

POSITION PAPER

NATIONAL ASSOCIATION OF EMS PHYSICIANS

PREHOSPITAL PAIN MANAGEMENT

Héctor M. Alonso-Serra, MD, MPH, Keith Wesley, MD,
for the National Association of EMS Physicians Standards and Clinical Practices Committee

POSITION STATEMENT

The National Association of EMS Physicians (NAEMSP) believes that the relief of pain and suffering of patients must be a priority for every emergency medical services (EMS) system. Adequate analgesia is an important step in achieving this goal.

NAEMSP believes that every EMS system should have a clinical care protocol to address prehospital pain management. Adequate training and education of prehospital personnel and EMS physicians should support this pain management protocol.

NAEMSP recommends that prehospital pain management protocols should include the following components:

- a. Mandatory assessment of both the presence and severity of pain
- b. Use of reliable tools for the assessment of pain.

Dr. Alonso-Serra is at the Emergency Medicine Unit & Office of Emergency Management, San Juan Veterans Administration Medical Center, San Juan, Puerto Rico; Dr. Wesley is the medical director for Eau Claire County EMS, Eau Claire, Wisconsin, and is at Sacred Heart Hospital.

Approved by the NAEMSP Board of Directors June 1, 2003. Received June 6, 2003; accepted for publication June 6, 2003.

Address correspondence to: National Association of EMS Physicians, P.O. Box 15945-281, Lenexa, KS 66285-5945.

doi:10.1197/S1090-3127(03)00226-0

- c. Indications and contraindications for prehospital pain management.
- d. Non-pharmacologic interventions for pain management.
- e. Pharmacologic interventions for pain management.
- f. Mandatory patient monitoring and documentation before and after analgesic administration.
- g. Transfer of relevant patient care information to receiving medical personnel.
- h. Quality improvement and close medical oversight to ensure appropriate use of pre-hospital pain management.

INTRODUCTION

In the practice of emergency medicine, pain is the most frequent symptom in patients, covering a wide variety of injuries and illnesses.^{1,2} Few EMS texts devote any significant attention to this topic and most EMS systems do not have protocols to treat pain and suffering other than ischemic chest pain.³ However, major organizations such as the Joint Commission on Accreditation of Healthcare Organizations⁴ and the American College of Emergency Physicians⁵ have made recognition and the appropriate treatment of pain a major priority in health care. Yet, in spite of frequent contact with patients who

have a painful condition, multiple investigators have demonstrated that prehospital personnel and emergency physicians fail to recognize and properly treat pain.⁶⁻¹⁶ Wilson and Pendleton, who coined the term "oligoanalgesia," recognized the practice of undertreatment of pain.¹⁷ Since then, several authors have studied different reasons for oligoanalgesia. Both psychological and educational barriers have been described as contributors to the lack of pain relief and consistency of treatment.^{18,19} Assessment and treatment of pain may vary with patients' ethnicity,^{20,21} sex,²²⁻²⁵ and age.²⁶

The challenge of treating pain in the prehospital setting is to use agents and techniques that are not only effective but also safe and do not lead to physiologic compromise, do not cause significant delays in transport to definitive care, or do not interfere with the patient's diagnostic workup following arrival at the emergency department. Research has confirmed that such a program of prehospital analgesia can be instituted safely with minimal delays and significant reduction in time to treat patients in pain.²⁷

DISCUSSION

Pain Assessment

Adequate pain control is not provided for a variety of reasons. The

most common reason is underestimation of the patient's needs.¹ Frequently, the need for analgesia is unrecognized because the patient is not questioned regarding his or her pain.¹² Even when the patient is asked, the response is often discredited by those providing care who judge that the pain is less than that reported. Medical personnel appear to base their judgment on past experiences of similar problems, even though the patient's pain perception is most influenced by his or her own past experiences.²⁸

The first step toward improving the comfort of patients must be to recognize the patient's pain. If prehospital providers were required to report the adequacy of pain control as much as they report the most recent set of vital signs, perhaps pain-management practices would improve.²⁹

Recommendation

Prehospital protocols should mandate assessment and documentation of pain severity with potentially painful injuries and illnesses, as well as reassessment and documentation of the level of pain after any given intervention. Reporting pain control as a standard-of-care assessment item during routine clinical care should reduce the incidence of oligoanalgesia by increasing awareness of the patient's pain.

Tools for Pain Assessment

Pain is a complex and multidimensional phenomenon. It can be generated by different mechanisms of tissue damage. The peripheral and central nervous systems carry the signal to the brain for cognitive processing and actively modify it along the way.^{30,31} Finally, interpretation of the nociceptive signal includes psychologic, physiologic, emotional, and behavioral dimensions. Therefore, accurate assessment of pain cannot be inferred from the degree of tissue damage

observed.³² Patient self-reporting is "the most reliable indicator of the existence and intensity of pain."³³ Further, it has been demonstrated that pain assessment is feasible in the prehospital setting.³⁴ Children under 8 years of age have a limited cognitive ability to understand instructions and to articulate descriptions of their pain.³⁵ Assessment of pain in the very young population will depend on close observation of behavioral components. However, it should be recognized that medical providers as well as parents significantly underestimate the severity of pediatric pain.^{36,37}

The ideal instrument for the assessment of pain should allow for the identification of the presence and intensity of pain, as well as the change in pain severity with time and treatment. This instrument should be applicable to any individual, regardless of psychological or emotional state, cultural background, or age.^{38,39}

Several types of instruments used to assess pain severity exist. The multidimensional scales such as the McGill Pain Questionnaire or the St. Antoine Pain Questionnaire^{40,41} explore all pain components and have been validated for the measurement of chronic pain. However, completing these multidimensional scales requires about 20 minutes of patient time, which is not acceptable in the prehospital setting.

Behavioral scales such as the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) have been described for measurement of pain in children and infants.⁴² This tool has been shown to have excellent interrater reliability and good evidence of validity when used for young children following surgery. It has also been used for assessment of distress in children undergoing painful procedures in the emergency department,⁴³ but its use has never been reported in the prehospital setting. Other well-documented scales for pediatric

pain assessment include the Color Analogue Scale and the Faces Pain Scale.⁴⁴

In general, one-dimensional pain scales are easy to complete and are therefore the most frequently used instruments to assess acute pain. The most common include the numeric rating scale (NRS), the visual analogue scale (VAS) and the verbal rating scale (VRS).³⁸

Table 1 describes the technique of each of the above-mentioned scales and how Berthier et al. presented them to the subjects of their study to compare the three scales. The VAS and NRS showed better discriminant power for all patients. However, the NRS proved more reliable for patients with trauma. Berthier concluded that the NRS would appear to be the best means for self-evaluation of acute pain intensity in the emergency department.⁹

Recommendation

Protocols for prehospital pain management must specify at least one instrument to measure intensity of pain. One-dimensional scales seem to be most appropriate for prehospital care. When dealing with small children and infants, it is important to take into consideration their inability to adequately self-report pain. The medical director must decide which scale is best for the individual system.

Indications and Contraindications for Prehospital Pain Management

As the medical community begins to address the issue of oligoanalgesia, we must question longstanding dogmas relating to the indications and contraindications for pain management. Zoltie and Cust⁴⁵ question the practice of withholding analgesia in patients presenting with acute abdominal pain. Others have concluded that appropriate pain management in

TABLE 1. Techniques of Three Pain Rating Scales

Numerical rating scale (NRS)

(patients verbally requested to rate their pain)

*Rate your pain from 0 (no pain) to 10 (unbearable pain)***Verbal rating scale (VRS)**

(five pain levels are indicated in large print on a sheet given to the patient: no pain, mild pain, moderate pain, severe pain, unbearable pain)

*Choose the adjective best corresponding to your pain level.***Visual analog scale (VAS)**

(A 100-mm rule with a movable cursor: "no pain" is written at the left end of the horizontal line along which the cursor is moved, and "maximal pain" at the right end)

*Move the cursor along the line to indicate the intensity of your pain. The left end of the line represents "no pain" and the right end the most intense pain imaginable, i.e., excruciating and unbearable pain.*Italics indicates the wording used by Berthier et al.⁹ to present the scales to the subjects of their study.

these patients would not alter their diagnosis and may, in fact, produce a more reliable physical examination.⁴⁶⁻⁴⁸ The myth that morphine sulfate is frequently associated with dangerous adverse effects has been refuted.⁴⁸

Prehospital providers must be directed to complete a thorough evaluation in all patients who are candidates for prehospital pain management regardless of gender, race, or age. Patients with isolated extremity trauma, hip fractures, and burns are only a few examples of conditions in which analgesia must be considered.

Recommendation

Clinical protocols for prehospital pain management must list clear indications and contraindications for each form of analgesic intervention. Prehospital protocols must be in accordance with protocols from local and regional trauma centers and developed through a consensus of opinion and acceptance by receiving physicians.

Nonpharmacologic Interventions for Pain Management

Pain management literature is heavily charged toward pharmacologic interventions and technology. Other techniques for pain management include biofeedback, hypnosis, music, acupuncture, and cold

therapy. Unfortunately, most of these techniques are not feasible in the hectic prehospital or emergency department environments. However, a very useful technique seldom used by prehospital providers is the therapeutic communication technique.⁴⁹ These techniques can be mastered by basic life support providers and can bring a significant degree of comfort to patients without pharmacological agents.³ Careful use of appropriate wording and distraction away from painful stimuli can provide comfort to the patient. In infants and young children, the presence of their parents has shown to reduce the level of distress in both the parents and the patient.⁴³ Other more traditional interventions such as immobilization of fractures, elevation of extremities, application of ice packs, and padding of spinal immobilization devices commonly used in prehospital medicine should be provided regardless of whether or not pharmacological interventions are used.

Recommendation

Prehospital pain management protocols should encourage providers to use communication skills to relieve suffering and anxiety as well as other common basic interventions (i.e., immobilization) to diminish pain. If possible, parents should be allowed to ride with pediatric patients in the ambulance. It must be recognized that these techniques

can act as powerful adjuncts to pharmacologic agents.

Pharmacologic Interventions for Pain Management

Few clinical studies have examined the safety and efficacy of analgesics in the field. The following is a brief review of the analgesic agents most commonly reported in use for prehospital analgesia. A complete review of medications used for analgesia in emergency medicine is beyond the scope of this paper. The medical director may want to consider other alternatives not currently reported in prehospital medicine once they have shown efficacy and safety in emergency medicine.

1. Morphine sulfate

In many systems morphine is the analgesic of choice for ischemic chest pain that is not relieved by administration of nitrates.⁵⁰ Its use for noncardiac pain has been limited due to exaggerated fears of side effects such as respiratory depression and hypotension. Morphine can be titrated via the intravenous route to produce safe and effective analgesia.⁵¹ Other forms of opiates such as dilaudid share many of the positive characteristics of morphine and may represent alternatives to consider. A major advantage of morphine and all other opioids is the availability of naloxone (opioid antagonist), which reverses most

adverse side effects. Naloxone has also proven to be safe in the pre-hospital arena.⁵²

2. Fentanyl

Fentanyl is rarely available in ground ambulances but it has been reported by critical air ambulances to be safe and effective.^{14,53} Fentanyl is highly lipid-soluble, leading to a much more rapid onset and higher potency than morphine. Given parenterally, onset of analgesia can be as short as 90 seconds. In equivalent doses, it is approximately 100 times as potent as morphine. The respiratory depression seen with fentanyl is less than with morphine. Histamine release is minimal compared with other opioids.⁵⁴

3. Nalbuphine

Nalbuphine has both agonist and antagonist effects. Advantages include less respiratory depression, no demonstrated cardiovascular effects, and low potency for abuse. Half-life is 3.5 hours. Nalbuphine is not subject to regulation under the Controlled Substance Act. This could be of benefit for prehospital systems that do not use opioids because of difficulties of maintaining or regulating distribution of controlled substances.⁵⁴ Nalbuphine has been demonstrated safe and effective in the prehospital environment.⁵⁵⁻⁵⁷ However, some research indicates that nalbuphine results in poorer pain control.⁵⁸

4. Nitrous oxide

Nitrous oxide is the only practical inhalable sedative/analgesic that has proven to be safe and effective for prehospital use.^{59,60} It is self administered as a 50/50 N₂O/O₂ mixture and has an onset of action of 3 to 5 minutes with a duration of action of 3 to 5 minutes. The mechanism of action is not certain but appears to blunt the reaction to pain rather than the painful stimuli. In a 16-year study with over 2,700 patients in the City of Pittsburgh

EMS, significant analgesia was achieved in over 80% of patients.³ Diffusional hypoxia has been reported but may be avoided by providing supplemental oxygen. Nitrous oxide preferentially enters areas of the body such as the gut and middle ear, possibly leading to overdistention. As such, contraindications to its usage include conditions exacerbated by gas expansion such as pneumothorax and bowel obstruction. Other minor side effects such as nausea and vomiting occur in 10% to 15% of patients.^{54,61}

5. Ketamine

Ketamine is a popular agent for pediatric sedation and anesthesia in the emergency department but with no published studies for routine use in the prehospital arena. Ketamine is a dissociative anesthetic that induces a trancelike, cataleptic state of sensory isolation, providing a unique combination of amnesia and sedation. It is highly lipid-soluble with clinical effects within 1 minute of administration when given intravenously and within 5 minutes when given intramuscularly. Ketamine also acts as a bronchodilator and produces a mild to moderate increase in heart rate and blood pressure.^{54,61} It has been suggested as a useful field agent for unusual situations such as disasters.⁶²

6. Ketorolac and oral NSAIDs

Another non-narcotic option for the EMS medical director to consider is the administration of nonsteroidal anti-inflammatory drugs (NSAIDs). Ketorolac may be administered intravenously or intramuscularly and has been proven to be particularly efficacious in the treatment of renal and biliary colic.⁶³ Earlier dogmas prohibiting the administration of any medication by mouth prior to arrival in the hospital have also been questioned, thus creating the possibility for providing oral analgesics in the field.⁶⁴

Recommendation

In choosing an analgesic for the field, desirable properties should be: safety, efficacy, ease of administration, rapid onset, short duration, low abuse potential for patients and staff, and reversibility.³ There is insufficient published evidence to decide which is the best agent for prehospital analgesia. The medical director of each EMS system must evaluate different alternatives available on the market and decide which agent or agents are most suitable for the system's local needs and capabilities. This decision should be made in consultation with the medical staffs of the system's receiving hospitals. The EMS system must be aware of local and regional regulations pertaining to the use of controlled medications. Prehospital providers must be educated in the appropriate use of these medications as well as the management of adverse effects and complications of each agent selected.

Patient Monitoring and Documentation before and after Analgesia

Prehospital providers must be aware of the pharmacology and possible complications of every analgesic in their protocols. As mentioned elsewhere in this document, prehospital analgesia is desirable and has been demonstrated to be safe and effective, but close monitoring of potential side effects and complications is essential.

In general, documentation of the patient's clinical status before and after analgesic administration is recommended. Monitoring should include, but not be limited to, assessment of mental status, blood pressure, heart rate, and respiratory rate. Serial assessments using a pain scale should be used to determine adequacy of analgesia. Cardiac monitoring and pulse oximetry are also suggested by the literature.⁵ Frequency of vital signs documen-

tation should depend on transport times and patient condition. Any significant change in clinical status should be recorded immediately, as well as any corrective actions taken. Protocols should provide for the treatment of analgesic complications such as respiratory depression, allergic reactions, hypotension, and nausea with specific medications and interventions such as reversal agents, advanced airway skills, antihistamines, and antiemetics.

Recommendation

Protocols for prehospital pain management should mandate recording of patient clinical condition before and after analgesia administration. At a minimum, two sets of vital signs should be documented before arriving at the receiving facility. Serial pain scale assessments are recommended and preparation and ability to care for complications are mandatory.

Transferring Information to Receiving Medical Facility

It is crucial that the receiving medical facility is provided a complete record of analgesics given to the patient during transport. The name of the medication, dose, route, and time of administration are important information that allows the emergency department personnel to follow up on patient status. Any side effects or complications must be conveyed to the receiving personnel as well. The continuum of care of the patient's general condition and pain management is dependent on appropriate communication between prehospital and emergency department personnel.

Recommendation

Protocols must mandate that adequate documentation regarding prehospital pain management be

made available to the receiving facility. This documentation may be provided by the routine patient care report used for every patient or by a specific form to be completed for pain management.

Quality Improvement and Medical Oversight

It is paramount that the institution and use of prehospital analgesics be monitored through an established quality improvement system. Research has shown that a quality control program can result in an increased awareness by prehospital providers of the need for analgesic use and leads to higher compliance to analgesic protocols.⁶⁵ Benchmarks should be set to identify candidates for analgesic administration as well as other forms of pain management. The route and dose of selected agents should be tracked and correlated with changes in pain severity assessment as well as the incidence of adverse side effects. Charts should be reviewed regularly to determine the degree to which prehospital analgesics are being used and this information shared with providers to improve their compliance to prehospital analgesic protocols. Any use of controlled substances should undergo periodic inventory control review to ensure compliance to state and federal regulations. Close medical oversight should include regular training of providers in the role of prehospital pain management, the assessment of pain severity, and the use of analgesics. Discussion should occur regularly with receiving hospital personnel to assess the appropriateness of prehospital pain control.

Recommendation

The administration of prehospital analgesics should be monitored through an established quality improvement program with medical oversight to ensure their appropri-

ate use, regular review of their indications, and education of prehospital providers to increase awareness of their need.

SUMMARY

This paper has presents a discussion regarding prehospital pain management and reviewed the current literature supporting the use of prehospital analgesics. EMS systems should evaluate the potential value of instituting protocols for the appropriate treatment of pain suffered by its patients. System medical directors should take a leading role in the development of such protocols and the oversight of their use.

References

1. Cordell WH, Keen KK, Giles BK, et al. The high prevalence of pain in emergency care. *Am J Emerg Med.* 2002;20:165-9.
2. Paris PM, Stewart RD. Preface. In: Paris PM, Stewart RD (eds). *Pain Management in Emergency Medicine.* Norwalk, CT: Appleton-Lange, 1988, p xiii.
3. Paris PM. Prehospital analgesia. In: Paris PM, Roth R, Verdile V (eds). *Prehospital Medicine: The Art of On-Line Medical Command.* St. Louis, MO: Mosby Lifetime, 1996, pp 85-90.
4. JCAHO: Joint Commission on Accreditation of Healthcare Organizations. *Comprehensive Accreditation Manual for Hospital, The Official Handbook.* Chicago, IL: JCAHO Publication, 1998.
5. ACEP: American College of Emergency Physicians. Clinical policy for procedural sedation and analgesia in the emergency department. *Ann Emerg Med.* 1998; 31:663-77.
6. Ricard-Hibon A, Leroy N, Magn M, et al. [Evaluation of acute pain in prehospital medicine]. *Ann Fr Anesth Reanim.* 1997;16:945-9.
7. Ducharme J. Emergency pain management: a Canadian Association of Emergency Physicians (CAEP) consensus document. *J Emerg Med.* 1994;12:855-66.
8. Stewart RD. Pain control in prehospital care. In: Paris PM, Stewart RD (eds). *Pain Management in Emergency Medicine.* Norwalk, CT: Appleton-Lange, 1988, pp 313-21.
9. Berthier F, Potel G, Leconte P, et al. Comparative study of measuring acute pain intensity in an ED. *Am J Emerg Med.* 1998;16:132-6.
10. Jones JB. Assessment of pain management skills in emergency medicine resi-

- dents: the role of a pain education program. *J Emerg Med.* 1999;17:349-54.
11. Johnston CC, Gagnon AJ, Fullerton L, et al. One week survey of pain intensity on admission to and discharge from the emergency department: a pilot study. *J Emerg Med.* 1998;16:377-82.
 12. Ducharme J, Barber C. A prospective blinded study on emergency pain assessment and therapy. *J Emerg Med.* 1995;13:571-5.
 13. Baskett PJ. Acute pain management in the field. *Ann Emerg Med.* 1999;34:784-5.
 14. De Vellis P, Thomas SH, Wedel SK. Prehospital and emergency department analgesia for air-transported patients with fractures. *Prehosp Emerg Care.* 1998;2:293-6.
 15. White LJ, Cooper JD, Chambers RM, et al. Prehospital use of analgesia for suspected extremity fractures. *Prehosp Emerg Care.* 2000;4:205-8.
 16. McEachin DD, McDermott JT, Swor R. Few emergency medical services patients with lower-extremity fractures receive prehospital analgesia. *Prehosp Emerg Care.* 2002;6:406-10.
 17. Wilson JE, Pendleton JM. Oligoanalgesia in the emergency department. *Am J Emerg Med.* 1989;7:620-3.
 18. Vassiliadis J, Hitos K, Hill CT. Factors influencing prehospital and emergency department analgesia administration to patients with femoral neck fractures. *Emerg Med (Fremantle).* 2002;14:261-6.
 19. McGrath PJ, Frager G. Psychological barriers to optimal pain management in infants and children. *Clin J Pain.* 1996;12:135-41.
 20. Todd KH, Deaton C, D'Adamo AP, Goe L. Ethnicity and analgesic practice. *Ann Emerg Med.* 2000;35:11-6.
 21. Hostetler MA, Auinger P, Szilagyi PG. Parenteral analgesic and sedative use among ED patients in the United States: combined results from the National Hospital Ambulatory Medical Care Survey 1992-1997. *Am J Emerg Med.* 2002;20:139-43.
 22. Raferty KA, Smith-Coggins R, Chen AHM. Gender associated differences in emergency department pain management. *Ann Emerg Med.* 1995;26:414-21.
 23. Kelly AM. Does the clinically significant difference in visual analog scale pain scores vary with gender, age or cause of pain? *Acad Emerg Med.* 1998;5:1086-90.
 24. Carr TD, Lemank KL, Armstrong FD. Pain and fear ratings: clinical implications of age and gender differences. *J Pain Symptom Manage.* 1998;15:305-13.
 25. Unruh AM. Gender variations in clinical pain experience. *Pain.* 1996;65:123-67.
 26. Jones JS, Johnson K, McNinch M. Age as a risk factor for inadequate emergency department analgesia. *Am J Emerg Med.* 1996;14:157-60.
 27. Fullerton-Gleason L, Crandall C, Sklar DP. Prehospital administration of morphine for isolated extremity injuries: a change in protocol reduces time to medication. *Prehosp Emerg Care.* 2002;6:411-6.
 28. Ducharme J. Acute pain and pain control: state of the art. *Ann Emerg Med.* 2000;35:592-603.
 29. Terndrup TE. Establishing pain policies in emergency medicine. *Ann Emerg Med.* 1996;27:408-11.
 30. Raja SN, Meyer RA, Campbell JN. Peripheral mechanism of somatic pain. *Anesthesiology.* 1988;68:571-90.
 31. Woolf CJ. Generation of acute pain: central mechanism. *Br Med Bull.* 1991;47:523-33.
 32. Walker J. Taking pains. *Nurs Times.* 1992;88:38-40.
 33. Acute Pain Management Guideline Panel. *Acute Pain Management: Operative or Medical Procedures and Trauma: Clinical Practice Guideline.* Washington, DC: U.S. Department of Health and Human Services, 1992.
 34. McLean SA, Domeier RM, DeVore HK, Maio RF, Frederiksen SM. Feasibility of pain measurement in the prehospital setting [abstract]. *Acad Emerg Med.* 2003;10:474-5.
 35. Jeans ME. Pain in children: a neglected area. In: Firestone P, MacGrath P, Feldman W (eds). *Advances in Behavioral Medicine for Children and Adolescents.* Hillsdale, NJ: Lawrence Erlbaum, 1983, pp 23-37.
 36. Singer AJ, Gulla J, Thode HC. Lack of correlation between practitioner and parental assessments of infants' and toddlers' pain severity [abstract]. *Acad Emerg Med.* 2001;8:426-7.
 37. Kelly AM. Lack of correlation between parent and child visual analog scale pain scores [abstract]. *Acad Emerg Med.* 2000;7:550.
 38. Ho K, Spence J, Murphy MF. Review of pain-measurement tools. *Ann Emerg Med.* 1996;27:427-32.
 39. Terndrup TE. Pediatric pain control. *Ann Emerg Med.* 1996;27:466-70.
 40. Melzack R. The McGill Pain Questionnaire: major properties and scoring methods. *Pain.* 1975;1:277-99.
 41. Melzack R, Torgeson WS. On the language of pain. *Anesthesiology.* 1971;34:50-9.
 42. MacGrath PJ, Johnson G, Goodman JT, et al. CHEOPS: a behavioral scale for rating postoperative pain in children. In: Fields HL (ed). *Advances in Pain Research and Therapy.* New York: Raven Press, 1985, pp 395-402.
 43. Wolfram RW, Turner ED, Philput C. Effects of parental presence during young children's venipuncture. *Pediatr Emerg Care.* 1997;13:325-8.
 44. Bulloch B, Tenenbein M. Assessment of clinically significant changes in acute pain in children. *Acad Emerg Med.* 2002;9:199-202.
 45. Zoltie N, Cust MP. Analgesia in the acute abdomen. *Ann R Coll Surg Engl.* 1986;68:209-10.
 46. Vermeulen B, Morabia A, Unger PF, et al. Acute appendicitis: influence of early pain relief on the accuracy of clinical and US findings in the decision to operate—a randomized trial. *Radiology.* 1999;210:639-3.
 47. LoVecchio F, Oster N, Sturmman K, et al. The use of analgesics in patients with acute abdominal pain. *J Emerg Med.* 1997;15:775-9.
 48. Pace S, Burke TF. Intravenous morphine for early pain relief in patients with acute abdominal pain. *Acad Emerg Med.* 1996;3:1086-92.
 49. Goldfarb B. Prehospital pain management: providing physical and psychological care. *Prehosp Care Rep.* 1992;2:73-80.
 50. Bruns BM, Dieckmann R, Shagoury C, et al. Safety of prehospital therapy with morphine sulfate. *Am J Emerg Med.* 1992;10:53-7.
 51. Paris PM, Weiss LD. Narcotic analgesics: the pure agonists. In: Paris PM, Stewart RD (eds). *Pain Management in Emergency Medicine.* Norwalk, CT: Appleton & Lange, 1988, pp 125-56.
 52. Yealy DM. The safety of prehospital naloxone administration by paramedics. *Ann Emerg Med.* 1990;19:902-5.
 53. DeVillis P, Thomas SH, Wedel SK, et al. Prehospital fentanyl in air-transported pediatric trauma patients. *Pediatr Emerg Care.* 1998;14:321-3.
 54. Blackburn P, Vissers R. Pharmacology of emergency department pain management and conscious sedation. *Emerg Med Clin North Am.* 2000;18(4):803-27.
 55. Hyland-McGuire P, Guly HR. Effects on patient care of introducing prehospital intravenous nalbuphine hydrochloride. *J Accid Emerg Med.* 1998;15:99-101.
 56. Chambers JA, Guly HR. Prehospital intravenous nalbuphine administered by paramedics. *Resuscitation.* 1994;27:153-8.
 57. Stene JK, Stoffberg L, MacDonald G, et al. Nalbuphine analgesia in the prehospital setting. *Am J Emerg Med.* 1998;6:634-9.
 58. Woollard M, Jones T, Pitt K, Vetter N. Hitting them where it hurts? Low dose nalbuphine therapy. *Emerg Med J.* 2002;19:565-70.
 59. Johnson JC, Atherton GL. Effectiveness of nitrous oxide in a rural EMS system. *J Emerg Med.* 1991;9:45-53.

60. Donen N, Tweed WA, White D, et al. Prehospital analgesia with etonox. *Can Anaesth Soc J.* 1982;29:275-9.
61. Sacchetti A, Schafermeyer R, Gerardi M, et al. Pediatric analgesia and sedation. *Ann Emerg Med.* 1994;23:237-50.
62. Dick W, Hirlinger WK, Mehrkens HH. Intramuscular ketamine: an alternative pain treatment for use in disasters? In: Manni C, Magnalini SI (ed). *Emergency and Disaster Medicine: Proceedings of the Third World Congress in Rome, 1983.* Berlin: Springer-Verlag, 1985, 167-72.
63. Cordell WH, et al. Comparison of Intravenous ketorolac, meperidine and both (balanced analgesia) for renal colic. *Ann Emerg Med.* 1996;28:151-8.
64. Agrawal D. NPO status and adverse events in children undergoing procedural sedation and analgesia in the emergency department [abstract]. *Acad Emerg Med.* 2003;10:482.
65. Ricard-Hibon A, Chollet C, Saada S. A Quality control program for acute pain management in out-of-hospital critical care medicine. *Ann Emerg Med.* 1999;34:738-44.



THANKS TO REVIEWERS

Prehospital Emergency Care proudly salutes the Editorial Board and the Peer Reviewers who contribute their time and effort to help make the journal the best publication possible. The names of the Editorial Board members appear on the journal masthead. Those listed below volunteered their time in serving as reviewers for the journal from August 2002 to August 2003. The journal could not exist without the efforts of these individuals, and we extend our sincere thanks to them.

Héctor M. Alonso-Serra, MD
 Syd Bauman, EMT-P
 Richard Beebe, RN, NREMT-P
 William Joseph Brady, Jr., MD
 Jane H. Brice, MD
 Lawrence Brown, EMT-P
 Jonathan L. Burstein, MD
 Debra Cason, RN, EMT-P
 David Cheng, MD
 Anne Clouatre
 Harold C. Cohen, PhD, EMT-P
 Elizabeth A. Criss, RN
 Tony Crystal
 Cathy Custalow, MD, PhD
 Robert DeLorenzo, MD
 Darrell J. DeMartino, NREMT-P
 James Dunford, MD
 Peter I. Dworsky
 Marc Eckstein, MD
 Deborah L. Funk, MD, EMT-P
 Alexander G. Garza, MD
 Robert T. Gerhardt, MD, MPH
 Terry Gisch, EMT-P
 John E. Gough, MD
 Matthew C. Gratton, MD

Mark J. Greenwood, DO, JD
 M. Ishmael Griffin, MD
 David Hale, MD, PhD
 Stephen Holbrook, MD
 David Hostler, PhD
 Michael W. Hubble, PhD
 Sandy Hunter, NREMT-P
 John William Jermyn, DO
 Craig B. Key, MD, EMT-P
 George Lindbeck, MD
 Daniel J. Lindholm, NREMT-P
 Beth Lothrop-Adams, RN,
 NREMT-P
 Glenn H. Luedtke
 Don MacMillan, PA, EMT-P
 Gerald E. Maloney, Jr., DO
 Juan March, MD
 Gregg S. Margolis, MS, NREMT-P
 David Samuel Markenson, MD
 Paul A. Matera, MD
 Deborah McCoy, EMT-P
 William R. Metcalf
 Ken Miller, MD
 Dennis M. Mitterer
 Ronald Moscati, MD

Jerry Lynn Mothershead, MD
 Michael O'Keefe
 M. Colleen O'Neil-Davis, MD
 Neill Oster, MD
 Barbara Overby, MD
 Scott Phelps, JD, MPH, NREMT-P
 Guillermo J. Pierluisi, MD
 Edward Racht, MD
 Kathy J. Rinnert, MD, MPH
 Christopher D. Robertson, BA, EMCA
 Judith A. Ruple, PhD, RN, NREMT-P
 Jeffrey Salomone, MD
 Manish N. Shah, MD
 Karl A. Sporer, MD
 G. Everett Stephens, MD
 Nathaniel J. Szweczyk, EMT-P
 David Thomson, MD
 Joshua M. Tobin
 Scott Tomek
 Henry Wang, MD
 Craig R. Warden, MD, MPH
 Gary E. Wiemokly, RN, EMT-P
 Helen J. Yurong, RN
 Matthew Zavarella, BS, NREMT-P

If you are interested in becoming a Peer Reviewer for *Prehospital Emergency Care*, send a letter of interest and your curriculum vitae to: James J. Menegazzi, PhD, Editor-in-Chief, *Prehospital Emergency Care*, Center for Emergency Medicine, 230 McKee Place, Suite 500, Pittsburgh, PA 15213. Your letter of interest should include mention of your areas of interest in EMS and/or topics you feel qualified to review.