

ORIGINAL ARTICLES

IMPACT OF LIBERALIZATION OF PROTOCOLS FOR THE USE OF MORPHINE SULFATE IN AN URBAN EMERGENCY MEDICAL SERVICES SYSTEM

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ABSTRACT

Objective. To investigate the impact of liberalization of paramedic management protocols for the use of morphine sulfate (MS). **Methods.** A retrospective database analysis tallied and categorized MS use into seven conditions during two intervals—six months before (control) and six months after (study) the protocol change. **Results.** In the control interval, 760 of 34,020 (2.2%) patients received MS. In the study interval, 999 of 30,320 (3.3%) received the drug, a 50% relative increase in MS use. MS use dramatically increased in two assessment categories: other painful medical conditions (19.0% vs. 2.8% of transports, relative risk [RR] 6.8, 95% confidence interval [CI] 5.2–8.9) and nontraumatic abdominal pain (9.2% vs. 1.9% of transports, RR 4.8, 95% CI 3.3–6.9). **Conclusion.** Liberalization of pain management protocols resulted in an appreciable increase in the use of MS only in medical categories, predominantly abdominal pain, with no apparent safety or misuse issues. **Key words:** morphine; emergency services; medical; prehospital emergency care; analgesia.

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Relief of pain is an important intervention performed by hospital personnel.^{1,2} Less emphasis has been placed on pain management by emergency medical services (EMS) systems, perhaps because of short transport times in urban areas, reluctance by physician medical directors to encourage administration of analgesics, and issues pertinent to the storage, use, and documentation of controlled substances.

There is no question that, even for well-recognized indications, patients in the EMS setting are undertreated for painful conditions.^{3,4} This fact is not terribly sur-

prising considering that oligoanalgesia has been widely reported in the emergency department environment.^{5,6}

EMS protocols commonly permit the administration of morphine sulfate (MS) or other parenteral analgesics for extremity fractures, burns, or cardiac chest pain, and as an adjunct prior to cardioversion or transcutaneous pacing. However, in the policies of many, if not most, EMS systems, either the administration of narcotic analgesics is not permitted for other painful conditions or a base hospital physician may administer these drugs only upon approval.

The study's primary goal was to determine the impact of an expansion of the indications for use of MS on the numbers and types of EMS patients receiving MS. Secondly, we sought to investigate the use of morphine in patients with nontraumatic conditions, particularly abdominal pain.

METHODS

Alameda County, California, includes the cities of Oakland and Fremont and is in the metropolitan San Francisco area. The population is approximately 1.5 million. The EMS system is an all-advanced life support model, and in most locations a first-responder fire engine staffed by at least one paramedic is met several minutes later by a transport unit with an equal configuration. The three dispatch centers receive approximately 110,000 EMS calls per year, and about 80,000 patients are transported to the county's 13 acute care hospitals.

The California state paramedic scope of practice includes the use of injectable MS. All Alameda County paramedics are trained in intravenous and intramuscular administration of morphine. Based on information in the literature⁷ that demonstrated the safety and efficacy of MS for patients with abdominal pain, the county's pain management policies were expanded on December 1, 2002. The change was prompted by input from both hospital and field providers. The county's three trauma center medical directors approved the

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TABLE 1. Alameda County Emergency Medical Services Pain Management Policy Indications for Morphine Sulfate (MS)

| Before December 1, 2002 | December 1, 2002–Present |
|---|--|
| <p>Adults (maximum dose 10 mg)</p> <p>MS may be given to any patient with the following:</p> <ul style="list-style-type: none"> • Significant isolated extremity injuries (e.g., fractures, lacerations, dislocations, significant muscle spasms) • Crush injuries—use caution if other major traumatic injuries are suspected • Burns—preferred route of medication administration for patients with significant burns is intravenous <p>MS should be given judiciously in patients with the following as it may mask other serious symptoms:</p> <ul style="list-style-type: none"> • Conditions not covered in this policy • Systolic blood pressure <90 mm Hg • Depressed respirations <p>MS should not be given to patients with the following unless paramedics consult with the base hospital:</p> <ul style="list-style-type: none"> • Head injuries • Abdominal pain • Potential intra-abdominal or intrathoracic trauma | <p>Adults (maximum dose 15 mg)</p> <p>MS may be given to any patient with a complaint of significant pain, including:</p> <ul style="list-style-type: none"> • Significant extremity injuries • Burn • Crush injury • Prolonged extrication • Severe back and spinal pain • Immobilization • Abdominal pain • Total prehospital time ≥ 10 minutes <p>MS may be given to critical trauma patients with:</p> <ul style="list-style-type: none"> • Abdominal trauma • Thoracic trauma <p>MS should not be given to patients with the following unless paramedics consult with the base physician:</p> <ul style="list-style-type: none"> • Head trauma • Decreased respirations • Altered mental status • Labor (women) • Systolic blood pressure <90 mm • Total prehospital time <10 minutes • Patients with pain not covered above |
| <p>Children (14 years or less) (maximum dose 5 mg)</p> <p>MS may be given to any patient with the following:</p> <ul style="list-style-type: none"> • Significant isolated extremity injuries (e.g., fractures, lacerations, dislocations, significant muscle spasms) • Crush injuries—use caution if other major traumatic injuries are suspected • Significant burns <p>MS should not be given to patients with the following unless paramedics consult with the base hospital:</p> <ul style="list-style-type: none"> • Age <6 months • Head injuries • Abdominal pain, or potential intra-abdominal or intrathoracic trauma • Blood pressure outside normal limits (see Length Base Resuscitation Tape) • Depressed respirations • Conditions not covered in this policy | <p>Children (14 years or less) (maximum dose 5 mg)</p> <p>MS may be given to any patient with a complaint of significant pain, including:</p> <ul style="list-style-type: none"> • Significant extremity injuries • Burn • Crush injury • Severe back and spinal pain • Immobilization • Abdominal pain • Total prehospital time ≥ 10 minutes <p>MS should not be given to critical trauma patients with the following unless paramedics consult with the base physician:</p> <ul style="list-style-type: none"> • Abdominal trauma • Thoracic trauma • Head trauma • Decreased respirations • Altered mental status • Total prehospital time <10 minutes • Pain not covered above • Blood pressure outside normal limits (see Length Base Resuscitation Tape) |

changes at a regular meeting in June 2002. The indications for the administration of MS to adults and children (aged 14 years and less) before and after the policy change are shown in Table 1.

The study was a retrospective chart review for all patients who received MS for the six-month period prior to the change in policy (June 1, 2002–November 30, 2002; control interval) and for a corresponding six-month period the year after the change in policy (June 1, 2003–November 30, 2003; study interval). Only patients from the county's principal transport provider (approximately 65,000 transports per year) were included in the review.

The review categorized the indications for administration of morphine into seven patient conditions: trauma, nontraumatic abdominal pain, congestive heart failure/pulmonary edema, cardiac chest pain, burns, procedural analgesia (cardioversion and tran-

scutaneous pacing), and other medical indications. The trauma category included: blunt assaults, bicycle accidents, bites/stings, falls, motor vehicle accidents, recreational/sports injuries, penetrating trauma, and other. The nontraumatic abdominal pain category was subdivided into nine categories: suspected urolithiasis, pancreatitis, hernia, appendicitis, cholelithiasis/cholecystitis, diverticulitis, obstetric/gynecologic problems, other/unknown, and not specified. The other medical indications category included painful conditions not falling into the other six categories. Medics were required to complete an age-appropriate pain assessment scale prior to and 10 minutes following the administration of morphine. Data for this study was provided by the Clinical and Educational Services Department and were accessed both from the Quality Improvement Clinical Network (QUICNET) System and from American Medical Response, the county's

principal EMS transport provider. Relative risk (RR) and confidence interval (CI) statistics were derived using StatCalc (AcaStat Software, Ashburn, VA). The database from which the study information was obtained contained no patient identifiers. Information about safety, dosage, and complications was collected from the Alameda County EMS unusual occurrence database. Exempt status was obtained from the local Alameda County Medical Center institutional review board.

RESULTS

Of 34,020 patients transported in the control interval, 760 (2.2%) received MS. During the study interval, of 30,320 patients transported, 999 (3.3%) received MS. This represented a 50% relative increase in MS use. The control interval patients were 55.3% male and had a mean age of 49.3 years (range 8 months to 96 years). The study interval patients were 45.2% male and had a mean age of 49.1 years (range 13 months to 99 years). Table 2 shows MS use by category in both the control and study intervals and, where available, as a percentage of total transports for the category. Table 3 provides a subcategorical breakdown of trauma indications in both intervals. In the other medical indications category, 154% more patients received MS in the study interval than in the control interval. In this category patients received MS in 19% of transports during the study interval vs. 2.8% in the control interval (RR 6.8, 95% CI 5.2–8.9). MS use in the nontraumatic abdominal pain category increased by 470% in the study interval. Patients received MS in 9.2% of transports in this category during the study interval vs. 1.9% in the control interval (RR 4.8, 95% CI 3.3–6.9) These increases were, by far, the largest in any categories between the two intervals. Table 4 breaks down MS use in the nontraumatic abdominal pain category.

DISCUSSION

Recently, increased awareness has been focused on the importance of pain management, particularly in the

TABLE 3. Numbers and Percentages of Patients Receiving Morphine Sulfate in the Trauma Category

| Category | Control Interval | Study Interval |
|------------------------------|------------------|----------------|
| Blunt assaults | 16 (3.5%) | 8 (1.7%) |
| Bicycle accidents | 16 (3.5%) | 10 (2.1%) |
| Motor vehicle accidents | 33 (7.2%) | 48 (10.5%) |
| Bites/stings | 1 (0.0%) | 2 (0.0%) |
| Falls | 207 (45.2%) | 243 (50.5%) |
| Recreational/sports injuries | 17 (3.7%) | 25 (5.2%) |
| Penetrating traumas | 9 (2.0%) | 9 (1.9%) |
| Other | 159 (34.7%) | 136 (28.3%) |
| Total | 458 | 481 |

hospital environment. Citing the fact that unrelieved pain results in costs approaching \$100 billion per year, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) instituted new standards for hospitals' use in treating pain.^{8,9} These policies require, among other components, that patients' pain be assessed and recorded, that staff be trained in pain assessment and management, that policies and procedures be in place regarding the ordering of pain medications, and that patients and their families be educated in the hospital, and upon discharge, regarding pain management.⁹

Research suggests that failure to initially control pain and aggressively manage it may result in an increase in future pain and possible functional and or structural central nervous system changes.¹⁰ For years, medical students have been exposed to *Cope's Early Diagnosis of the Acute Abdomen*. Even the 2005 edition admonishes against the use of pain medications in abdominal conditions until an attending surgeon has assessed the patient.¹¹ Fortunately, the literature in the last ten years has shown that intravenous analgesia not only does not impair the ability of physicians to evaluate and treat patients with abdominal pain, but also indeed may facilitate the examination and diagnosis.^{12–14}

In a concise summary of the literature that debunks the advice in Cope's text, Brewster, and colleagues state that "early and appropriate pain relief for patients with acute abdominal pain is humane, does not adversely affect diagnostic acumen or clinical decision making, and

TABLE 2. Numbers and Percentages of Patients Receiving Morphine Sulfate (MS)

| Category | Control Interval | | | Study Interval | | | RR | 95% CI |
|--|------------------|------------------|------|----------------|------------------|------|-----|-----------|
| | MS Transports | Total Transports | % | MS Transports | Total Transports | % | | |
| Other painful medical indication not specified | 67 | 2,380 | 2.8 | 170 | 893 | 19.0 | 6.8 | (5.2–8.9) |
| Nontraumatic abdominal pain | 33 | 1,723 | 1.9 | 150 | 1,637 | 9.2 | 4.8 | (3.3–6.9) |
| Trauma | 458 | 7,329 | 62 | 481 | 6,163 | 7.8 | 1.2 | (1.1–1.4) |
| CHF/PE | 23 | 134 | 17.2 | 19 | 117 | 16.2 | 0.9 | (0.5–1.7) |
| Cardiac chest pain | 135 | NA | | 118 | NA | | | |
| Burns | 23 | 52 | 44.2 | 21 | 42 | 50.0 | 1.1 | (0.7–1.7) |
| Procedures | 0 | NA | | 2 | NA | | | |
| Unable to locate record | 21 | NA | | 38 | NA | | | |
| Total transports, all categories | 760 | 34,020 | 2.2 | 999 | 30,320 | 3.3 | 1.5 | (1.3–1.6) |

RR = relative risk; CI = confidence interval; CHF/PE = congestive heart failure/pulmonary edema; NA = data not available.

TABLE 4. Numbers and Percentages of Patients Receiving Morphine Sulfate in the Nontraumatic Abdominal Pain Category

| Category | Control Interval | Study Interval |
|--------------------------------|------------------|----------------|
| Nephrolithiasis | 13 (39.4%) | 23 (15.3%) |
| Pancreatitis | 3 (9.1%) | 6 (4.0%) |
| Hernia | 2 (6.1%) | 5 (3.3%) |
| Cholelithiasis/cholecystitis | 1 (3.0%) | 15 (10.0%) |
| Diverticulitis | 1 (3.0%) | 2 (1.3%) |
| Appendicitis | 0 (0%) | 6 (4.0%) |
| Obstetric/gynecologic problems | 2 (6.1%) | 12 (8.0%) |
| Other/unknown/unspecified | 11 (33.3%) | 81 (54.0%) |
| Total | 33 | 150 |

should be considered part of the initial management of every such patient."¹³

Many EMS systems, including ours, have removed the unnecessary burden of requiring a base physician's approval prior to the administration of narcotics.³ In our EMS system, base physician approval was and is required for nonlisted indications (Table 1). The indications for administration of morphine in the medical category were varied. Some examples included back pain, headache, and terminal illness. This category and the nontraumatic abdominal pain categories were the only ones in which there was an appreciable increase in the administration of morphine between the two time period studies.

LIMITATIONS

Inferences garnered from a chart review were limited by that methodology and the documentation provided by the field personnel. The results are only for one transport provider in Alameda County; however, this provider transports more than 80% of all patients. Wide ranges of socioeconomic conditions and demographics are represented by this provider's patient contacts. The medics were limited to a total of 15 mg (5 mg in children) of morphine without being required to contact a physician. There were no incidents of morphine-related complications during the study intervals, either for prehospital or hospital personnel. Alameda County EMS experienced no incidents and received no disciplinary actions related to MS in either interval. The adequacy of the dosages and the patients' assessments of pain relief were not tallied. The number of total transports in the "other painful medical indications" category appreciably decreased between the two intervals. This category represents a "catch-all" for patients whose assessments do not "fit" in another, better defined category.

However, in mid study in 2002, information garnered from a chart review revealed that many of the paramedics' categorizations should have been assigned to a more specific assessment. Training that reinforced the need for indicating the correct category on the QICNET form was conducted in autumn 2002. This fo-

cused education most likely accounted for the drastic decrease in MS use in the "other painful medical indications" category. This fact, of course, confounded the results. The number of "unable to locate record" cases increased from 21 (2.8%) MS cases in the control interval to 38 (3.8%) MS cases in the study interval. This was due to an inability to physically locate these charts rather than a failure in documentation.

The vast majority of the total transports for the two intervals were in the "nonpainful medical illness" category, not included in the analysis in this report. Among other conditions, this category included breathing problems, nausea, seizures, behavioral illnesses, diabetes, fever, gastrointestinal bleeding, poisonings/overdoses, cerebrovascular accident, vomiting, and weakness, conditions for which pain medications are generally not indicated.

CONCLUSION

The study demonstrates that expansion of indications for the use of MS for paramedics in an urban area resulted in increased use in the nontraumatic medical patient category. This increased use was specifically predominant in patients with abdominal pain. Relief of pain should receive the same emphasis in the prehospital arena as it does in the hospital environment. More study is indicated to further delineate the indications and impact of perpetual pain medications in out-of-hospital care.

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