Abstract—This review aims to describe and evaluate current practices and controversies surrounding provision of pain relief in the prehospital setting. The review addresses analgesia indications and contraindications, frequency with which analgesics are used, and factors associated with improved prehospital analgesia care in Emergency Medical Services systems with both physician and non-physician staffing. As part of its evaluation of the state of the art in prehospital pharmacologic treatment of pain, the review will summarize available evidence relevant to the major drugs. Although some situations have been insufficiently studied to allow for definitive data-driven analgesia recommendations, the review will, where possible, include evidence-based recommendations concerning prehospital pain medication. © 2008 Elsevier Inc.

Keywords—prehospital; analgesia; EMS; helicopter EMS

OVERVIEW

This review covers the important issue of prehospital analgesia provision for injured patients. Perusal of the available literature reveals a problem in prehospital care that is both significant and, for the most part, amenable to solution. Prehospital analgesia’s shortcomings start with pain underestimation and continue with underdosing, infrequent dosing, or inappropriate withholding of pain medications (1). Addressing these shortcomings represents a major potential for Emergency Medical Services (EMS) to positively impact an important “outcome” (pain relief) (1).

Recent evidence shows that the prehospital oligoanalgesia problem can be refractory to myriad interventions (2). With growing emphasis on desirability of evidence-based approaches for out-of-hospital care, the use of pain relief as an outcome of importance is sensible and appropriate (3). Examples of pain care-related outcome measures that have been proposed as reasonable include pain assessment (as well as reassessment at regular intervals), pain treatment and reduction, patient satisfaction with pain care, and evaluation of quality of pain care at transition points of care (4).

The overarching objective of this review is to make a case for increased frequency of provision of pain relief for injured patients in the prehospital setting. The intent is to identify, and offer solutions to, some important barriers to field administration of analgesics. The review is organized into the following sections:

- Explanation of why pain relief is an important goal in prehospital medicine
- Survey of evidence suggesting that EMS analgesia rates need improvement
- Assessment of reasons for current low analgesia rates
- Overview of approaches to improving prehospital analgesia

WHY PREHOSPITAL ANALGESIA SHOULD BE A HIGH PRIORITY

Relief of suffering—if and when this goal can be pursued with acceptable risk—should be a priority in any setting.
The caveat regarding safety should neither be forgotten nor unreasonably applied. Prehospital providers encountering trauma patients should approach the clinical situation with an a priori assumption that patients will be in pain of sufficient severity to warrant medication.

Analgesia’s importance is magnified by the frequency with which EMS providers interact with injured patients in significant pain. Moderate or severe pain is present in nearly one-third of all-diagnosis cases, and over 80% of patients with extremity fractures (the literature is characterized by imprecision in defining “significant” pain, which usually corresponds to pain levels at least halfway up the scale being used) (5–7). Provision of analgesia thus represents an area where prehospital providers can positively impact an important endpoint in a large number of patients (3,6).

Physiological Reasons to Relieve Pain

Pain, associated with many untoward effects, is physiologically “bad” (1,8). Anxiety can be counterproductive to diagnostic and therapeutic processes. Cardiac effects of pain include dysrhythmias and ischemia. Immune function and wound healing are impacted. Pain also can be associated with diagnosis-specific adverse impact (e.g., blood pressure elevation in head-injured patients) (9). When considering analgesia’s risks, one must keep in mind the risks attendant to pain non-treatment.

Clinical Benefits of Prehospital Pain Relief

Higher levels of patient satisfaction (demonstrated to result from better prehospital pain care) are likely to facilitate the diagnostic and therapeutic process (6). The administration of prehospital analgesia can be associated with an “up-triaging” upon arrival at the Emergency Department (ED)—a patient who has received analgesia is often perceived as being of higher acuity (10). Anecdotal experience also suggests that prehospital administration of pain therapy increases the likelihood of timely ED analgesia.

In practice, time benefit reaped by prehospital analgesia far exceeds the duration of the transport. This is due to common delays in ED administration of pain medication (1,11,12). A helicopter EMS (HEMS) study found that only a fifth of extremity fracture patients receiving fentanyl received any ED analgesia—and pain medications were administered a median 45 min after hospital arrival (11). Another study, focusing on ground EMS-transported extremity fracture patients, found a median time to analgesia of nearly 3 h (10). EMS analgesia advantages were highlighted by a comparison of the time to first pain medication received by ambulance-transported patients who got initial therapy from EMS (23 min) vs. hospital providers (113 min) (12).

CURRENT PREHOSPITAL ANALGESIA PROVISION RATES: MUCH ROOM FOR IMPROVEMENT

There are relatively few rigorous studies in the arena of prehospital analgesia (13,14). Some of the available data (particularly from HEMS) depict admirable prehospital analgesia rates, but reviewers assessing the totality of the evidence conclude it is a “...myth that care providers currently do a good job providing adequate assessment and treatment of pain” (4,11,15–17). A typical study found analgesia administered to only 23.4% of extremity trauma patients (82% of whom had intra-transport pain that was “moderate or severe”) (6). When given, treatment was often non-efficacious: pain levels decreased in only half those who received analgesia, and two-thirds of patients didn’t believe their pain was well managed (6). Other investigators (even those reporting from systems with standing analgesia orders) confirm poor analgesia rates for patients with fractures or burns (ranging from 1.8% to 21%) (12,18).

The underanalgesia problem is not unique to the United States, nor is it limited to non-physician crew configurations. Australians found that fewer than half of femoral fracture patients received field analgesia (10). In Germany, 41% of children in severe pain treated by a physician-staffed EMS service were judged to have received inappropriate pain care; when given, analgesics were dosed incorrectly in 82% of cases (19). A French physician-staffed system found just 49% of patients rated prehospital pain relief “adequate” (20). The French also have reported that physician prehospital providers have “low knowledge about severe acute pain management” in adult and pediatric patients, and that fewer than half of the nation’s EMS services use opioids for pediatric patients even though nearly all (93%) have access to morphine (21,22).

ANALGESIA RISKS AND BARRIERS TO MORE FREQUENT ANALGESIA ADMINISTRATION

This section will explore reasons for EMS non-administration of pain medication. For each issue, “pro” and “con” arguments are presented, followed by a “bottom line” conclusion based upon available literature, clinical experience, and common sense.
Analgesics Interfere with Assessment of Mental Status in the Potentially Head-Injured

Neurological assessment in traumatic brain injury is paramount—so important that even analgesia-friendly organizations such as the National Association of EMS Physicians caution against opioid use in the head-injured (23). However, there are arguments in favor of providing analgesia in this group. Not all head-injured patients are equal, and universal proscription of prehospital analgesics in any patient with potential for head injury has unsettling ramifications.

Unanswered questions remain. Where is the evidence that judiciously administered opioids change patients’ ability to cooperate with discriminating components of the neurological assessment? What about the fully conscious patient with an obvious hip fracture, in severe pain, who also has a scalp contusion? Should EMS really withhold analgesia in every prehospital situation where there is potential for head injury?

Pain’s inherent risks for the head-injured are recognized by trauma anesthesiologists, who have included analgesia in head-injury care protocols (9). Realizing that universal proscription against analgesia due to possible intracranial trauma would mean frequent non-treatment of pain, a panel of pediatricians acknowledged the potential for opioid-mediated mental status depression, but felt that the combination of observation, naloxone, and computed tomography (CT) scanning would ameliorate opioids’ untoward effects (24).

Of the arguments against prehospital analgesia, the neurological examination issue may have the most validity. Even in the age of cranial CT scans, there are no shortcuts to the neurological examination. Nevertheless, some analgesia is warranted in the head-injured patient with significant pain (or with an endotracheal tube in place). The “bottom line” for this issue: in the absence of high-quality guiding evidence, the prudent approach for head-injured patients in pain entails judicious employment of analgesia, preferably with short-acting, reversible agents such as fentanyl.

Analgesics Interfere with Other Parts of the Physical Examination (e.g., Abdominal Assessment)

Long-standing tradition—whether clinically accurate or not—holds that abdominal and general examination assessments can be obscured by opioids. An Israeli study identified concerns about examination limitations as the reason that nearly half of surveyed physicians indicated trauma analgesia should be withheld pending complete diagnosis (8).

Fortunately, proscriptions against abdominal pain analgesia have proved to be overcautious and, even if applicable in non-trauma, have no evidence basis in trauma (perhaps due to frequency of imaging) (25–27). It seems heretical to de-emphasize the physical examination. Nevertheless, it is difficult to find evidence that trauma pain relief results in missed diagnoses of clinical import. The available data actually suggest otherwise.

After the Israelis in the above-cited study attended a prehospital analgesia program administered by trauma anesthesiologists, their bias against relieving pain during the trauma resuscitation was reversed—with no adverse patient outcomes (8). Acute care specialists endorsing prehospital analgesia conclude that benefits outweigh risks (24).

In considering the “bottom line” on the examination alteration issue, administration of analgesia seems to be safe and appropriate. Imaging capabilities such as CT scan do not replace the need for a physical examination. However, the data fail to support arguments that, on those instances in which it is administered, trauma analgesia is causing missed significant injuries. The reasons for analgesia’s safety aren’t completely clear. It may be that the CT scanner does a good job of picking up significant injuries, or it’s possible that seriously injured patients tend to be admitted anyway (where diagnosis may be delayed but not missed). Perhaps the diagnostic test threshold is lowered when patients are known to have received opioids. In any event, one could argue that distracting pain from untreated (obvious) injuries limits the examination at least as much as does opioid administration. Furthermore, it is unlikely that small-aliquot administration of even potent opioids will result in a good examiner’s missing an injury of life- or limb-threatening import. In the unusual case where clinicians must have an examination that is “unaltered,” a reversal agent (naloxone) can be employed (28).

Analgesics Can Cause Hemodynamic or Respiratory Suppression

Hypoxemia and hypotension can worsen outcome in trauma patients (29). Hemodynamic concern has been acknowledged even by “pro-analgesia” experts, who have cautioned against potential hemodynamic consequences from opioids (24).

Fortunately, there are data to support the safety of appropriately administered opioids. The study of Kanowitz et al., though more methodologically rigorous than most reports, is typical in its demonstration of safety: of 2129 patients receiving an opioid (fentanyl), only 12 (0.6%) had a medication-related vital sign abnormality and an intervention was required only once (in a patient who had no sequelae) (30). Another study confirmed opioids’ hemodynamic and respiratory safety in 500 con-
secutive HEMS-transported patients receiving over 1000 doses of fentanyl (31). Other studies of varying size and setting have demonstrated that opioid analgesia (usually morphine) can be administered with no major sequelae detected by monitoring heart rate, blood pressure, oxygen saturation, and (in non-intubated patients) end-tidal carbon dioxide (11,20,28,30,32–37).

One group reported post-fentanyl decrements in blood pressure and heart rate as 5% and 3%, respectively; the authors concluded these changes were consistent with reduction of pain (37). In another study, fentanyl and morphine were each found to have minor side effects, with an incidence of about 1%; no significant sequelae were noted (34). Another prehospital series of morphine and alfentanil entailed monitoring of vital signs every 2 min after analgesia administration; no adverse events were found in either group (36).

The safety of opioid administration is enhanced with titration of small aliquots of medication. The ability to use lesser dosing is important because opioid side effects are predictable; as examples, respiratory depression is a greater risk in older patients with chronic obstructive pulmonary disease, and hemodynamic depression is more likely in patients who have had previous hypotensive episodes. When a drug is used judiciously, it is unlikely that profound hemodynamic or respiratory depression will develop. Naloxone availability should never justify taking inappropriate risk, but the antagonist does broaden opioids’ safety margin.

The “bottom line” for the issue of analgesia and respiratory or hemodynamic effects must be reached with imperfect guidance from the literature. Reports of opioids having been administered in the field with “no side effects” are often retrospective, and thus subject to biases that would tend to underemphasize analgesia-associated problems (11,30,37). Those series that do make a case for analgesia safety are often lacking in measures of analgesia efficacy. Because much of the literature suggests field analgesia is often underdosed, it simply may be that the literature only proves that opioids, when underdosed, are safe. What are truly needed are prospective evaluations of prehospital analgesia administration that simultaneously assess both efficacy and safety.

Often the analgesia decision is easy: absent major hemodynamic or respiratory depression concerns, analgesia should always be given to patients in pain from isolated extremity fracture. In other cases, such as multiple-organ system trauma or head injury, the decision may be more difficult, and the issue may come down to drug selection.

There are few (if any) high-quality studies assessing safety of prehospital morphine use in multi-trauma patients. Fentanyl, on the other hand, has been studied in the multi-trauma population, but such work is largely in HEMS settings—settings in which patient acuity can obscure opioids’ role in any deterioration, and in which high-level attendants can quickly address any opioid-caused safety issues (33,37,38). In the final analysis, fentanyl’s pharmacology is particularly well suited to patients with the potential for multiple injuries (39,40). Reports of fentanyl’s safe and effective use by ground EMS (though in a population with unclear injury severity) bolster arguments in favor of this agent as a preferred analgesic for trauma patients (30). Although fentanyl is the preferred agent for multiple trauma, morphine remains appropriate for patients with little risk of hemodynamic instability (41).

LOGISTIC AND RELATED BARRIERS TO PREHOSPITAL ANALGESIA

In addition to the types of issues addressed in the above section, other logistical and practical problems can cause suboptimal prehospital analgesia provision. These obstacles, as well as potential solutions, are outlined in this section.

Analgesics Require Intravenous Access

Although there are some prehospital pain relief interventions of non-pharmacologic (e.g., fracture splinting, burn dressing) and pharmacologic (e.g., topical non-steroidal anti-inflammatory drugs [NSAIDs] for corneal abrasions, oral opioids in wilderness settings, inhaled opioids) nature that can be provided in the absence of intravenous (i.v.) access, absence of an i.v. has been identified as a barrier to effective analgesia (1,14,42,43). The initial and obvious steps to address this are training advanced life support (ALS) providers well in the arts of i.v. placement, and insuring dispatch of ALS crews to cases where i.v. analgesia is likely required. Also, ALS providers should be well trained in “rescue” access techniques such as intraosseous line (IO) placement; it is doubtful whether an IO line should be placed solely for analgesia, but in many cases the IO is there for another reason, and analgesics such as fentanyl have been safely and effectively given through the IO route by helicopter EMS crews (17).

Placement of IO lines is not without complications, but there are other non-i.v. drug administration approaches that have been assessed for utility in acute care. Intranasal fentanyl (given as a total dose of 1.5 μg/kg), having been found useful in a pediatric ED setting, has been touted as a particularly attractive avenue for prehospital pain relief (44). Inhaled analgesia is generally limited to
Patients Don’t Request Analgesia

In one study, investigators assessing patients with extremity fractures found that three-fourths of patients who did not receive analgesia from EMS were in “moderate to severe” pain (6). Nearly two-thirds of these patients didn’t even aware that EMS could give analgesia. However, even when patients were aware that EMS personnel could provide pain medications, they almost always (about 90%) failed to request analgesics.

Because patients weren’t necessarily aware that EMS could give analgesia, and because they tended to not ask for pain medications even when they were aware EMS could give them, it is tempting to conclude that injured patients felt that prehospital analgesia wasn’t important. However, this was not the case: patients overwhelmingly (93%) indicated that their pain was poorly assessed by EMS, and two-thirds of patients felt their pain was not well managed in the prehospital setting (6).

Others have noted that patients may not be aware that EMS can provide analgesia, and that failure of patients to request pain medications is not a determining factor in whether pain relief should be given (3). There may be many reasons why patients don’t request analgesia, but those reasons usually have little bearing on whether analgesia provision is appropriate. The bottom line for this issue is that prehospital providers shouldn’t rely on patients to ask for pain medication, and EMS providers shouldn’t equate absence of a patient’s making an analgesia request with absence of significant pain (or patient satisfaction with pain care). Studies have demonstrated that assessment of pain using a 10-point (verbal) scale is feasible in the vast majority of cases (approximately 85% or more) in both air and ground-transported patients (5,38). Therefore, pain assessment should occur in objective fashion, and prehospital providers shouldn’t rely on the patients to spontaneously report pain. The use of some sort of pain assessment (verbal scales for adults, and age-specific tools for pediatric patients) is now a standard of good care for prehospital providers (4).

Prehospital Providers Underestimate Pain

It has been shown that prehospital care workers, like others in health care, underestimate patient pain levels; patients at age extremes and minorities are at particular risk to have their pain levels underestimated (1,4). Therefore, the best approach for prehospital providers is to actively question patients about pain, preferably using scales; fortunately, verbal analog scales (e.g., asking patients to rate pain from 1 to 10) have been demonstrated to be sufficient for use in most (awake) trauma patients and these scales have been endorsed by prehospital analgesia investigators with interest in trauma (28,45). Use of such scales results in better pain treatment for acute trauma, and the employment of pain scales also affords a mechanism for EMS systems to provide documentation that pain levels were addressed (46). Pain assessment thus should be incorporated into the “vital signs” of prehospital patient assessment (28).

Prehospital Providers Must Contact Medical Control before Providing Analgesia

Noting delays associated with requirement for medical control contact before administration of prehospital analgesia, expert commentators have stated that direct oversight should not be required for prehospital pain medication administration (1). Editorialists have noted that prehospital providers used to be required to contact medical control for a variety of interventions (e.g., dysrhythmia treatment) that are now provided “by protocol,” and EMS experts have contended that protocol-driven analgesia administration is the proper means for improving patient care (15).

The available evidence suggests that, as long as protocols are written in such fashion as to prioritize safety, the extra step of contacting medical control to authorize pain medications incurs time costs and isn’t beneficial. If one agrees with the premise advanced by some, that earlier treatment of severe pain by even a few minutes...
represents a worthy goal, then there is wisdom in development of pain protocols as an important part of improving prehospital analgesia care (4).

Pain treatment without conversing with medical control has been reported as safe and effective in series in which the authors emphasize the need for initial and ongoing education about analgesia and its risks (11,33,37). Administration of 10 mg morphine “per protocol” is clearly inappropriate in patients such as the blunt trauma victim with borderline blood pressure. In practice, most such cases are easily defined and recognized, and it is not problematic to educate prehospital providers about risks of overzealous analgesia. Just as it is incorrect to administer 10 mg morphine to a hemodynamically unstable trauma patient, it is incorrect to withhold analgesia in a straightforward case such as that of a young, healthy skateboarder with a wrist fracture-dislocation; in such a case, no medical control contact should be required before opioid administration should immobilization fail to effect pain relief. EMS providers should have access to help from medical control for patients in the “middle ground” (e.g., elderly patient with chronic obstructive pulmonary disease who has a hip fracture). Finally, medical control should emphasize the need for EMS to follow early analgesia protocols. Investigators reporting the effects of liberalization of analgesia protocols found that, although morphine use for non-trauma increased (e.g., nearly seven-fold for abdominal pain), there was no increase in analgesia rates for burn patients, and only limited improvement (20% increase) for trauma patients (47).

**Medical Control Physicians are Reluctant to Approve Analgesia**

Often, prehospital (non-physician) providers lament the fact that in a given transport they wished to give pain medications, but that they were precluded from doing so by their physician oversight. Medical oversight can take two forms: *direct* (traditionally called “on-line” medical control) or *indirect* (e.g., with patient care protocols). There is potential for both forms of medical oversight to result in pain undertreatment due to physician reluctance to authorize field analgesia. In 2001, a research group questioned medical control physicians who refused prehospital analgesia, and found analgesia refusal was due to the following perceptions by base station physicians: 1) Pain is inevitable; 2) Pain treatment isn’t a priority (i.e., as compared with diagnosis and other therapies); 3) Analgesics interfere with the diagnostic process and also have other (physiologic) side effects; and 4) Prehospital analgesia precludes hospital providers’ obtaining informed consent for necessary interventions. The group found that medical control pain medication refusal was attributable to biases (race, sex, age), poor EMS–physician communications, inadequate assessment of pain levels, and physician indifference (48).

In some venues, there is categorical restriction against non-physicians providing out-of-hospital pain medication. Although the efforts of prehospital medical control authorities in these areas to provide non-pharmacological pain relief are to be applauded (see discussion on acu-pressure, below), it seems reasonable to hope that advanced level (non-physician) field providers will one day be allowed to administer drugs for pain (49).

Physicians who write restrictive protocols, and those who routinely deny on-line EMS requests for provision of field analgesia, may base their decisions on just about any of the points mentioned in this review. As a general argument for limiting provision of pain relief in the field, medical control authorities have cited the paucity of studies establishing the safety of prehospital analgesia (13,14). Such an argument ignores the commentators and expert panels that have judged that the extant literature, although imperfect, justifies administration of field analgesia in at least some cases (1,23,50).

Other arguments against prehospital analgesia have been found to be flawed. Analgesia may be denied to save time, although there is little evidence that provision of pain medication incurs delays (1). Another issue, opioid addiction, has been demonstrated to be vastly overplayed, and should not be a basis for analgesia denial (15).

The current state of medical control in many jurisdictions has been characterized as being one in which “analgesia provision is simply not a priority for trauma providers” (24). This needs to be remedied. Under the best circumstances, triage protocols for vehicle dispatch should incorporate the likely need for analgesia; a patient with severe pain from an extremity injury warrants ALS dispatch, because only ALS can provide appropriate analgesia (3). It is understood that the practice of ALS dispatch “for pain management” may be problematic or even unachievable in rural systems or other areas with limited ALS resources. Still, early pain management remains a laudable goal, and one worthy of priority in every EMS system where resources allow. Granting prehospital analgesia appropriate priority will reverse the current situation, in which “undertreatment of pain is generally due to physicians who’ve overplayed risks and underplayed benefit” (50). Physicians must take some of the responsibility for poor prehospital pain relief; the truth of this statement is all too clear in studies finding that even having physicians in the field doesn’t guarantee adequate prehospital analgesia (50).


**Paramedics are Reluctant to Give Analgesia**

Although medical control issues are an important component of the pain undertreatment picture, available evidence shows that in many cases, prehospital personnel who do have standing analgesia orders still undermedicate pain. Even standing orders don’t ensure that pain medications will be given expeditiously (or at all). For example, one study of patients with suspected extremity fractures, transported by EMS providers with standing orders for morphine for such patients, found that analgesia was given in only 1.8% of cases (18). Other studies of areas where standing orders are in place have had similar results (3, 12). Although paramedics can justifiably criticize medical control for delays and inadequate pain therapy, institution of standing analgesia orders is no panacea. Successful education for prehospital analgesia will have to include paramedics as well as physicians.

**Analgesics Are Not Given in Appropriate Doses**

Prehospital underdosing of pain medication is often reported in both adults and children (1, 19). For example, in a study of patients with extremity fractures, pain medications administered in the field resulted in lower pain levels in only half of the cases (6). Although a judicious approach to administration of analgesics is important, it seems likely that efforts to improve prehospital pain care will need to include emphasis on the clinical pharmacology of the medications to be employed. For most patients with isolated painful injuries, there is little reason to use low total analgesic doses (though titration may result in low individual doses, given as multiple injections). Reviewers of the pain literature in EMS, commenting upon inadequate dosing as a major analgesia issue, have noted that “giving 2 mg of morphine to a healthy adult provides little relief;” they prefer an initial dose of 0.1 mg/kg with titration as needed (4).

**Analgesics Preclude the Ability to Obtain Informed Consent for Necessary Procedures**

Concerns about opioids’ invalidating informed consent may seem well founded when initially considered. However, upon consideration of the facts, consent issues are no reason to withhold analgesia from suffering patients. The myth of analgesia’s impairing the informed consent process has been debunked with respect to pain medications in the ED and medical, legal, and ethical experts also have firmly and consistently come down in favor of pain relief in the prehospital setting (48). For informed consent to be valid, the following circumstances should be present (48):

- The autonomous patient must understand treatment information and choices.
- The patient must be able to exercise autonomy and communicate decisions.
- The process should not involve coercion of any type.
- Information appropriate to the decision must be understandable by the patient.

As considered in light of the above points, administration of opioids doesn’t inherently interfere with the consent process. In fact, even if some altered mental status is presumed to be present, consent and ability to make judgments about care are not necessarily invalidated. This is clear when it is considered that on a daily basis, EDs discharge patients who have received opioids, or who have non-zero alcohol levels; thus, patients are allowed to exercise judgment even when the mental status is altered (48).

As a complement to arguments that analgesia doesn’t invalidate consent, those in favor of prehospital pain relief have opined that withholding analgesia creates a situation in which the patient isn’t able to objectively weigh decisions. Patients in severe pain may in fact be under a form of coercion when physicians are trying to explain what they need to do to relieve the pain. When patients who have had painful injuries are later asked about their participation in informed consent, many have (unsurprisingly) indicated that they just wanted the medical team to “do what they needed to do” to alleviate the condition. It is hard to imagine that a patient in agony can really give “informed consent”—the consent from a patient who is not in pain, but perhaps under mild influence from opioids, seems much preferable (48).

**SPECIFIC ANALGESIA APPROACHES FOR EMS**

As the concept of prehospital provision of pain relief has become more commonly discussed, useful reviews by experts in the field have appeared (14, 28). These reviews and related research have shed light on the best known practices related to prehospital analgesia. Although the current discussion is intended more as an overview of prehospital analgesia controversies than as a pharmacologic reference, some salient points about available drugs are warranted (Table 1).
Opioids

Morphine. Morphine (abbreviated MS for morphine sulfate) is the most commonly used prehospital analgesic, and is considered safe and effective by many in the realm of EMS (15,17,19,20,22–24,28,34,41,42,51). The EMS-C (EMS for children) partnership’s panel, recommending MS for pediatric trauma analgesia, cited long experience and safety and efficacy of MS use in injured children. The safety margin of MS is bolstered by the availability of naloxone, which can antagonize untoward (but also analgesic) effects of opioids (28).

Fentanyl. Fentanyl, compared to MS, is at least as effective and is easier to titrate (4,9,11,17,20,21,24,28,30,33,34,37,38,44,52). Some anesthesiologists have opined that fentanyl is the preferred agent in patients with potential neurotrauma (9). Fentanyl has been reported to be safe and effective in physician-staffed and non-physician EMS systems, in adult and pediatric patients (11,17,37,38,52). Fears of hemodynamic and respiratory effects from fentanyl likely will be allayed by data such as the 2006 series demonstrating no sequelae from fentanyl use in over 2000 patients (only one of whom required naloxone for respiratory depression) (20,30).

Alfentanil. Alfentanil has never been studied in the field for trauma patients (to the author’s knowledge). However, it has been demonstrated safe and effective when used by physician-staffed EMS in cardiac patients in Finland (36). More study is necessary before it can be recommended for use in prehospital trauma.

Nalbuphine. Nalbuphine has been in use in the United States since as long ago as 1988 (16,53). The drug also has been utilized in England with some success (16). Although actual study numbers are low, English authors have endorsed an increase in prehospital nalbuphine use (16). Widespread adoption of nalbuphine awaits further data.

Butorphanol. Butorphanol can be administered when i.v. access is lacking, and thus has potential for prehospital use. An agonist-antagonist, butorphanol has little evidence support for prehospital use. A review of military field analgesia concluded that although intranasal butor-
phenol has potential, there is not much supporting evidence or experience (42).

Non-Opioid Approaches

*Tramadol.* Tramadol is, strictly speaking, an opioid agonist with about 10% analgesic potency of that achieved with morphine (54). It has been reported to be used, though infrequently, in U.S. and international EMS systems. At least one reviewer has expressed concern with tramadol’s 30% nausea rate (4). Tramadol can cause serotonin syndrome if used inappropriately (e.g., in patients taking monoamine oxidase inhibitors or other serotoninergic antidepressants) (55).

*Ketamine.* Ketamine is a dissociative anesthetic agent (i.e., dissociates the cortex from the limbic system so patients do not perceive pain) used in the out-of-hospital setting with the same (nearly 100%) efficacy achieved in the hospital (51,56). There is some risk of apnea with rapid i.v. administration, but ketamine has high potential attractiveness in austere or in mass casualty incidents, where the numbers of injured patients outstrip the i.v.-placement and -monitoring capabilities of prehospital providers (42,57,58).

*Ketorolac.* Ketorolac has been mentioned in preliminary reports of surveys of agents used in prehospital and wilderness settings (42). The administration of NSAIDs has been reported to be associated with increased surgical bleeding in patients who require operative intervention, and NSAID use may be associated with non-union in fracture patients (59,60).

*Nitrous oxide.* Nitrous oxide is the only inhaled agent that is available (in limited locations) for prehospital use, having been used in the field for over three decades (4). It has been proven both safe and effective (> 80% rates of pain relief in the prehospital setting) and is recommended in prehospital reviews of analgesic methods for adults and children (4,23,41,51). It has the same precautions (e.g., pneumothorax) as those attendant to administration of any gas, and causes vomiting in 10–15% of patients; these limitations have potentially serious ramifications to trauma patients (28).

*Nerve blocks.* Nerve blocks, not traditionally described in the United States (with non-physician prehospital personnel), have been found successful for field use in France and England, particularly for patients with hip and femur fractures (51). This type of intervention may be appealing for physician crews or providers in austere environments (42).

Non-Pharmacologic Approaches

Although most patients with severe pain warrant pharmacological therapy, some other approaches also have been mentioned in the prehospital literature. Splinting is an important part of reducing pain from fractures. A rigid backboard may be both uncomfortable and unnecessary; avoiding backboards has been identified as an area for significant improvement in both comfort and safety (because prolonged immobilization on the rigid board incurs risk of pressure sores) (61).

Other non-pharmacologic approaches utilize innovative pain control techniques such as acupressure and transcutaneous electrical nerve stimulation. In an Austrian setting, where paramedics aren’t allowed to administer pain medications, acupressure has relieved pain in many “minor situations” and transcutaneous electrical nerve stimulation has been useful (though potentially expensive) for hip fracture analgesia (49,62).

Additional non-pharmacological approaches to pain control in the field range from the common-sense (e.g., covering burns) to the novel (e.g., musical distraction). As is often the case with acute care medical practice, a case-by-case consideration of how to make patients comfortable can identify potential improvements in management. Cognitive and behavioral approaches to analgesia, reviewed in detail elsewhere, are less widely applied than drug administration (4).

Changing Practice Patterns and Educational Programs

Other important “non-pharmacologic interventions” in prehospital analgesia practice include the incorporation of pain assessment and treatment into training (and subsequent care patterns) for prehospital providers (4). Education on fundamentals of pain assessment and analgesic pharmacology improve prehospital pain care as viewed from perspectives of prehospital providers and medical control physicians (1,8,15,16,20,28,45).

As an example, U.S. educational intervention directed toward non-physician prehospital personnel, institution of a protocol change, and accompanying education, allowing for standing morphine orders for patients with extremity fractures resulted in a modest increase in the proportion of patients receiving analgesia (69% vs. 63% before the intervention) (15). The authors reported that standing orders resulted in patients getting about the same average dose (6–7 mg), but receiving the analgesia 11% faster (in 17 min vs. 19 min before the intervention); they contended that even a few minutes’ improvement was a worthy finding because, for patients in severe pain, getting relief even a little bit earlier is desirable. Even when the target prehospital providers are physi-
cians, just a few weeks’ training can result in increased rates of achieving adequate pain relief, from less than half to over two-thirds in one study (20).

**CONCLUSION**

The literature is imperfect, but there is clear evidence supporting the safety of prehospital analgesia. EMS providers should assess the available information in light of their own systems, and consider how they can safely improve pain relief. In balancing the laudable desire to “do no harm,” those designing out-of-hospital pain relief protocols should keep in mind that “primum non nocere” also means it is unacceptable to allow patients to suffer needlessly.

**REFERENCES**