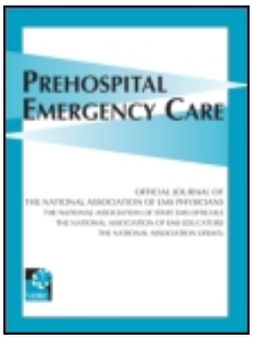

Prehospital Emergency Care

ISSN: 1090-3127 (Print) 1545-0066 (Online) Journal homepage: informahealthcare.com/journals/ipec20

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To cite this article: Marianne Gausche-Hill, Kathleen M. Brown, Zoë J. Oliver, Comilla Sasson, Peter S. Dayan, Nicholas M. Eschmann, Tasmeen S. Weik, Benjamin J. Lawner, Ritu Sahni, Yngve Falck-Ytter, Joseph L. Wright, Knox Todd & Eddy S. Lang (2014) An Evidence-based Guideline for Prehospital Analgesia in Trauma, Prehospital Emergency Care, 18:sup1, 25-34, DOI: 10.3109/10903127.2013.844873

To link to this article: https://doi.org/10.3109/10903127.2013.844873

An Evidence-based Guideline for Prehospital Analgesia in Trauma

Marianne Gausche-Hill, MD, Kathleen M. Brown, MD, Zoë J. Oliver, MD, CCFP (EM), Comilla Sasson, MD, MS, Peter S. Dayan, MD, MSc, Nicholas M. Eschmann, EMT-P, MS (Epidemiology), Tasmeen S. Weik, DrPh, MPH, Benjamin J. Lawner, DO, EMT-P, FAAEM, Ritu Sahni, MD, MPH, Yngve Falck-Ytter, Joseph L. Wright, MD, MPH, Knox Todd, MD, MPH, Eddy S. Lang, MDCM, CCFP (EM)

Received June 19, 2013, from the David Geffen School of Medicine at UCLA, Los Angeles, California, USA, and Harbor–UCLA Medical Center, Torrance, California, USA. Revision received September 8, 2013; accepted for publication September 9, 2013.

Co-authors: Kathleen M. Brown, MD, Children's National Medical Center, Washington, DC; Zoë J. Oliver, MD, CCFP (EM), University of Manitoba, Winnipeg, Manitoba, Canada; Comilla Sasson, MD, MS, Department of Emergency Medicine, University of Colorado, Aurora, Colorado; Peter S. Dayan, MD, MSc, Columbia University College of Physicians and Surgeons, New York, New York; Nicholas M. Eschmann, EMT-P MS (Epidemiology), City of Kenosha Fire Department, Kenosha, Wisconsin; Tasmeen S. Weik, DrPh, MPH, Health Resources and Services Administration/Maternal and Child Health Bureau, Rockville, Maryland; Benjamin J. Lawner, DO, EMT-P FAAEM, Department of Emergency Medicine, University of Maryland School of Medicine and Baltimore City Fire Department, Baltimore, Maryland; Ritu Sahni, MD, MPH, Oregon Health and Sciences University and Oregon EMS and Trauma System, Portland, Oregon; Yngve Falck-Ytter, MD, AGAF, Case Western University, Cleveland, Ohio; Joseph L. Wright, MD, MPH, George Washington University School of Medicine and Public Health and Child Health Advocacy Institute, Children's National Medical Center, Washington, DC; Knox Todd, MD, MPH, Department of Emergency Medicine, University of Texas, MD Anderson Cancer Center, Houston, Texas; and Eddy S. Lang, MDCM, CCFP (EM), University of Calgary and Alberta Health Services, Calgary, Alberta, Canada.

Author contributions: MGH, ZO, PD, CS, NE, BL, and RS appraised the literature and reported their findings to the review panel. KB, TW, JW, and EL designed the methodologies for the EBG and gave input into the final recommendations. EL and YFY provided guidance regarding GRADE processes. All authors contributed to the manuscript.

Review panel members: Eddy Lang, University of Calgary, Calgary, AB, Canada; Marianne Gausche-Hill, Harbor-UCLA Medical Center, Torrance, CA; Kathleen Brown, Children's National Medical Center, Washington, DC; Tasmeen Weik, Health Resources and Services Administration, Washington, DC; Daniel Spaite, University of Arizona, Phoenix, AZ; Peter S. Dayan, Columbia University College of Physicians and Surgeons, New York, NY; Yngve Falck-Ytter, University Hospitals/Case and VA Medical Center, Cleveland, OH; Stephen Thomas, University of Oklahoma, Tulsa, OK; Ritu Sahni, Oregon Health Sciences University, Portland, OR; Zoe Oliver, University of Manitoba, Winnipeg, MB, Canada; Matthew Erskine, University of Calgary, Calgary, AB, Canada; Comilla Sasson, University of Colorado, Aurora, Colorado; Nicholas M. Eschmann, City of Kenosha Fire Department, Matthew Erskine, University of Calgary, Calgary, AB, Canada; Joseph Wright, Children's National Medical Center, Washington, DC; Jon Mark Hirshon, National Study Center for Trauma and EMS, Baltimore, MD; Benjamin Lawner, University of Maryland, Baltimore, MD; Richard Alcorta, Maryland Institute for EMS, Baltimore, MD; Douglas Floccare, Maryland Institute for EMS, Baltimore, MD; Michael Millin, Maryland Institute for EMS, Baltimore, MD;Richard Hunt, Centers for Disease Control, Atlanta, GA; Cathy Gotschall, NHTSA, Washington, DC; Drew Dawson, NHTSA, Washington, DC.

Abstract

Background. The management of acute traumatic pain is a crucial component of prehospital care and yet the assessment and administration of analgesia is highly variable, frequently suboptimal, and often determined by consensus-based regional protocols. **Objective.** To develop an evidence-based guideline (EBG) for the clinical management of acute traumatic pain in adults and children by advanced life support (ALS) providers in the prehospital setting. **Methods.** We recruited a multi-stakeholder panel with expertise in acute pain management, guideline development, health informatics, and emergency medical services (EMS) outcomes research. Representatives of the National Highway Traffic Safety Administration (sponsoring agency) and a major children's research center (investigative team) also contributed to the process. The panel used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology to guide the process of question formulation, evidence retrieval, appraisal/synthesis, and formulation of recommendations. The process also adhered to the National Prehospital Evidence-Based Guideline (EBG) model process approved by the Federal Interagency Council for EMS and the National EMS Advisory Council. **Results.** Four strong

This research was funded through a Cooperative Agreement between Children's National Medical Center and the National Highway Traffic Safety Administration [DTNH22–09-H-00282]. Supplemental funding was provided by the EMS for Children Program of the Maternal and Child Health Bureau, Health Resources and Services Administration.

The views contained in this article are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

The study was undertaken as part of the response by the Federal Interagency Committee on EMS. The authors acknowledge Jaclynn Haymon and Rinal Patel for their project management support, and Richard Alcorta as the Maryland Institute for Emergency Medical Services Systems (MIEMSS) project liaison.

Address correspondence to Kathleen M. Brown, MD, Children's National Medical Center, 111 Michigan Avenue NW, Washington, DC 20010, USA. e-mail: Kbrown@cnmc.org

doi: 10.3109/10903127.2013.844873

and three weak recommendations emerged from the process; two of the strong recommendations were linked to high- and moderate-quality evidence, respectively. The panel recommended that all patients be considered candidates for analgesia, regardless of transport interval, and that opioid medications should be considered for patients in moderate to severe pain. The panel also recommended that all patients should be reassessed at frequent intervals using a standardized pain scale and that patients should be re-dosed if pain persists. The panel suggested the use of specific age-appropriate pain scales. **Conclusion.** GRADE methodology was used to develop an evidence-based guideline for prehospital analgesia in trauma. The panel issued four strong recommendations regarding patient assessment and narcotic medication dosing. Future research should define optimal approaches for implementation of the guideline as well as the impact of the protocol on safety and effectiveness metrics.
Key words: clinical practice guidelines; evidence-based medicine; pain management; prehospital care

PREHOSPITAL EMERGENCY CARE 2014;18(Suppl 1):25–34

INTRODUCTION

Background

In their 2006 report on the Future of Emergency Care in United States, the Institute of Medicine called for an improvement in the quality of care delivered by prehospital Emergency Medical Systems (EMS).[1] Among their recommendations was a mandate to develop a national approach to prehospital evidence-based guidelines (EBGs) and protocols. In response to this report and the priorities outlined in the 2001 National EMS Research Agenda, the National Highway Traffic Safety Administration convened a national conference of evidence-based medicine and EMS experts to develop a national process for the creation of EBGs tailored to the prehospital environment.[2] This National Prehospital EBG Model Process focuses on using objective and standardized methods, including specific guideline development methodologies, such as the Grades of Recommendation Assessment, Development and Evaluation (GRADE) system, to make best use of available evidence and to minimize bias wherever possible.[3]

In 2009, the Children's National Medical Center partnered with the Maryland Institute for Emergency Medical Services Systems (MIEMSS) to develop and test an EBG and protocol for the treatment of acute traumatic pain in prehospital patients. The process and rationale used to develop this EBG using GRADE techniques are described below.

Objectives

The objective of this guideline is to recommend an evidence-based strategy for the assessment and treatment of acute traumatic pain in prehospital patients of all ages.

Scope

This EBG applies to patients of all ages with acute traumatic pain. It is applicable to EMS systems where advanced life support (ALS) EMS providers make decisions partially or completely independent of direct online medical control. EMS system administrators, medical directors, and policy makers can utilize this guideline to develop structured protocols for the treatment of patients experiencing pain from traumatic injury in the prehospital setting. This guideline excludes patients who do not demonstrate normal age-appropriate mentation and who are allergic to narcotics.

Interpretation

This guideline was developed using GRADE methodology and contains both strong and weak recommendations.[3,4] According to the GRADE paradigm, the implication of a strong recommendation is that it should be adopted in policies or protocols in most settings covered by the scope of the guideline. Weak recommendations are conditional and should be adopted only after consideration of specific contextual factors and preferences with relevant stakeholders, including local policy makers and patients.[4]

Methods

Further details on the methods used to generate the EBG and model protocol may be found in a separate publication.[5] Overall, the process followed the guidelines set forth in the National Model for the Development of Prehospital EBGs.[3] This process included implementation of the guideline in the Maryland EMS system, which is described in a separate publication. Leaders from the Maryland Institute for Emergency Medical Services System (MIEMSS) were included in initial protocol development to ensure the engagement of relevant stakeholders cognizant of the logistical considerations associated with implementation.[5]

A core-working group consisting of the lead investigators and two GRADE methodologists first recruited a guideline panel consisting of stakeholders with content expertise in prehospital care, emergency medicine, pediatric emergency medicine, EMS systems administration, and evidence-based medicine. Panelists selected areas of responsibility within the guideline project and engaged the expertise of health information specialists to identify literature relevant to their PICO (patient, intervention, comparison, outcome) question (see Appendix A, available online). Contributors then created GRADE tables also known as evidence profiles for their PICO question and

generated draft guideline components. In July 2010 panelists presented evidence pertinent to their PICO question to the larger group and invited feedback regarding their assessment of the quality of evidence (as very low, low, moderate, or high) and strength of recommendations (as strong or weak).

Although the group discussed oral analgesics, and nonpharmacologic means of pain control, such as distraction and splinting, they felt that for maximal impact the guideline should focus on the assessment of pain and the delivery of pharmacologic agents available in the field to ALS-level EMS providers. Based on their evidence-based recommendations, the panel developed a model EMS protocol for the management of acute traumatic pain.

In February 2012, panelists repeated their literature searches to identify new research that might impact the recommendations. These more recent publications were appraised via correspondence among authors and incorporated into the existing evidentiary tables where applicable. The core working group was prepared to reconsider the strength of recommendations based on this new evidence, although changes were deemed unnecessary given the concordance in quality and content between the old and new literature.

RECOMMENDATIONS

1) Assess pain as part of general patient care.
2) Consider all patients with acute traumatic pain as candidates for analgesia, regardless of transport interval.
   (Strong recommendation, low quality evidence)
3) Use an age-appropriate pain scale to assess pain.
   a. <4 years: Consider using an observational scale, such as Faces, Arms, Legs, Cry, Consolability (FLACC) or Children's Hospital of Eastern Ontario Pain Scale (CHEOPS)
      (Weak recommendation, very low quality evidence)
   b. 4–12 years: Consider using a self-report scale, such as Wong Baker Faces, Faces Pain Scale (FPS), or Faces Pain Scale Revised (FPS-R)
      (Weak recommendation, very low quality evidence)
   c. >12 years: Consider using a self-report scale, such as the Numeric Rating Scale (NRS)
      (Weak recommendation, moderate quality evidence)
4) Use narcotic analgesics for patients in moderate to severe pain.
   (Strong recommendation, moderate quality evidence)

   Consider:
   a. IV morphine (0.1 mg/kg)
   b. IV or IN fentanyl (1.0 μg/kg)
5) Cautions and relative contraindications include
   - GCS < 15
   - Hypotension
   - Allergy to morphine and/or fentanyl
   - Hypoxia (SpO_2 < 90%) after maximal supplemental oxygen therapy
   - Signs of hypoventilation
   - Condition preventing administration (blocked nose, no IV/IO)

   (Weak recommendation, very low quality evidence)
6) Reassess all patients who have received analgesia using an age-appropriate scale every 5 minutes (end-of-dose time). Evidence of sedation or other serious adverse effects (hypotension, hypoxia, anaphylaxis) should preclude further drug administration.
   (Strong recommendation, moderate quality evidence)
7) Redose if still in significant pain.
   (Strong recommendation, low quality evidence)
8) Redose at half the initial dose
   (Weak recommendation, very low quality evidence)

A suggested protocol was drafted based on these recommendations (Figure 1).

DISCUSSION

Why Is It Important to Assess Pain?

Given the importance of safely and effectively relieving suffering, evidence-based analgesia protocols should be integral to all health-care systems. And yet, it has been repeatedly demonstrated that oligoanalgesia is a common reality for prehospital trauma patients related to insufficient timeliness, frequency, or efficacy. Two studies of patients with isolated painful extremity fractures demonstrated that only a minority received prehospital analgesia, while an observational study from Australia showed that pain is poorly controlled en route to hospital.[6–8] Other research indicates that providing analgesia in the prehospital environment, often when pain is most acute, substantially hastens the relief of discomfort rather than waiting for pain medication administration in frequently overcrowded emergency departments (EDs).[7–9]

Pain control has benefits that extend beyond the relief of patient discomfort. In fact, prompt analgesia might prevent long-term sequelae in very young children.[10] The elevations in heart rate and blood pressure that accompany pain might be misconstrued as another clinical process, as well as having untoward effects on certain disease processes, such as myocardial ischemia and head injury.[11] For chest wall injuries, such as multiple rib fractures or flail chest, analgesia

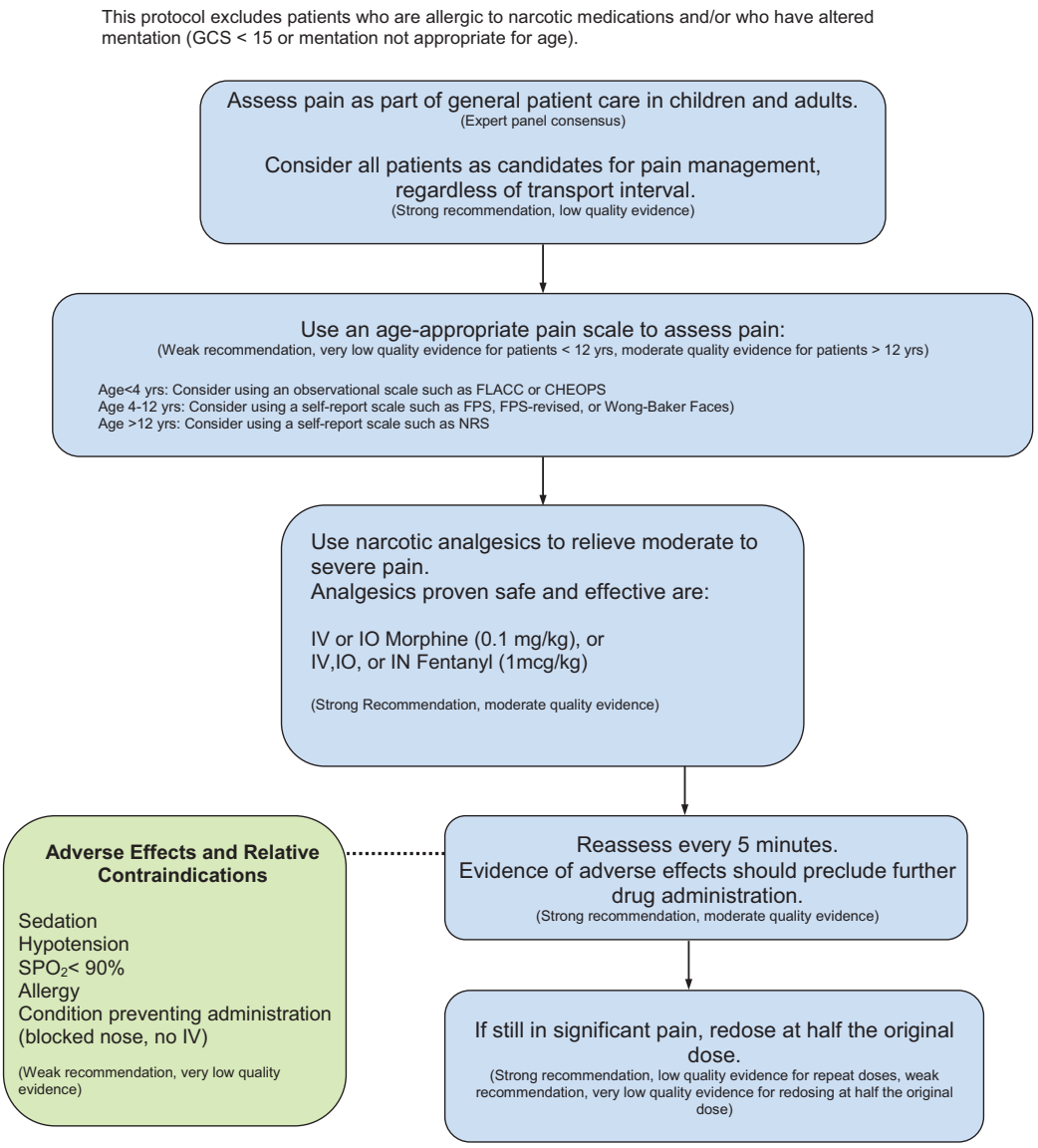

FIGURE 1. Prehospital protocol for the management of acute traumatic pain.

might improve clinical status by facilitating respiratory effort and increasing oxygenation.

Given the rationale above, a multitude of research groups have recommended an increased focus on pain control in the prehospital setting. The first EMS Outcomes Project (EMSOP I) identified analgesia as a key outcome parameter in adult and pediatric priority conditions, and EMSOP IV focused exclusively on pain assessment tools.[12,13] The Pediatric Emergency Care Applied Research Network (PECARN) group cited analgesia as a key priority for research in pediatric prehospital care.[14] However, the measurement of pain is inherently subjective, which leads to a host of methodological challenges when conducting pain research, particularly in the prehospital environment. Generally, patient self-reports of pain are preferred to purely observational assessments by EMS providers and the National Association of EMS Physicians (NAEMSP) recommends that reliable tools be used in the assessment of pain.[15,16]

A strong recommendation to "assess pain" was reached by review panel consensus. Based on their collective expertise in prehospital care, their knowledge of patient preferences, and their review of the evidence supporting the other recommendations in this EBG, the panel felt that the recommendation to assess pain was so intuitively sensible that it did not require formal GRADE analysis.

Should the Length of Transport Interval Influence the Assessment and Management of Prehospital Pain?

Given that relief of discomfort is a key priority for patients, the panel sought to determine whether it was clinically beneficial and feasible to assess and treat

pain in patients with short transportation times. Unfortunately, the evidence-based analysis of this clinical question was confounded by the paucity of good quality clinical studies that address how transport and destination offload times affect prehospital analgesia. No systematic reviews or meta-analyses directly address this issue, and, in fact, there is even a dearth of observational studies on the subject.[6,9,11,17]

Indirectly, the available evidence shows that meaningful and expeditious pain relief as measured by an objective pain scale can be achieved in the prehospital setting. In fact, relief of patient discomfort is achieved much more quickly when analgesia is initiated out-of-hospital.[7,9,18] In a randomized controlled trial comparing two morphine protocols, a substantial number of patients had an improvement in pain scores of 50% or more 10 minutes after a morphine sulfate injection of 0.1 mg/kg.[19] Other studies examining paramedic compliance with prehospital analgesia protocols demonstrate that it is feasible for paramedics to administer analgesia within 10–20 minutes of the beginning of the clinical encounter.[20,21]

In formulating their recommendation, the panel placed high importance on expeditious pain relief, and a lower priority on the resources required to provide effective prehospital analgesia, i.e., need for IV access, availability of medication, and prior training. Since it has been demonstrated that time to administration of pain relief for patients with fractures is significantly reduced if analgesia is initiated in the prehospital setting, the committee felt strongly that initiation of prehospital pain management improves outcomes for patients with painful conditions.[11,19] Since no studies directly addressed the specific relationship between transport interval and feasibility of analgesia administration, the quality of evidence was judged to be low by virtue of indirectness. Nevertheless, in light of the strong patient preference for prompt and effective pain relief, the panel issued a strong recommendation to consider all patients for pain management regardless of transport interval.

On What Basis Do We Justify Our Recommendations Regarding Pain Assessment Scales?

The panel reviewed the literature to determine which pain measurement scale, if any, would be most accurate and reliable in assessing pain in the prehospital setting. The main outcome of interest was the valid measurement of pain intensity. Other outcomes of importance (in descending priority) included the reliability of the scale when assessed by different observers and over time, the responsiveness of the scale to changes in pain with treatment, the ease of use of the scale, the ease of training personnel in scale use, equipment needs, the validity and reliability across populations, and the clarity of a threshold value to initiate therapy.

Given the variation in communication and comprehension among patients of varying ages, the panel considered how age might affect the recommendations and separated the patients into three separate cohorts for analysis: less than 4 years of age, between 4 and 12 years of age, and greater than 12 years of age. These subpopulations were created based on expert consensus suggesting use of observational scales for children less than 4 years old and self-report scales for patients greater than 4 years old.[22,23] In general, the literature regarding use of pain scales in the prehospital setting is limited by the lack of a reference standard against which to measure any particular pain scale.

Patients Less Than Four Years Old

The evidence for the use of particular observational pain scales in children younger than 4 years old was judged to be very low and was based on a systematic review by von Baeyer and Spagrud.[22] The review used qualitative criteria to assess each observational scale's validity, reliability, and responsiveness with no pooling of data. None of the referenced studies were conducted in the prehospital setting, most assessed postsurgical or procedural pain, and some included a range of patient ages extending beyond 4 years. The review did not identify a preferred pain scale. However, two observational pain scale scores, the FLACC (Faces, Legs, Arms, Cry, and Consolability) scale and the CHEOPS (Children's Hospital of Eastern Ontario Pain Scale), showed degrees of validity, reliability, and responsiveness that may make them potentially appropriate for use. CHEOPS has been studied more extensively but the FLACC scale was reported to show greater ease of use, being a 0- to 10-point scale.[22]

Patients Four to Twelve Years Old

Based on two systematic reviews, the panel determined that the evidence supporting the use of specific self-report pain scales in children 4–12 years of age was of very low quality.[23,24] The component studies of these systematic reviews were mainly observational, mostly assessed postsurgical or procedural pain, were not conducted in the prehospital setting, and focused on psychometric properties. A systematic review by Stinson et al. looked at six self-report pain scale studies (Pieces of Hurt Tool, Faces Pain Scale (FPS), Faces Pain Scale-Revised (FPS-R), Oucher scale, Wong-Baker FACES Pain Scale, and the Visual Analogue scale), and used qualitative criteria to assess scale's psychometric properties. There was no quantitative pooling of data. All scales had literature supporting their validity, reliability, and responsiveness, though to varying degrees. Qualitatively, the authors noted the FPS-R to be "most

psychometrically sound," and scales using faces, such as Wong Baker Faces, were preferred by younger children in this age range.[23] Overall the review found that no single scale was optimal for use with all types of pain or across the developmental age span.

A second systematic review by Tomlinson et al. focused exclusively on self-report faces pain scales, given the previously established pediatric preference for this method of pain measurement.[25,26] Fourteen faces scales were identified, although ten of these were felt not to have undergone extensive psychometric testing. The four remaining scales were assessed and the number of component studies included for each was FPS ($n = 26$), FPS-R ($n = 22$), Wong-Baker FACES Pain Scale ($n = 56$), and the Oucher pain scale ($n = 29$). The investigators used numeric thresholds to assess the strength of psychometric properties though conducted no pooling of data. For each scale, the authors presented the degree of "positive evidence" and "negative evidence" for each psychometric outcome. The Wong-Baker FACES Pain Scale had the most consistent and extensive evidence supporting its validity, reliability, and responsiveness, though substantial positive evidence was noted for all scales. The review did not clearly identify one preferred pain scale, though, when given a choice, children preferred the Wong-Baker scale to the FPS and FPS-R.

Patients More Than 12 Years Old

Overall, the evidence supporting the use of specific pain scales in children greater than 12 years old is of moderate quality. In total, 12 studies informed our recommendations, although the panel placed most emphasis on the findings of a recent systematic review by Hjermsted et al.[27]

Hjermsted's team attempted to synthesize the data surrounding the Numeric Rating Scale (NRS), the Visual Analog Scale (VAS), and the VRS (Verbal Rating Scale). Their review used three primary outcomes (validity, reliability, and responsiveness) to assess which scale had the best psychometric properties, and also looked at patient compliance and user friendliness. It also assessed patient preferences, statistical methods, and a variety of other traits.

Fifty-four observational studies were included in the final systematic review. None of the component studies were conducted in the prehospital setting. Eight studies were conducted in the ED or intensive care unit, with the others being conducted in postoperative ($n = 13$), outpatient ($n = 16$), or experimental research settings ($n = 3$), or varied populations/ages/settings ($n = 14$). Of the 54 studies, 29 studies did not conclude a preference for one tool over another. Three studies recommended tools other than the NRS/VRS/VAS, while 11 studies recommended NRS due to ease of use and high compliance. Seven studies recommended VRS due to ease of use, low age-dependent failure rates, superior psychometric properties, and better responsiveness to fluctuating symptoms, while 4 studies recommended the VAS. It is imperative to note that there was marked inconsistency of interchangeability between scales. Overall, the NRS and VAS scores appeared to correspond reasonably well, except that VAS scores were uniformly higher.

Given the inconsistency in research findings, the lack of cohesive recommendations, and the absence of data specific to the prehospital setting, the EBG panel felt that no one scale could be strongly recommended. Overall, it appears that the VAS is the most frequently used, but it also has the highest reported error rates, especially in the geriatric or cognitively impaired. The NRS appears to have the most compliance, and is therefore recommended by 11 of the 54 studies. Although it appears that the NRS is useful, more rigorous prehospital studies will need to be conducted to assess the utility of these tools by patients of different ages and cognitive levels.

Given the lack of high quality evidence, the EBG panel cannot strongly recommend a specific pain assessment tool to be utilized to assess pain in the prehospital setting. Some options for consideration by EMS administrators are offered in the Recommendations section.

What Is the Basis of Suggesting Morphine and Fentanyl for Pain Control in Prehospital Trauma?

The panel reviewed the literature to determine which analgesics are proven effective and safe. Although there were a number of articles on use of nitrous oxide, methoxyflurane, tramadol, nalbuphine, and ketamine in the field or battlefield environments, the panel focused on narcotic medication agents routinely available in United States EMS systems. Emphasis was placed on intravenous and intranasal methods of administration given their shorter onset of action as opposed to intramuscular and oral analgesia.[28] Pain reduction and the prevalence of serious adverse events (SAEs), including hypotension, hypoventilation, allergy, hypoxia, and/or altered level of consciousness, were considered important outcomes. The panel considered minor adverse events (AEs), such as nausea, dizziness, bad taste, and pruritus, as outcomes of lesser importance.

The overall quality of the evidence was moderate regarding the choice of morphine and fentanyl, the route of administration, and the specific initial dose. Several high quality studies specifically addressed prehospital pain control, but the evidence base as a whole suffered from some indirectness and inconsistency. One clear

limitation was the underrepresentation of pediatric patients in the prehospital literature, owing to both the infrequency of pediatric patient encounters and the specific exclusion of this population in some studies. On the whole, inclusion and exclusion criteria varied substantially. Additionally, many studies were retrospective and did not specifically compare one route of analgesia to another. Despite these limitations, the panel determined that a strong recommendation was warranted, given the efficacy of both morphine and fentanyl, the generally low rate of adverse events in all studies, and the established importance of pain relief to patients.

Adverse events were infrequent and often not quantified, so the evidence base was of very low quality for establishing specific cautions and relative contraindications. As such, the panel suggests that EMS providers refrain from giving initial or repeat doses of narcotics should the patient have a Glasgow Coma Score of less than 15, hypoxia after maximal supplemental oxygen therapy, signs of hypoventilation, hypotension, or allergy to morphine or fentanyl. In addition, the inability to establish intravenous access and/or conditions blocking the nasal passage (e.g., profuse epistaxis) might prevent administration of analgesia as per the protocol. The weak strength of the recommendation stems from the paucity of evidence on the subject, and is not meant to undermine the importance of withholding medication should the EMS provider deem that a serious adverse event has occurred.

Safety and Efficacy

Many prehospital studies focused on efficacy and the occurrence of adverse events following the administration of opioid analgesia. Morphine and fentanyl appeared to be well tolerated and resulted in quantifiable decreases in both self-reported and objectively measured pain scores.[29–33]

Fentanyl is a versatile agent in that it can be administered via transmucosal, intranasal, and intravenous routes. It is rapid in onset (within t_{max} 5–16 min) and has duration of action up to 65 min.[34] A systematic review of intranasal fentanyl in children aged 6 months to 18 years by Mudd et al. included 188 articles from 1999 to 2010. Dosing ranged between 1 and 2 μg/kg without a significant effect on the number of adverse events reported.[35]

Several randomized trials also support the safety and efficacy of IN fentanyl, although some studies were only indirectly related to acute traumatic pain the prehospital setting. In 2007, Rickard et al. compared IN fentanyl to IV morphine for patients with cardiac and noncardiac pain. Both medications were found to be safe and there was no significant difference in analgesic efficacy.[36] A similar study by Borland et al. randomized children to IN fentanyl or IV morphine for the treatment of suspected long bone fractures. Both agents reduced pain significantly at across all time intervals, and there were no statistically significant differences between them. Furthermore, the children in this study received a mean IN fentanyl dose of 1.7 μg/kg and no serious adverse events were reported.[37] In an emergency department study using higher doses, Furyk et al. randomized children with clinically suspected extremity fractures to receive fentanyl 4 μg/kg IN or morphine at 0.2 mg/kg IV. Both groups experienced a significant reduction in pain, and the difference in effect of IN fentanyl versus IV morphine did not reach statistical significance but favored IN fentanyl. There were no major SAEs in this trial.[38] Younge et al. randomized 47 patients to IN fentanyl at 1 μg/kg or morphine sulfate 0.2 mg/kg IM in the ED setting. Intranasal fentanyl was more effective than IM morphine at 10 minutes, although the result did not reach statistical significance ($p < 0.14$).[39] Randomized controlled trials comparing morphine sulfate with various agents identified similar safety profiles and effectiveness.[19,40,41]

A number of observational studies in prehospital and emergency department settings have evaluated the efficacy and safety of fentanyl and morphine.[29–32,42,43,44] These studies uniformly showed that fentanyl and morphine compare favorably to one another in both the reduction of pain and lack of adverse events. In 2006, Kanowitz et al. conducted a retrospective chart review of 2,129 patients who were administered fentanyl in an out-of-hospital setting and concluded fentanyl was effective in decreasing pain scores without causing substantial hypotension, respiratory depression, hypoxia, or sedation.[45] Other pediatric emergency department based studies reported similar efficacy and safety results.[37,38,46]

Doses

Studies looking at IV or IN fentanyl generally used 1–2 μg/kg, although dosing up to 4 μg/kg was used for IN fentanyl. Dosing for morphine was less commonly reported on a mg/kg basis. In a randomized trial of fentanyl and morphine in the prehospital setting, Galinski et al. demonstrated that doses of 1 μg/kg of IV fentanyl and 0.1 mg/kg of IV morphine sulfate had similar efficacy and lack of adverse events in adults and children. In adults, Rickard et al. demonstrated that fentanyl 180 μg IN and morphine sulfate 2.5–5.0 mg IV were equally effective in reducing pain.[29,36] Borland et al. used 1.7 μg/kg of fentanyl and 0.1 mg/kg IV of morphine in a randomized trial comparing the two agents.[42] As such, the EBG panel strongly recommended dosing regimens of 1 μg/kg IV or IN for fentanyl and 0.1 mg/kg IV for morphine. The panel acknowledges the studies demonstrating

the safety and efficacy of fentanyl at higher doses, but upon consideration of evidence felt that 1 μg/kg of fentanyl was the most reasonable starting point.[35,43] Future high quality studies are needed to further delineate the optimum dosing for both morphine and fentanyl.

Routes

The guideline's recommendations focused on intravenous and intranasal routes of administration, as they were the most frequently studied in the prehospital literature and have the shortest onset of action.[28,31–33,35] There were few direct comparisons made between IV morphine and IV fentanyl, although a number of studies compared IN fentanyl with IM or IV morphine.[29–32,36] Intravenous administration was the most commonly researched route for fentanyl, but in a few observational studies, intranasal delivery appeared to be safe, effective, and less painful than intravenous cannulation.[36]

While the panel acknowledges the potential value of administering analgesia via intraosseous access, there was little evidence in the prehospital literature to inform a recommendation.[47] Indirect evidence from other care settings (i.e., emergency department, inpatient) supports the efficacy of intraosseous analgesia, so this route might be further considered in individual EMS jurisdictions for patients in which intravenous and intranasal analgesia is impractical. Certainly EMS providers would need to weigh the discomfort of gaining intraosseous access against the potential pain relief for the traumatic injury in question.

On What Basis Do We Justify Our Recommendations Regarding Repeat Doses of Analgesics?

Recognizing that a single dose of any analgesic agent may not completely relieve pain for many patients, the expert panel evaluated criteria for administering repeat doses. A number of studies have documented safe and effective redosing strategies for patients with traumatic painful conditions in the field. In 2008, Bounes et al. recommended a redosing strategy of 0.05 mg/kg every 5 min for patients with pain unrelieved by an initial dose of 0.1 mg /kg of morphine sulfate.[19] More recently, Bendall et al. described the use of inhaled methoxyflurane, IN fentanyl, and IV morphine for almost 100,000 patients with painful conditions treated in the prehospital setting in Australia. Redosing regimens ranged from 2 to 10 minutes, with 2 minutes for morphine boluses in adults to 5- to 10-minute intervals for fentanyl doses in children.[31] A prehospital study by Garrick et al. described interval dosing of 5 minutes for IV or IM fentanyl and 3–5 minutes for patients receiving morphine sulfate in the prehospital setting.[30]

Overall, a moderate level of evidence supported the frequent reassessment of patients with acute traumatic pain using validated pain scales. Intervals varied significantly in the literature, but reassessment every 5 minutes appears to be the most common and is both practicable and safe. Despite the limitations of the literature base, the panel felt that the critical importance of pain relief and the low likelihood of adverse events supported a strong recommendation. For the same reasons, the panel issued a strong recommendation to give repeat doses of analgesia to patients who are found after reassessment to have significant ongoing pain, despite the low quality of supporting evidence for redosing. Although the panel felt the ability to reassess a patient's pain and redose pain medication was important, there was even less consistent evidence justifying specific redosing amounts, so the panel issued a weak recommendation to redose at half the initial dose.

What Are Possible Barriers to Implementation and Evaluation of the Guideline?

The panel identified logistical and systemic barriers to the implementation of this guideline. Practically speaking, administration of morphine as per the guideline will require intravenous cannulation, meaning that ease of venous access and EMS provider training will possibly affect implementation. Concerns regarding the initiation of IV access might be a particular concern in the pediatric population.[48] This is not an issue with fentanyl, as it can be safely and readily administered by the IN route. EMS systems will need to purchase atomizers for IN administration that may incur additional costs. Another logistical challenge might be the reassessment of pain using a validated scale every 5 minutes, particularly in multisystem trauma where the EMS provider might have many other responsibilities. Attitudinal change might be necessary for some providers, given the common misconception that analgesia could interfere with the assessment of head and abdominal injuries.[11]

Other challenges to implementation might occur at the system level. Some EMS systems currently require direct online medical direction in order to administer analgesia. Although it has been shown that paramedics can safely administer narcotics, lingering concerns regarding safety and appropriateness might remain without specific educational interventions. Also, the lack of a strongly recommended standard scale for assessing pain means that regional systems will need to contextualize the recommendation regarding use of a validated scale to their region's needs.

In evaluating the guideline, the lack of coordinated data networks can pose a significant problem.

Disparate electronic patient care reporting methods can interfere with ongoing quality improvement. Indeed, EMS systems should adopt data collection practices that are consistent across jurisdiction and interface with the hospital patient care report.

What Are the Strengths and Limitations of This Guideline?

This EBG represents one of the first attempts to use the GRADE framework to inform care recommendations for prehospital analgesia. All efforts possible were made to use transparent and explicit processes when creating this guideline. However, the lack of high quality randomized controlled trials and systematic reviews in some areas resulted in fairly low assessment of evidence quality for most GRADE profiles. The lack of a reference standard to assess pain represents a barrier to performing additional studies.

What Further Research Is Needed?

After their review of the literature, the authors identified several areas where additional research might improve the standard of care for prehospital traumatic pain. These include

1) The development of prehospital-friendly pain assessment tools useful in diverse patient populations
2) The treatment of pain in patients with cognitive impairment and/or altered level of consciousness
3) The treatment of pain in children with special health-care needs
4) The use of other agents (i.e., ketamine) in the treatment of prehospital traumatic pain
5) Optimal dosing and redosing regimens for morphine and fentanyl
6) Adequate comparisons of morphine and fentanyl by various routes, including the intraosseous route
7) The use of oral analgesics for pain control in the prehospital setting

Conclusions

This evidence-based guideline offers guidance for EMS system leaders to establish protocols for the assessment and treatment of pain in the prehospital setting. This guideline highlights the importance of pain management and has the potential to improve meaningful outcomes for patients by allowing for rapid cessation of pain. Narcotic agents such as morphine sulfate 0.1 mg/kg IV and fentanyl 1 μg/kg IV and IN are preferred agents in U.S. EMS systems and offer pain relief along with an acceptable safety profile.

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SUPPLEMENTARY MATERIAL AVAILABLE ONLINE

Appendix A: Literature Search Strategies

Appendix B: Evidence Tables

Appendix C: GRADE Tables

Supplementary contents can be viewed and downloaded at http://informahealthcare.com/pec.