the study. All participants gave informed consent, and anonymity was maintained.
Data Analysis
Both descriptive and statistical analyses were performed with the Statistical Package for the Social Sciences 11.0 for Windows (SPSS Inc., Chicago, IL). Statistical analysis involved (1) Pearson correlations for pain reduction scores on the NRS-P, VRS-PR, and NRS-S; (2) analysis of variance to compare the average percentage of reduction between categories on the VRS-PR; and (3) multivariate analysis to check for effects of biographic and cultural data.

RESULTS
Description of Participants
The sample characteristics are presented in Table 2.

Relationship Between NRS-P and VRS-PR
The attempt to relate the patients’ rankings on the VRS-PR to corresponding changes in the pretest and posttest scores on the NRS-P proved to be futile. The reason being that a reduction of, for example, 2 points on the NRS-P may have high clinical relevance for someone with mild pain but be of little or no relevance to someone with severe pain (Cepeda et al., 2003). The scores for pain reduction, that is, the pretest–posttest differences on the NRS-P, were therefore converted to percentages of pain reduction. For instance, a pretest pain severity score of 8 that was reduced to a score of 4 on posttest amounted to a reduction of 50%.

There was a significant correlation between the percentage of improvement in pain severity on the NRS-P and the patients’ ratings of descriptive categories of pain improvement on the VRS-PR \( r = 0.709, p < .000 \). Satisfaction with the level of improvement for pain on the NRS-S was positively correlated with the descriptive ratings of pain improvement on the VRS-PR \( r = 0.592, p < .01 \) and with percentage of improvement \( r = 0.503, p < .01 \).

Figure 1 shows a graph of the pretest–posttest differences in pain severity and the average degree of improvement expressed in percentage terms for each descriptive category of pain reduction. The graph shows that patients who ranked their level of pain reduction as “minimal” had an average of 35% reduction on the NRS-P. There was a 67% reduction for “moderate,” 70% reduction for “much,” and 93% reduction for “complete.” A one-way analysis of variance showed that there was a strong significant difference between the mean values for the percentage of pain reduction for these categories \( F = 9.294 < 0.000 \). The averages and standard deviations for the data are presented in Table 3.

Figure 2 shows the distribution of responses on the VRS-PR. It shows that the data are slightly skewed to the right with the majority of subjects indicating that their treatment had provided them with “much relief” from pain.

A multivariate analysis showed no significant effects for demographic or cultural variables such as gender, age, religion, educational level, or ethnicity.

DISCUSSION
Study Limitations
The selection of subjects was limited to a convenience sample drawn from only one hospital. The data were collected on busy surgical wards, and the patients were not always able to complete the questionnaires without interruptions from nurses and doctors. Seven patients had a poor understanding of both Hebrew and English, thus necessitating explanations from the researcher. In such cases there was always the possibility of inadvertently biasing the patient’s response, although every effort was made to avoid this.

Determining Clinically Meaningful Pain Reduction
The principle objective of this study was to check the relationship between postsurgical pain reduction as mea-
sured by the NRS-P and the degree of meaningfulness from the patient’s perspective. Meaningfulness was measured by the patient's ratings of verbal categories describing the amount of pain reduction.

Although there was a positive correlation between pain reduction scores on the NRS-P and meaningfulness, it became apparent on analysis of results that one cannot directly determine how clinically meaningful changes are in pain levels as measured by the NRS-P by comparing them with ratings on the VRS-PR. This is because the NRS-P is a scale with discrete numeric divisions of 10 points ranging from 0 to 10. Thus, an improvement score on this scale will have different clinical relevance depending on the level of pain before treatment with analgesia. If the patient had a high level of pain that was reduced by only 3 points on the scale after treatment, this may be perceived by the patient to be of little or even no significance. However, a patient with a moderate to low level of initial pain would perceive a reduction of 3 points to be of great relief. Therefore, a nurse would be unable to accurately determine how clinically meaningful a patient’s pain reduction is by reading straight from an NRS-P. Furthermore, the NRS-P only measures one dimension of pain, whereas scales that involve descriptive categories can encompass a wider perspective of the pain experience. Because pain is a subjective experience, any attempt to quantify it will not capture the full experience. The same applies when trying to quantify the clinical meaningfulness of pain relief.

In an attempt to overcome the problem described above, the pretreatment and posttreatment scores of the NRS-P were converted into percentage of improvement. For example, a patient with an initial pain score of 2 and a posttreatment score of 0 (a 2-point reduction) had a 100% improvement, whereas a patient with an initial score of 10 and a posttreatment score of 8 (also a 2-point

**TABLE 3.** Averages and Standard Deviations for the Variables Measured When Grouped According to the Levels of Pain Relief on the VRS-PR

<table>
<thead>
<tr>
<th>Levels of Pain Relief on the VRS-PR</th>
<th>Pretest Pain Levels on the NRS-P (0-10)</th>
<th>Posttest Pain Levels on the NRS-P (0-10)</th>
<th>Percentage of Pain Relief (0-100)</th>
<th>Satisfaction with Pain Relief (0-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal</td>
<td>6.00 (2.67)</td>
<td>4.21 (2.72)</td>
<td>35.87 (28.42)</td>
<td>4.29 (2.2)</td>
</tr>
<tr>
<td>Moderate</td>
<td>7.68 (2.37)</td>
<td>3.84 (2.06)</td>
<td>67.00 (19.22)</td>
<td>6.81 (1.79)</td>
</tr>
<tr>
<td>Much</td>
<td>7.03 (2.5)</td>
<td>2.08 (1.2)</td>
<td>70.08 (12.23)</td>
<td>7.92 (1.53)</td>
</tr>
<tr>
<td>Complete</td>
<td>5.47 (2.34)</td>
<td>0.42 (0.77)</td>
<td>93.84 (10.93)</td>
<td>8.97 (1.67)</td>
</tr>
</tbody>
</table>

VRS-PR, Verbal rating scale for the amount of perceived relief; NRS-P, numeric rating scale for pain severity.
reduction) has only a 20% improvement. Thus, converting the scores to percentages gave a much more realistic picture of the extent of pain reduction.

The percentage of improvement values were compared with their respective ratings on the VRS-PR, and a clearer picture emerged. The results suggested that for patients to experience “much improvement” they would need to have at least 70% reduction in pain. More than 90% reduction is required before patients will consider the pain relief to be “complete.” Pain reduction of less than 30% is certainly perceived as “minimal.”

CONCLUSIONS

It is important for nurses to ask patients to describe their pain and pain relief in their own words because this will certainly give a more accurate picture of the patients’ pain experiences in terms that are clinically meaningful to the patient. Asking the patient to rank pain on a scale of 0 to 10 may have value for documentation when charted in the nursing notes, but such a procedure does not convey an accurate picture of how clinically meaningful the level of pain relief was from the patient’s perspective. It does, however, show the direction and extent of change in pain severity.

Words are better than numbers when dealing with abstract concepts. Because of the multidimensional and subjective nature of pain, it presents a challenge to meaningfully quantify levels of pain reduction. Nurses would be better advised to ask patients to describe their pain and pain reduction in their own terms. This would be in concordance with the McCaffery (1968) definition of pain, namely, “pain is whatever the experiencing person says it is, existing whenever he says it does.” The final conclusion from a clinical perspective is that nurses should aim to achieve optimal pain relief in terms that are clinically meaningful to the patient.

Further research is needed to develop more comprehensive, multidimensional pain assessment instruments that are easy to administer. These instruments would need to include a patient-generated assessment of levels of clinically meaningful pain reduction. Such a component would provide an important perspective to strategies for quality pain management.

REFERENCES


