Measurement of Pain in the Prehospital Setting Using a Visual Analogue Scale

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Keywords: benchmarking; emergency medical services; emergency medical technicians; pain measurement; prehospital; visual analogue scale

Abbreviations:
ASNSW = Ambulance Service of New South Wales
CI = Confidence Interval
EMS = Emergency Medical Services
PRF = patient report form
T_{end} = hospital of destination
T_0 = initial patient assessment process
VAS = visual analogue scale
VNRS = verbal numeric rating scale

Received: 23 May 2003
Accepted: 03 July 2003
Revised: 08 July 2003
Web publication: 11 June 2004

Abstract

Introduction: The aim of this study was to use a visual analogue scale (VAS) to measure the adequacy of prehospital pain management. Patients reported pain severity at two points in time during treatment and transport by ambulance paramedics. The change in pain score was compared with a benchmark reduction of 20 mm that has been shown to correspond with the minimum clinically significant change in pain perception reported by patients.

Methods: This prospective, observational study used a VAS to record pain severity among patients reporting pain who were transported to a hospital by paramedics. Patients used a VAS to score pain severity during the initial patient assessment process (T_0), and again at the hospital of destination (T_{end}). This study reports the mean changes in the scores, and the percentage of cases for whom the difference between T_0 and T_{end} in the study population achieved or exceeded the 20 mm benchmark. A survey also was administered to paramedics who participated in this study in order to identify attitudes, values, and beliefs relating to the measurement of pain.

Results: A total of 262 patients were enrolled in this study. The mean value for the reduction in VAS (T_0-T_{end}) was 18.2 ±23.9 mm [±SD] (Median = 14.0mm, 95% confidence interval (CI) = 15.3–21.1 mm). One hundred and thirty-four patients (51.1%) did not receive analgesia (either morphine sulfate or methoxyflurane). The mean initial (T_0) pain score for the no-analgesia group was 54.5 ±24.7 mm [±SD], with the mean value for the change in VAS (T_0-T_{end}) = 10.6 mm (median = 5 mm, 95% CI = 6.4-14.8 mm). Forty-six patients (17.6%) recorded some deterioration in their pain score at T_{end} (T_0-T_{end}<0 mm). Survey results identified attitudes that may affect paramedics' pain management practice.

Conclusion: The results suggest that inadequate analgesia is an issue in this study setting. Effective analgesia requires formal protocols or guidelines supported by effective analgesic therapies along with education that addresses attitudes that may inhibit pain assessment or management by paramedics. Regular audits form part of clinical quality assurance programs that assess analgesic practice. However, such audits must have access to data obtained from patient self-reporting of pain using a valid and reliable pain measurement tool.

Lord B, Parsell B: Measurement of pain in the prehospital setting using a visual analogue scale. *Prehosp Disast Med* 2003;18(4):353–358.

Introduction

Pain management is a vital, yet sometimes neglected or inadequately managed, component of the patient-care process. Much of the evidence that confirms this belief arises from the study of analgesia in the hospital

emergency department, postoperative, and palliative care settings.[1–3] Although evidence of the efficacy of pain management practice in the prehospital environment is scant, the available studies suggest that inadequate analgesia also is a problem in this setting.[4–7]

In an effort to develop a foundation and framework for out-of-hospital research, Maio and colleagues undertook a study to determine priority emergency medical services (EMS) research conditions. This identified "discomfort"—which includes pain—as a priority condition for prehospital outcomes research.[8]

Despite the fact that effective pain management relies on the formal assessment of the nature and severity of the patient's pain, several studies have recognized problems associated with accurately assessing pain, and have described cases of inadequate pain relief resulting from difficulties in assessment. Such studies recognize that pain management decisions are affected by difficulties in quantifying and qualifying pain, and by individual beliefs, values and attitudes relating to the use of analgesics.[1]

While it may be difficult to quantify the pain that a patient may be experiencing, an attempt should be made to objectively assess the severity and quality of a patient's pain. It also must be recognized that the patient is best placed to report the severity and quality of the pain they experience.[9] This assessment can examine several dimensions including quality and severity. While some of these multi-dimensional scales may be impractical for use in the prehospital setting, use of a simple, uni-dimensional assessment of severity may provide useful information that may guide treatment decisions. Lee relates evidence suggesting that "formal pain measurement reveals unrecognized or under-treated pain", with the consequence that improved recognition of pain can lead to improved pain management practice.[10]

Australian State and Territory ambulance services, with the exception of the Ambulance Service of New South Wales (ASNSW), include a section for recording pain severity on the patient report form (PRF). This usually is recorded using the verbal, numeric rating scale (VNRS), which requires the paramedic to ask the patient to describe the severity of their pain on a scale from zero to 10, with 10 being most severe and zero representing no pain. The term "paramedic" in this context is used to describe all clinical levels of qualified ambulance officers.

However, the ASNSW does not require paramedics to record pain scores on the PRF. Therefore, the actual use of pain scores by paramedics employed by the ASNSW is unknown. The efficacy of interventions that aim to manage pain instead are reduced to a dichotomous response in the "observations and treatment" section of the PRF, where the response is recorded under the heading "Effective (Y or N)". This evidence of efficacy tends to be based on the paramedics' judgment rather than on patient self-reporting.

While the VNRS is a valid and reliable tool, other types of scoring systems are available that may confer additional benefits in the measurement of pain.[11] Studies that have used a visual analogue scale (VAS) to identify the minimum reduction in pain score needed to achieve a clinically significant change in pain perception have reported differing results. Lee *et al* found that a mean value for pain reduction using a VAS of 29 mm corresponds with patients' perception of adequate pain relief.[12] Research conducted by Todd and Funk indicated that the minimal, clinically important reduction in VAS pain score to be 18 mm.[13] Kelly reported the results of a prospective study of pain measurement in the emergency department, and identified that "a difference in visual analogue scale pain score of less than about 20 mm is unlikely to be clinically meaningful," and recommended that future pain management studies adopt this 20 mm change as the benchmark.[14]

Analgesic	n	(%)
Morphine sulfate	15	5.7
Methoxyflurane	112	42.7
Midazolam	1	0.4
Nil	134	51.1
Total	262	100

Table 1—Drugs administered (n = number)

In order to measure the actual change in pain severity reported by patients in the prehospital setting, this study used a VAS to assess the pain reported by patients at two points in time during treatment and transport by paramedics employed by the ASNSW. The change in pain score was compared with a benchmark reduction of pain severity of 20 mm.

Methods

This prospective, observational study involved the use of a VAS to record pain severity among patients requiring ambulance transport, in which the patients reported pain and the case was classified as an "emergency" or "urgent" call. Ethics approval for this study was granted by the Ethics in Human Research Committee of Charles Sturt University on 08 April 2002 (protocol number 02/029), and by the Central Sydney Area Health Service Ethics Review Committee on 22 April 2002 (protocol number X02-0085).

The study setting was the Sydney region, comprising a population of approximately 3.7 million persons. Prehospital care was provided by the ASNSW. There are 46 ambulance stations servicing this region; however, a convenience sample using four stations was chosen for this study.

Paramedics working from four ambulance stations in the central, northern, western and southwestern areas of Sydney were asked to seek patient consent to record pain severity using a VAS during the initial patient assessment process. This required the treating paramedic to ask the patient to rate the severity of his/her pain by using a simple device that involved the movement of a slider to a point that represented their pain. One end of the scale was marked "no pain" and was associated with a representation of a "happy face". The opposite end of the scale was marked "worst pain ever", and was represented by a "sad face".

The reverse consisted of a 10 cm scale marked in 1 mm increments. After the patient moved the slider, the position of the slider to the nearest millimeter was recorded on the PRF, and the time of first assessment recorded (T_0). The

patient was asked to repeat the process again on arrival at the hospital of destination, with the slider returned to zero before the second assessment was conducted. The position of the slider to the nearest millimeter was again recorded on the patient report form. The time of the second assessment was recorded, and the assessment is reported as T_{end}. Differences in VAS scores were calculated by subtracting the VAS at T_{end} from the VAS at T_0.

Analgesics available for the management of pain were morphine sulfate and methoxyflurane. However, only a relatively small cohort of Advanced Life Support (ALS) or Intensive Care Paramedic officers are authorized to administer morphine sulfate. Intensive Care Paramedic officers may use midazolam to augment morphine sulfate in the treatment of orthopedic injuries.

Any patient aged ≥10 years, where the patient reported pain during the clinical assessment, was eligible for inclusion in this study. Pain scores were to be recorded in all cases where the patient reported pain, even when no analgesic was administered.

Patients were excluded if they met any of the following criteria: (1) Age less than 10 years; (2) An altered level of consciousness that was likely to affect the reliability of the assessment of pain; (3) Known or suspected psychiatric illness that was likely to affect the reliability of the assessment of pain; (4) Language difficulties that may affect the reliability of the assessment of pain; or (5) Patients requiring ventilation or those too breathless to provide an accurate indication of pain severity.

Mean and median values for the differences between T_0 and T_{end} for the cohort are reported. Given that a benchmark VAS reduction of 20 mm has been identified as the minimum clinically significant reduction in pain severity, this study reports the percentage of cases for which the difference between T_0 and T_{end} in the study population achieves or exceeds the benchmark 20 mm reduction in score.

A survey also was administered to each paramedic participating in this study to identify attitudes, values, and beliefs that may influence their measurement of pain. This survey used a five-point Likert scale to record responses to 25 statements.

Results

A total of 262 patients were enrolled in this study during the period of June to November 2002. The mean of the ages of the participants was 52 ±22.7 years (±1 standard deviation), and 49% were male.

Changes in Level of Pain

The mean value of the time differences between T_0 and T_{end} was 16.6 ±0.01 minutes. The mean value for pain severity at T_0 was 66.0 ±25.2 mm and for T_{end} was 47.8 ±26.1 mm. The mean value for T_0-T_{end} was 18.2 ±23.9 mm with the median at 14.0 mm, and a 95% confidence interval (CI) of 15.3–21.1 mm.

The benchmark for pain reduction was ≥20 mm. There were 112 patients (42.7%) that recorded a change of ≥20 mm at T_{end}. One hundred, thirty-four patients (51.1%) did not receive any analgesia. The mean of the initial (T_0) values

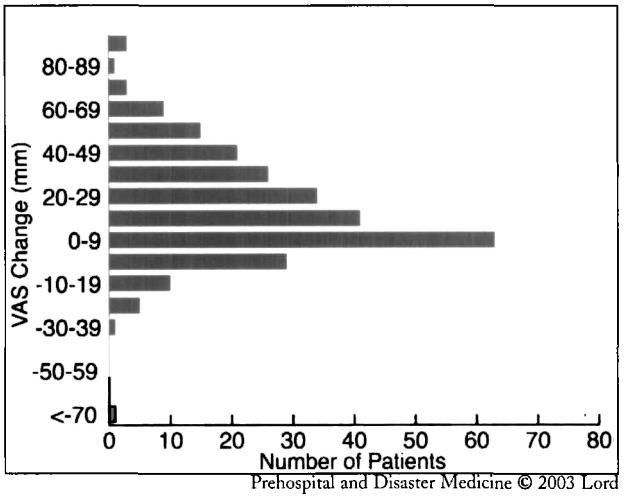

Figure 1—VAS score change

for pain score for the no-analgesia group was 54.5 ±24.7 mm, with the mean value for the changes in VAS (T_0-T_{end}) = 10.6 ±22.0 mm (median = 5 mm, CI = 6.4–14.8 mm). Figure 1 illustrates the frequency and distribution of VAS scores (T_0-T_{end}) for all patients (n = 262). Of the total patients, 39.7% reported no to minimal (0–9 mm) change in VAS. The remainder (55.7%) reported a clinically significant decrease in their pain using the VAS. Thirty-one reported at least a 50% reduction in their level of pain.

Forty-six patients (17.6%) recorded some deterioration in their pain score at T_{end} (T_0-T_{end} <0 mm). Eight of these patients (17.4%) received methoxyflurane. None of the patients who received morphine sulfate reported worsening of their pain. The remaining 38 patients (82.6%) who experienced an increase iun their level of pain did not receive either methoxyflurane or morphine sulfate. Table 1 lists the agents used as analgesics in this study and their frequency of use. Just over 50% (51.1%) did not receive any pain medication; 42.7% received methoxyflurane, and 5.7% receive morphine sulfate. Thus, 71.6% of the patients who did not receive analgesia, reported at least no change or improvement in their level of pain.

Attitudinal Survey

Thirty-five paramedics (36%) returned the attitudinal survey. The attitudinal survey results should be interpreted on the basis that the low return rate represents a small and potentially biased sample, which limits any generalization of trends to the study population. However, the following responses are noteworthy as the stated beliefs may have a significant influence on the assessment and management of pain by paramedics:

Question 4. "The Visual Analogue Scale (VAS) is too cumbersome to use in the prehospital setting." Only eight of the respondents (23%) agreed with this statement; 14 (40%) disagreed, eight (23%) remained neutral, and five did not answer the question (Figure 2).

Question 9. "A numeric rating scale (asking the patient to rate their pain between 1 and 10) is a more useful method of assessing pain." Thirty-one responded to this

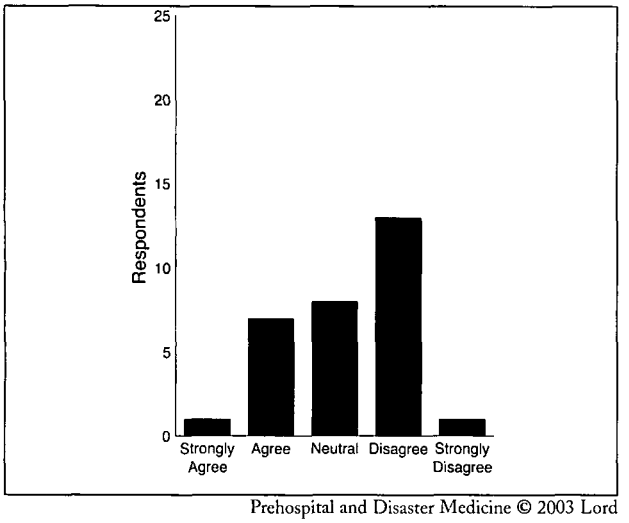

Figure 2—Responses to Question 4

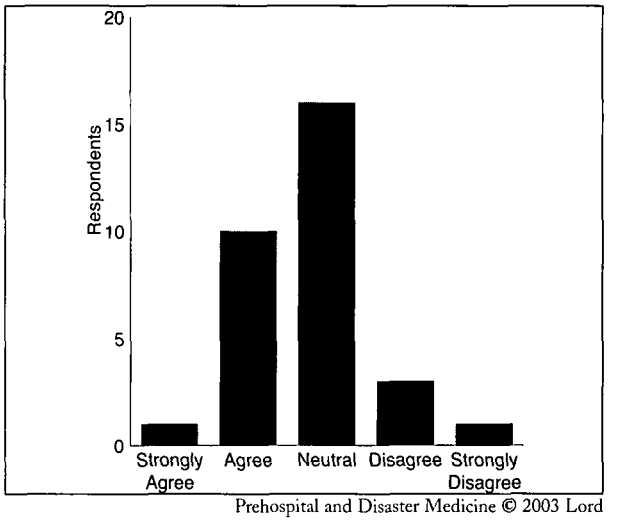

Figure 3—Responses to Question 9

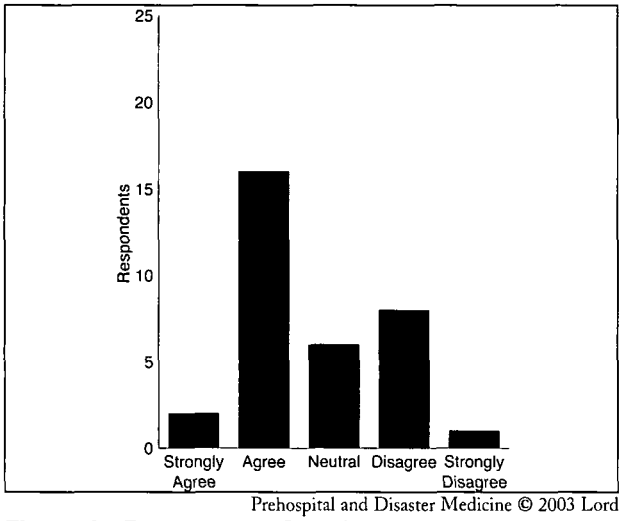

Figure 4—Responses to Question 10

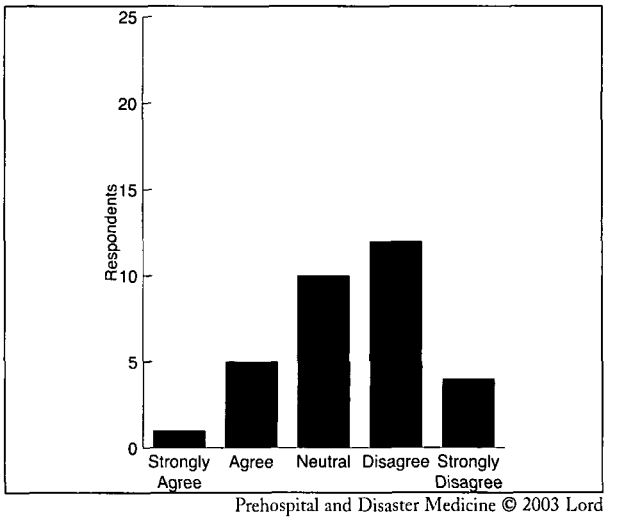

Figure 5—Responses to Question 15

question (Figure 3). Of these, 35% agreed, and 13% disagreed, and the majority remained neutral.

Question 10. "I am able to assess the severity of the patient's pain without the use of a pain scale." Thirty-three responded to the question (Figure 4). One-third agreed and 27% disagreed. Only six (18%) remained neutral.

Question 15. "The VAS encourages patients to overstate their pain." Thirty-two paramedics answered the question of which half disagreed that the scale encourages patients to overstate the severity of their pain (Figure 5). Only six (19%) agreed with the statement.

Several respondents included additional comments. The following seemed particularly important:

Respondent #20. "Human nature would have us exaggerate [sic] our plight and my perception is patients give a higher pain rating on a visual scale versus numeric."

Respondent #35. "We felt embarrassed asking adult patients to use what looked like a child's toy. I have never had problems with the one to 10 scale. You can see that some patients overstate their pain on the one to 10 scale, but I think these same people would overrate their pain using the VAS as well".

Respondent #27. "I believe it is unnecessary. I believe I can assess [a] patient's [sic] level of pain without the VAS. The majority of patients exaggerate their pain."

Respondent #33. "My main concern is that patients, if given a chance, will overstate their pain level. I also don't think that this device has a place in our setting at times."

Discussion

This study analyzed the pain scores obtained by self-assessments by patients using a VAS, as a means of evaluating the effectiveness of pain management in this setting. The study also attempted to identify attitudes that may influence the paramedics' assessment of pain.

Given that only 42.7% of patients reported a change in pain score of ≥20 mm, the results suggest that inadequate analgesia is an issue in the study setting. Of concern is the data arising from the attitudinal survey administered to participating paramedics. Several respondents claimed that patients tend to over-rate the severity of their pain, and that the caregivers are able to use their clinical judgment to assess patients' pain. This is in contrast with contemporary practice, as it is recognized that there is a poor correlation

https://doi.org/10.1017/S1049023X0000131X Published online by Cambridge University Press

between patient and observer assessment of pain severity.[15] Ho *et al* reinforces the fact that "reliance on healthcare worker assessment of patient pain results in underestimation of the intensity of that pain".[16]

Measurement of the severity of pain in this study setting, is not formally required, making it impossible for the organization to assess pain management practice and the efficacy of analgesic agents for the treatment of pain. Although paramedics are familiar with the assessment of pain severity using a VNRS, the actual incidence of its use is unknown. Given that the use of pain measurement tools can help health professionals appreciate the severity of the patients' pain,[15] this study used a VAS to evaluate adequacy of prehospital pain management in a prehospital setting where formal measurement of the severity of pain was not common. The VAS was selected for use in this study on the basis of evidence validating its use in the emergency department.[10,14] There also is evidence that ambulance officers in the United Kingdom have successfully used the VAS for this purpose.[17]

A study of paramedic-administered analgesia involving seven ambulance services in the United Kingdom found that there was no provision for pain scores to be entered on the patient report forms (PRFs). The authors recommend that "means must be made available to permit assessment of the efficacy of prehospital analgesia, which must be included on the patient report form to allow automatic and consistent statistical analysis of this important aspect of clinical effectiveness and patient care."[18]

The practicality of the use of a VAS in the prehospital setting is an important consideration in deciding whether it may have a place in the assessment of pain severity. Eight respondents (26%) agreed or strongly agreed that the VAS is too cumbersome (Figure 2). Anecdotal evidence suggested that the VAS device often was lost or was not easy to locate, particularly during the initial pain assessment when the paramedics may have left the scale in the ambulance.

Responses to the attitudinal survey, which indicate paramedics believe they are able to judge the severity of a patient's pain, have serious implications in the general area of pain management, whether or not any type of pain scale is used. The belief that patients cannot be trusted to give a true indication of their pain is misguided, and probably would benefit from a focused effort to educate paramedics about the effect that their beliefs and attitudes can have on the effective management of pain.

Education that attempts to influence the paramedics' beliefs, values, and attitudes may help to improve pain management practice in the prehospital setting. Ricard-Hibon and colleagues demonstrated that the VAS can be an appropriate pain measurement tool in the out-of-hospital setting, and also showed that appropriate training led to improvements in analgesic practice.[5] However, this study involved emergency physicians in the prehospital setting. While education of paramedics may help to address analgesic practice, there is some doubt about the efficacy of such education.[19] Of critical importance is the prevailing organizational culture regarding pain management, and the mechanisms in place to achieve and maintain appropriate clinical standards for analgesia.

Conclusion

Effective analgesia requires formal protocols or clinical practice guidelines supported by effective analgesic therapies, along with regular audits as part of a clinical quality assurance program. However, such programs rely on reliable and valid data derived from patient self-assessment using a recognized pain measurement tool. If the VAS is not practical for use in the prehospital setting, other measurement tools, such as the VNRS, should be employed regularly to assess the severity of the patient's pain and the response to treatment.

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