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Parent visual analogue scale ratings of children's pain do not reliably reflect pain reported by child

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Objectives: **To determine whether parent and child visual analogue scale (VAS) scores for the pain associated with acute conditions in the child agree sufficiently for these methods of measurement to be considered interchangeable in pain and analgesia research.**

Design: **This was a prospective, two-group, repeated measures, blinded study in an urban pediatric emergency department. Children aged 8 to 15 years seeking treatment for painful conditions and the parents of these children were asked to rate the child's pain independently using a VAS on as many as four occasions at 20-minute intervals. Both participants were blinded to their previous rating and the rating of the other participant. The main outcome measure was the correlation of child and parent VAS pain scores by Pearson correlation and bias plot (Bland-Altman) analysis of agreement between tests.**

Results: **Seventy-eight child-parent sets participated, yielding 289 VAS pain score comparison pairs for evaluation. The correlation between child and parent VAS pain scores was 0.63 (95% CI, 0.56–0.70). Bias plot analysis revealed a bias of 5% and 95% limits of agreement from −38 to +47 mm. The degree of difference between child and parent scores was variable, but there was an increasing tendency for parents to underestimate the child's pain when the child recorded VAS pain scores at the higher end of the scale.**

Conclusions: **Parents' VAS score ratings of their children's pain correlate only moderately with the children's VAS pain scores and show poor levels of agreement. The difference between the measures is variable and appears to be more marked when the child reports a higher VAS score. This research raises doubt about whether parental rating of a child's pain is an appropriate surrogate marker in pediatric pain and analgesia research.**

INTRODUCTION

Pain must be recognized and accurately quantified before it can be treated effectively. In research with one treatment compared with another, the accurate quantification of pain is essential for valid results. In adults, the gold standard tool for the quantification of pain is the visual analogue scale (VAS) (1). The VAS is easy to use, its results are reproducible, and it can be applied in a variety of practice settings (1). It is sensitive to treatment effects, and the data derived can usually be analyzed using parametric statistical techniques (2, 3). Although the VAS has also been validated for use with children as young as 8 years (4–6), many studies rely on proxy VAS scores (both as primary and secondary outcome measures) collected from parents, health workers, or other caregivers to quantify pain in children. Although moderate to high degrees of correlation have been shown between parent and child pain ratings (7–17), doubt has been raised about the validity of this approach because of poor kappa statistics (7).

The aim of this study was to determine whether parent and child VAS scores for the pain of acute conditions in the child agreed sufficiently for these methods of measurement to be used interchangeably in pain and analgesia research. To the authors' knowledge, this is the first study to investigate this relationship in the emergency department (ED).

METHODS

Design and Setting. This was a prospective, two-group, repeated measures, blinded study conducted in the Department of Emergency Medicine of Sunshine Hospital, a 200-bed women's and children's hospital in Melbourne, Australia with an annual ED census of 18,000 children.

Study Participants. Participants were children aged 8 to 15 years seeking treatment for painful conditions and the parents of these children. Inclusion criteria included ability to understand the study in English and the provision of informed, written consent by both parent and child. Patients were excluded if there was cognitive or conscious state impairment, such as head injury, intoxication, or mental retardation. Data collection was stopped if children reported a VAS pain score of 0, if they were discharged, or if they or their parents requested that data collection cease.

Study Process. At examination, children and their parents, independently and blinded to the other's assessment, marked the intensity of the child's pain on a 100-mm, nonhatched VAS scale. This process was repeated at 20, 40, and 60 minutes, with both parent and child blinded to the previous mark and each other's mark. Analgesia or other pain management strategies (eg, splinting) were

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administered as directed by the treating clinician and were not delayed by participation in the study. The 20-minute interval between pain measurements was selected because it reflected an interval between pain assessments appropriate for the management of acute pain in children in the ED.

Data Analysis. Correlation analysis was performed by Pearson correlation. Agreement was measured by bias plot analysis (Bland-Altman analysis). Bland and Altman (18, 19) suggest that when assessing two tests, agreement rather than correlation is important. This can be shown visually in a bias (Bland-Altman) graph that plots the difference between the tests against an estimation of the true result of the test (assumed to be the mean of the test results). From this plot, any bias (or constant disagreement) can be estimated and the 95% levels of agreement calculated. Assuming a normal distribution of differences between VAS scores, 95% of the differences will fall within the 95% levels of agreement. If the levels of agreement band are large, there is lack of agreement.

This study was conducted with the approval of the Network Research and Ethics Committee.

RESULTS

Seventy-eight child and parent sets were enrolled in the study. Sixty-two sets were mother and child, and 16 were father and child. The average age of the children involved was 11.9 years (range, 8–15 y; SD, 2 y). Causes of pain were limb trauma (48%), abdominal pain (31%), head or face trauma (8%), medical condition (4%), back trauma (3%), abdominal trauma (3%), and headache (3%). No patients with sickle cell disease were enrolled. Sickle cell disease was not an exclusion criterion; this condition is extremely rare in Australia, where this study was conducted.

A total of 289 VAS score comparison pairs were collected for evaluation. Figure 1 plots child VAS score against the VAS score of the parent at the same time. The correlation between child and parent VAS pain scores was 0.63 (95% CI, 0.56–0.70). Figure 2 shows a bias plot (Bland-Altman type) of the average of the parent's and child's VAS score plotted against the difference between the scores. The bias on this plot is 5 mm, and the 95% limits of agreement are −38 mm to +47 mm around the mean VAS score value. This plot also shows that the difference between parent and child scores is highly variable.

DISCUSSION

In evaluation of analgesic agents and the efficacy of analgesia, the accurate quantification of pain experience is essential if results are to be valid. The gold standard tool in adults is the VAS (1), and the VAS has been validated for use in children as young as 8 years (4–6); however, many studies of pain in children continue to rely on proxy VAS scores collected from parents, health workers, or other caregivers to quantify pain in children.

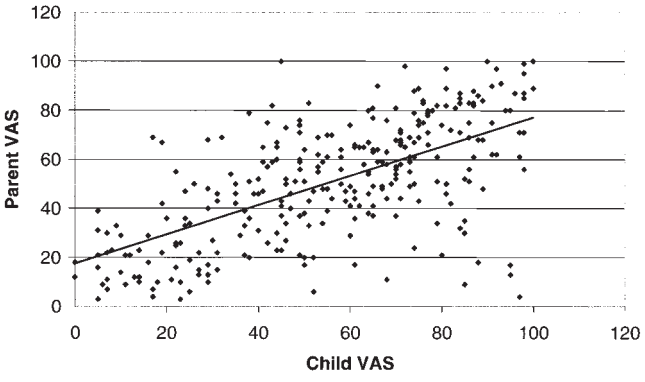

FIG. 1. Comparison of child and parent visual analogue scale scores.

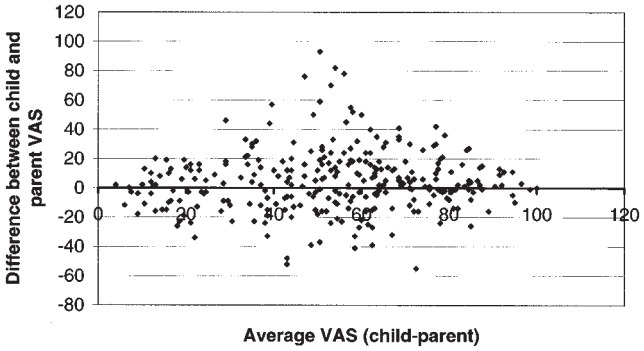

FIG. 2. Bias plot of average of child and parent visual analogue scale scores and the difference between them.

Health care worker assessment of pain experienced by children has been shown to be unreliable compared with child self-report (20, 21). Previous studies have shown moderate to high degrees of correlation between parent and child pain ratings (0.2–0.8) (7–16); however, doubt was raised about the validity of this approach because of poor kappa statistics (7). Chambers et al. (7) have argued that correlation *per se* overestimates the relationship between parent and child pain ratings because high degrees of correlation can be found even when agreement about the magnitude of pain is poor. However, kappa statistics also have limitations. They are used to compare categorical rather than continuous variables, and if the number of categories is high (eg, millimeter bands on a VAS), absolute agreement is unlikely.

Other studies have examined the agreement between parent and child pain ratings using a variety of pain measurement instruments. Chambers et al. (7) used a seven-point Faces Pain Scale and found a highly significant correlation between child and parent pain ratings but poor agreement (kappa 0.18 and 0.32). That study also found that parents consistently underestimated pain compared with a child's self-rating. St-Laurent-Gagnon et al. (22) compared parent and child ratings of the pain of immunization using the McGrath Facial Affective Scale, the Hester Poker Chip Tool, and the Multiple Size Poker Chip Tool. This study found good correlation between parent and child ratings on all instruments ($r = 0.66$–0.76); however, agreement in pain rating was not close, with parents tending to underestimate the intensity of pain on two of the three scales. Doherty et al. (23), investigating the pain of juvenile chronic arthritis using the Childhood Health Assessment Questionnaire, found no correlation between children's and mothers' assessments of pain. Vihunen and Sihvonen (24), using the Faces Scale for pain assessment of children undergoing tonsillectomy, also found good correlation between parent and child ratings of pain ($r = 0.74$) but did not report the degree of agreement.

Although child and parent pain ratings were significantly correlated, the present study confirms the poor agreement between parents' ratings of their children's pain and children's self-report of pain. Correlation is quite different from agreement. Agreement measures how well the actual quantity reported by each rater matches, whereas correlation measures the degree of association between values. Correlation can be very good even when agreement is poor. Because the aim of pain assessment is the quantification of pain, agreement between raters is the most appropriate comparison. The analysis of agreement

between the parent and child pain scores showed a 95% level of agreement band of −38 to +47 mm. This band is unacceptably broad compared with the minimum clinically significant difference in VAS pain score for children of 10 mm (25). Interestingly, there is some overestimation of pain by parents when the child reports a low VAS pain score and underestimation by increasing amounts as the child reports higher VAS pain scores (Fig. 2). This tendency of parents to underestimate significant pain experienced by their children was also found in studies in other clinical settings (7, 17, 22–24). The reasons for this finding are unclear. When considered with previous research (7, 14–17, 22–24), these findings raise doubt about whether parents' estimates of their children's pain are reliable as either a clinical or a research tool in this age group.

The level of disagreement found in this study raises questions about how parents assess children's pain in the setting of acute pain resulting from sudden illness or injury. Previous research has shown that for the assessment of the pain of procedures, a variety of behavioral cues, including facial expression, motor behavior, and verbal cues, are used (26). In the ED, however, other psychologic factors such as anxiety, guilt, and relief may influence parents' VAS ratings. These factors were not investigated in this study, but they are areas for future research.

It could also be argued that accepting the child's report of pain as the gold standard may be flawed, with psychologic factors such as fear and limited experience of pain influencing the VAS score. This possibility is considered in the Bland-Altman analysis, which assumes that the true measure is the mean of the parent's and child's score. Despite this, the 95% limits of agreement are very broad. There are also significant psychologic aspects to adults' ratings of acute pain in the ED, yet adults' ratings are accepted as true. To question children's pain ratings on this basis when a valid instrument has been used seems paternalistic.

The findings of this study have implications for both research and clinical practice in EDs. For research, the findings reinforce the position that parents' ratings of their children's pain are not the most appropriate research tool. As has been accepted for adults, the gold standard for children should be self-report of pain. Future studies of pediatric pain and analgesia should be designed using this gold standard, and studies reported using the parent rating as a surrogate marker should be interpreted with extreme caution. The implications for clinical practice are not so clear. Parents have an important role in the management of their children's pain, proving reassurance and distraction and participating in treatment decisions. Parents also usually know their children well and can detect subtle behavioral changes that may be clinically important, both diagnostically and therapeutically. They should not be excluded from the pain assessment and management process; however, self-report of pain by the child should be the key to pain assessment. When there is a discrepancy between the parent and child about the level of pain experienced, clinicians should favor the child's assessment as more accurate.

Some limitations of this study must be considered in interpreting its results. This study focuses on acute pain in the ED setting; thus, its findings cannot be generalized to chronic pain states or other settings. In addition, the sample is limited to a convenience sample of patients who were able to communicate in English and who sought treatment at a community teaching hospital ED, possibly further reducing the extent to which the study results can be generalized. Patients were not given access to their previous pain ratings. Although it is common practice to blind patients to previous ratings, it has been shown that patients may overestimate their pain if previous ratings are not available (27). There may also be an effect attributable to interpersonal relations between the interviewers and the patient or parent. Finally, not all parent and child groups completed all four planned comparisons. Because there were a number of reasons for not completing all the comparisons, including discharge and transfer to a ward or theater, a systematic bias should not have been introduced.

CONCLUSIONS

Parents' VAS score ratings of their children's pain correlate only moderately with the children's VAS pain score and show poor levels of agreement. The difference between the measures is variable and appears to be more marked when the child reports a higher VAS score. This study raises doubt about whether parents' rating of their children's pain is an appropriate surrogate marker in pediatric pain and analgesia research.

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