EDITORIAL

PRIMUM NON NOCERE—FIRST DO NO HARM:

AN IMPERATIVE FOR EMERGENCY MEDICAL SERVICES

Primum non nocere. First do no harm. This is one of the most basic tenets of medical care. Do not make the patient's condition worse with your interventions. As the specialty of emergency medical services (EMS) enters its fourth decade, many of its practices that have been accepted and promoted have only recently been challenged. Just as emergency medicine is adopting an evidence-based approach, EMS must do the same.

There has never before been such a need for "outcomes"-based research. The following sections describe three high-risk EMS practices that must undergo such study. Recent literature for each of these topics begs the question, is EMS following the "first do no harm" mantra, or is it merely operating on past practice despite preliminary evidence to the contrary?

EMERGENCY/CODE 3 RESPONSE

In 2004, many EMS systems still dispatch all resources via "emergency" response, also known as "lights and siren" or "code 3" response. No one believes that the use of lights and siren automatically gives an ambulance or fire engine the right of way. With the virtual soundproofing of late-model vehicles, along with cell phones and additional distractions inside modern passenger cars, motorists often do not hear or see emergency vehicles until they are dangerously close. In fact, a recent television commercial for a popular pickup truck demonstrated this by effectively muting the sound of an emergency air horn siren by the act of closing the driver's side window. When motorists do finally hear the siren or see the lights, they may panic and brake suddenly, rather than slowly pull to the right to allow the emergency vehicle to pass safely.

What are EMS systems accomplishing by running lights and siren to every call? The intent is to get resources on scene as quickly as possible so that time-critical, lifesaving interventions can be provided. Unfortunately, EMS administrators, fire chiefs, and politicians all too often judge their EMS systems by their response times. The shorter the duration from the time of alarm until a resource is on scene, the better the system. At least, that's what one might be led to believe.

Several studies have evaluated just how much time is actually saved by responding with lights and siren. The time savings varied from only a few seconds to less than 2 minutes.[1,2] While these studies were done in suburban areas or medium-sized cities, it remains to be seen just how much time is saved in the nation's major urban areas, where traffic congestion is considerable. Even if a few minutes are saved, the question is, does this time savings result in a decrease in morbidity or mortality?

A relatively small percentage of EMS calls require any form of advanced life support (ALS), let alone time-critical interventions. Can we identify those few life-threatening situations so that we prioritize *only* those calls for a lights and siren response?

Priority (tiered) dispatch is a well-established practice.[3–5] Personnel trained as emergency medical dispatchers ask the callers a series of carefully scripted questions to determine the nature of the problem, what types of resources are needed, and the type of response that is warranted, and to provide certain prearrival instructions. The effective use of priority dispatch results in the dispatch of fewer resources to incidents, and minimizes unnecessary emergency responses.

Every aspect of patient care should be approached in terms of risk versus benefit. According to the Centers for Disease Control and Prevention, ambulance crashes cost an estimated $500 million each year in the United States. From 1991 to 2000, there were 300 fatal crashes involving ambulances, the majority of which occurred during emergency responses.[6] Ambulances are 13 times more likely to be involved in an accident than other vehicles in terms of the number of accidents per miles driven, and are also five times more likely to be involved in a crash that causes an injury.[7] The best way to decrease these crashes may be to simply decrease the number of code 3 responses.

Newspaper series have documented the daily occurrence of ambulance crashes in the United States.[8,9] The daily depiction of the

carnage on our nation's roadways demands action. As with any dangerous practice, the loss of innocent lives begs the question, is there not a better way? How many more incidents in which an innocent motorist loses his or her life from crashing into a speeding ambulance going to a noncritical patient will we tolerate before we collectively say "enough is enough"?

What if only the closest resource or first responder responded with lights and siren? Surely, getting the closest would-be rescuer with an automated external defibrillator (AED) and means of ventilatory support [bag–valve–mask (BVM) or mask] should suffice for the majority of calls. The ambulance [either ALS or basic life support (BLS)] can then be added on request of the on-scene resource, or be dispatched via non-emergency response at the time of initial dispatch. Some fire department–EMS providers have added one paramedic to their engine companies, so that the first responders now include ALS capability.[10]

Despite the logic, the literature, and the daily newspaper articles describing the latest ambulance crashes and untold human suffering that results, many EMS systems continue to send everyone code 3 to everything. The law enforcement community has recognized the danger, limiting its emergency responses to the point of even severely curtailing pursuits.[11] For a system that was created to save lives, when is EMS going to wake up and stop the preventable loss of life resulting from its practices?

Rapid-sequence Intubation

The literature in many areas of EMS suffers from a lack of controls. Many "studies" evaluating a particular intervention or device typically find that emergency medical technicians or paramedics are able to properly use the device or administer the medication, thus leading to the conclusion that it must be beneficial to the patient. The paradigm that "if something is beneficial for patient care in the emergency department setting, then it must be a good thing in the prehospital arena" must be challenged.

The use of rapid-sequence intubation (RSI) medications is a prime example of this faulty logic. Merely memorizing the basic pharmacology, dosages, and contraindications behind the medications involved does not make them safe. Knowing when *not* to administer succinylcholine is at least as important as knowing when to give it. How many paramedics in large systems truly possess the experience and training to know the difference? How many patients will each paramedic encounter who are candidates for RSI? How many times per year does a paramedic need to perform this skill in order to become or remain proficient? To many of us in the EMS arena, the recently reported results from San Diego's RSI study were not surprising.[12] Rather than having a handful of highly trained individuals with expertise in this very risky intervention, all 500 paramedics in the system were trained via eight hours of didactics and manikin practice. Then they were permitted to "hit the streets" with their RSI cocktails.

The results bring to mind the phrase that while they "won the battle, they lost the war." Paramedics were able to administer the correct dosages of the RSI drugs and intubate their patients 84% of the time, or insert a Combitube 15% of the time.[13] However, their on-scene times doubled! Mortality rates, as compared with those of historical controls, increased.[12] Do we want our multitrauma patients in the field for 26 minutes to get intubated via RSI or have these patients at the trauma center in half that time to receive definitive care by a multidisciplinary team? Certainly, if a patient is exsanguinating from a splenic rupture, the additional 13 minutes on scene required to perform RSI would be better spent in providing rapid transport to the closest trauma center with BVM ventilation en route.

Despite the recent publication of the results of the San Diego RSI trial, and the lack of *any* published controlled studies on RSI, this practice continues in many EMS systems. While it is easy to merely discard the results of one study due to perceived system weaknesses or methodological flaws, it is incumbent upon every EMS medical director who oversees a system where RSI is performed to closely examine this practice. The mere fact that an endotracheal tube is successfully placed in the trachea of a trauma patient in the field does not guarantee that the patient did not have prolonged periods of hypoxemia, hypercarbia, or hypotension, or prolonged on-scene times.[14]

As we finally learned after many years of using military antishock trousers (MAST), it is easy to misinterpret improvement of prehospital vital signs as being indicative of improved patient outcome.[15] How many systems using RSI have closely evaluated all of these parameters? Just as the Food and Drug Administration assigns a "black box" designation to certain medications when the potential for harm is considered to be unacceptable, should we assign a "black box" warning to prehospital RSI?

Pediatric Intubation

Many EMS systems have allowed their paramedics to perform prehospital endotracheal intubation (ETI) on children for many years.[16] To date, only one randomized controlled clinical trial has compared prehospital ETI in children with the use of BVM.[17] This study found that prehospital ETI provided no benefit to children in respiratory failure from any etiology. Furthermore,

children with prehospital ETI had worse outcomes in several subgroups. Despite the provision of qualitative end-tidal carbon dioxide detectors to confirm endotracheal tube placement, compliance with these devices was an appalling 75%. Of 186 patients in whom intubation was believed successful, three (2%) were esophageally intubated, 12 (6%) suffered unrecognized dislodgment of the endotracheal tube en route to the ED, 15 (8%) experienced recognized dislodgment of the endotracheal tube, 33 (18%) received main-stem intubation, and 44 (24%) were intubated with a tube of the incorrect size.[17]

As with RSI, the literature from other systems in which pediatric prehospital ETI is performed merely documents the "success rates," i.e., the percentage of tubes successfully placed.[18–21] Without any controls, the potential adverse effects of prehospital ETI cannot be measured.

SUMMARY

Unlike the response to landmark studies in other disciplines of medicine, the few existing controlled, randomized EMS studies have not led to any calls for "moratoriums" on the practices in question. Why haven't they?

It is all too easy to continue to dismiss the negative results of studies from a system other than our own. The paramedics in the system studied were not as well trained, were not as closely supervised, or did not have adequate medical oversight; the study was flawed, etc. Any or all of these variables may be true. A particular system may be safely performing one of the practices in question. However, the published results of any study that finds a high-risk practice to be more harmful than beneficial should immediately mandate the close examination of the practice in each and every system. To do otherwise is in direct conflict with the mission of EMS, and minimizes the value of the lives of the people in the communities who depend on us. First do no harm . . . is anyone listening?

MARC ECKSTEIN, MD
Keck School of Medicine
University of Southern California
Department of Emergency Medicine
Los Angeles County/University of Southern California Medical Center
Los Angeles Fire Department
Los Angeles, California

References

1. Brown LH, Whitney CL, Hunt RC, et al. Do warning lights and sirens reduce ambulance response times? Prehosp Emerg Care. 2000;4:70–4.
2. Ho J, Casey B. Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment. Ann Emerg Med. 1998;32:585–8.
3. Clawson JJ, Dernocoeur KB. Prinicples of Emergency Medical Dispatch. Salt Lake City, UT: National Academy of Emergency Medical Dispatch, 2000.
4. Slovis CM, Carruth TB, Seitz WJ, et al. A priority dispatch system for emergency medical services. Ann Emerg Med. 1985;14:1055–60.
5. Zachariah BS, Pepe PE. The development of emergency medical dispatch in the USA: a historical perspective. Eur J Emerg Med. 1995;2:109–12.
6. Ambulance crash-related injuries among emergency medical services workers—United States, 1991–2002. MMWR. 2003; 52:154–6.
7. Biggers WA, Zachariah BS, Pepe PE. Emergency medical vehicle collisions in an urban system. Prehosp Disaster Med. 1996;11:195–201.
8. Davis R. Speeding to the rescue can have deadly results. USA Today. 2002;Mar 21:01A.
9. EMSNetwork Ambulance Crashes '03. Available at: http://www.emsnetwork.org/artman/publish/cat_index_13.shtml. Accessed June 24, 2004.
10. Assessment Unit. Reference 416. Los Angeles, CA: Department of Health Services, County of Los Angeles, 2000.
11. Los Angeles 2000 Police Department Pursuit Policy, Special Order No. 24, Aug 7, 1998, Los Angeles, CA: Los Angeles Police Department, 1998.
12. Davis DP, Hoyt DB, Ochs M, et al. The effect of paramedic rapid sequence intubation on outcome in patients with severe traumatic brain injury. J Trauma. 2003;54:444–53.
13. Ochs M, Davis D, Hoyt D, et al. Paramedic-performed rapid sequence intubation of patients with severe head injuries. Ann Emerg Med. 2002;40:159–67.
14. Davis DP, Dunford JV, Ochs M, et al. Inadvertent hyperventilation following paramedic rapid sequence intubation of severely head-injured patients [abstract]. Acad Emerg Med. 2003;10:446.
15. Mattox KL, Bickell W, Pepe PE, et al. Prospective MAST study in 911 patients. J Trauma. 1989;29:1104–12.
16. Stratton SJ, Underwood LA, Whalen S, et al. Prehospital pediatric endotracheal intubation: a survey of the United States. Prehosp Disaster Med. 1993;8:323–6.
17. Gausche M, Lewis RJ, Stratton SJ, et al. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome: a controlled clinical trial. JAMA. 2000;283:783–90.
18. Brownstein D, Shugerman R, Cummings P, Rivara F, Copass M. Prehospital endotracheal intubation of children by paramedics. Ann Emerg Med. 1996;28: 34–9.
19. Sirbaugh PE, Pepe PE, Shook JE, et al. A prospective, population-based study of the demographics, epidemiology, management, and outcome of out-of-hospital pediatric cardiopulmonary arrest. Ann Emerg Med. 1999;33:174–84.
20. Pointer JE. Clinical characteristics of paramedics' performance of pediatric endotracheal intubation. Am J Emerg Med. 1989;7:364–6.
21. Aijian P, Tsai A, Knopp R, Kallsen GW. Endotracheal intubation of pediatric patients by paramedics. Ann Emerg Med. 1989;18:489–94.