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ORIGINAL ARTICLE

An observational study of agreement between percentage pain reduction calculated from visual analog or numerical rating scales versus that reported by parturients during labor epidural analgesia

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ABSTRACT

Background: This study aimed to determine the level of agreement between calculated percentage pain reduction, derived from visual analog or numerical rating scales, and patient-reported percentage pain reduction in patients having labor epidural analgesia.

Methods: In a prospective observational study, parturients were asked to rate their pain intensity on a visual analog scale and numerical rating scale, before and 30 min after initiation of epidural analgesia. The percentage pain reduction 30 min after epidural analgesia was calculated by the formula: 100 × (score before epidural analgesia − score 30 min after epidural analgesia)/score before epidural analgesia. To evaluate agreement between calculated percentage pain reduction and patient-reported percentage pain reduction, we computed the concordance correlation coefficient and performed Bland-Altman analysis.

Results: Ninety-seven women in labor were enrolled in the study, most of whom were nulliparous, with a singleton fetus and in spontaneous labor. The concordance correlation coefficient with patient-reported percentage pain reduction was 0.76 (95% CI 0.6 to 0.8) and 0.77 (95% CI 0.6 to 0.8) for the visual analog and numerical rating scale, respectively. The Bland-Altman mean difference between calculated percentage pain reduction and patient-reported percentage pain reduction for the visual analog and numerical rating scales were −2.0% (limits of agreement at 29.8%) and 0 (limits of agreement at 28.2%), respectively.

Conclusion: The agreement between calculated percentage pain reduction from a visual analog or numerical rating scale and patient-reported percentage pain reduction in the context of labor epidural analgesia was moderate. The difference could range up to 30%. Patient-reported percentage pain reduction has advantages as a measurement tool for assessing pain management for childbirth but differences compared with other assessment methods should be taken into account.

Keywords: Labor pain; Epidural analgesia; Pain scales; Concordance correlation coefficient

Introduction

In clinical practice, intensity is the most commonly evaluated dimension of the experience of pain. Self-assessment scales such as the visual analog scale (VAS), graduated from 0 (no pain) to 10 cm or 100 mm (worst pain imaginable) and the numerical rating scale (NRS), graduated from 0 to 10, which can be administered in both written and verbal forms, are the most widely used to measure pain intensity.[1,2]

Percentage pain reduction has been used in different contexts to evaluate or compare the effectiveness of analgesics,[3] and is obtained directly by questioning patients. However, information on the intensity of pain and level of relief after treatment is usually collected using VAS or NRS.[3–5] These scores must be transformed mathematically to derive the percentage of pain reduction (100 times the difference between pre- and post-treatment pain intensity, divided by pre-treatment pain intensity). In the context of acute pain, mainly postoperative, and chronic pain, a good correlation

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has been reported between calculated percentage pain reduction (CPPR) and patient-reported percentage pain reduction (PRPPR).[4,6] Cepeda et al. found a good correlation between the NRS and the direct estimate by the patient in a population of 430 patients with acute or cancer pain.[6]

Currently, of all methods for managing the pain of childbirth, epidural analgesia (EA) is considered the most effective.[7] To date there have been no studies evaluating the correlation between CPPR and PRPPR after initiation of EA in labor. Therefore, our main objectives were to determine the level of agreement between these two measurements and to determine whether CPPR, from VAS or NRS, and PRPPR could be interchangeable and thus suitable for use in clinical practice or in the context of obstetric research. Secondary objectives were to verify the correlation and level of agreement between VAS and NRS for evaluation of obstetric pain and to determine which scale was preferred by women in labor.

Methods

This was a prospective observational study conducted between February and September 2015 in a category III maternity unit. The study was approved by the ethics committee of the Hôpitaux Universitaires Paris Nord Val de Seine (HUPNVS), Paris 7 University (IRB 00006477). Women requesting labor EA during business hours on weekdays were recruited in the labor suite after informed consent. Patients were excluded if they were under 18 years of age, had a contraindication to EA, were admitted in an emergency situation or were unable to understand the pain assessment methods.

Parturients were asked to assess their pain on a VAS and NRS at the peak of uterine contractions before and 30 min after initiation of EA. The percentage pain reduction was calculated by the formula: 100 × (score before EA − score 30 min after EA)/score before EA. The VAS was presented as a 10-cm horizontal line, anchored by the verbal descriptors "no pain" and "worst imaginable pain". Participants marked the VAS at a chosen distance from 0 cm to 10 cm to indicate severity of pain. The NRS was a numbered (0–10) scale where the extremities were "no pain" and "worst imaginable pain". Participants circled a specific number to indicate their level of pain. We chose a written form of NRS in order to have as few interactions as possible in the self-assessment of parturients by the verbalization of a question. The two scales were presented on different documents.

To determine PRPPR, 30 min after initiation of EA, parturients were asked the following question: "*What is your estimate of the percentage reduction of pain intensity between pre-epidural and now?*" In addition, we collected information on demographic and obstetric characteristics: age, body mass index (BMI), gestational age, parity, singleton or multiple pregnancy, fetal presentation, spontaneous, directed or induced labor, and cervical dilation at the initiation of EA. Finally, women in labor were asked which pain assessment scale they preferred out of three possible responses: VAS, NRS or either scale.

Induction and maintenance of EA were managed according to institutional clinical protocols, with no modifications required by the study protocol. An initial 12-mL dose of 0.0625% levobupivacaine plus sufentanil 0.4 μg/mL and clonidine 1.4 μg/mL was given over 10 min. This was followed by patient-controlled epidural analgesia (PCEA) using the same solution. The PCEA pump was programmed to deliver 5-mL boluses with a lockout interval of 10 min, a continuous infusion of 3–5 mL/h and a maximum dose of 35 mL/h.

Statistical analysis

Data analysis was performed with R version 3.2.1 (R Foundation for Statistical Computing, Vienna, Austria). Sample size was determined for precision of 95% confidence intervals (CI) around the estimated correlation coefficient. The sample size required to obtain 95% CI of approximately 15% (upper limit minus lower limit) was 97 subjects overall, if the true correlation coefficient was 80%. Results are expressed as median [interquartile range (IQR)] or number (percentage), unless otherwise stated. The agreement between two quantitative responses was analyzed on a Bland-Altman plot and bias (mean difference) ± standard deviation (SD) was calculated.[8] Agreement between the two responses was evaluated using the concordance correlation coefficient (CCC) (with 95% CI) as elaborated by Lin.[9] The CCC can vary from −1 to 1, with a value close to 1 indicating perfect agreement between the two responses. A scatter plot of the two responses was also constructed, with the linear regression line that best fitted the data. The percentage pain reduction 30 min after EA evaluated by PRPPR and CPPR (using either VAS or NRS) was compared using the Kruskal-Wallis test.

Results

Ninety-seven women in labor were enrolled. Their demographic and obstetric characteristics are presented in Table 1. Epidural analgesia was initiated in early labor at a median cervical dilation of 3 [2–4] cm. Pain scores at initiation of EA were 7 [6.5–8.5] and 8 [7–9] for VAS and NRS, respectively (P=0.09). Thirty minutes after EA, pain scores were 1 [0–2] and 1 [0–2] for VAS and NRS, respectively (P=0.16). The percentage pain reduction 30 min after EA was 79 ± 21.5, 82 ± 21.8, and 80 ± 21.2 for PRPPR and for CPPR from VAS and NRS, respectively (P=0.43).

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