Published in final edited form as:

Ann Intern Med. 2015 November 3; 163(9): 721–722. doi:10.7326/M15-2192.

Is Prehospital Advanced Life Support Harmful?

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Each year in the United States, approximately 21 million persons call 911, are evaluated by emergency medical services (EMS), and are transported to emergency departments (EDs) for potential medical emergencies (1). Of these, approximately 35% are related to injuries or chest, respiratory, or neurologic symptoms and more than one third of all patients aged 65 years or older are transported to the ED by ambulance (1, 2). Ambulance transport to the hospital is a common and costly intervention.

At the time of a 911 call, the dispatcher must quickly determine if basic or advanced care is needed, often with little clinical information. Matching the appropriate level of care (that is, basic life support [BLS] or advanced life support [ALS]) to the undifferentiated patient in the prehospital setting is complex and requires both an understanding of the efficacy and effectiveness of prehospital interventions and the availability of EMS resources.

For potentially life-threatening conditions, many EMS agencies in urban settings deploy ALS services rather than BLS services; they assume ALS paramedics have more clinical training, a broader skillset, and larger therapeutic armamentarium. It is easy to believe ALS is more effective than BLS in the prehospital setting based on these assumptions. But the level of training, extent of quality assurance, and overall experience vary tremendously between individual paramedics and EMS systems, and the effectiveness of ALS remains uncertain in the prehospital setting. Further, there may also be an opportunity cost associated with using ALS transport when it is not needed.

In this issue, Sanghavi and colleagues (3) report the results of a well-conducted study examining the relationship between levels of care provided in the prehospital setting (ALS or BLS) and mortality for 4 time-sensitive conditions: acute myocardial infarction, respiratory failure, stroke, and trauma. The investigators used claims data from a random sample of Medicare beneficiaries living in nonrural U.S. counties. Given the retrospective observational design, prehospital care was not randomly assigned. As such, the authors

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Disclaimer: The views expressed are those of the authors and do not necessarily represent those of the American Heart Association or the National Institutes of Health.

Disclosures: Disclosures can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M15-2192.

performed multivariable analyses, including propensity score matching and instrumental variable analysis, to account for both measured and unmeasured characteristics that may confound the relationship between the level of prehospital care and mortality.

Using propensity score matching, the authors found no benefit of ALS compared with BLS. In 3 of the 4 conditions (respiratory failure, stroke, and trauma), the estimates suggested potential harm when patients were transported by ALS providers. The 90-day survival rate was higher with BLS than ALS for respiratory failure (3.7 percentage points [95% CI, 2.5 to 4.8 percentage points]), stroke (7.0 percentage points [CI, 6.2 to 7.7 percentage points]), and trauma (6.1 percentage points [CI, 5.4 to 6.8 percentage points]). No survival difference was found for patients with acute myocardial infarction at 30 days (−0.3 percentage point [CI, −1.1 to 0.5 percentage points]), but patients had better survival with ALS at 90 days (1.0 percentage point [CI, 0.1% to 1.9 percentage points]). In instrumental variable analyses, the 90-day survival rate was significantly higher for BLS versus ALS for acute myocardial infarction (5.9% percentage points [CI, 2.2 to 9.6 percentage points]), stroke (4.3 percentage points [CI, 1.3 to 7.3 percentage points]), and trauma (4.1 percentage points [CI, 1.3 to 6.9 percentage points]) but not for respiratory failure (0.2 percentage point [CI, −4.7 to 5.1 percentage points]).

Further, ALS transport was associated with better survival in patients with chest pain. The American Heart Association guidelines for patients with ST-segment elevation myocardial infarction recommend percutaneous coronary intervention within 90 minutes from a patient's arrival at the ED (4). Prehospital activation of the catheterization laboratory decreases the time to percutaneous coronary intervention (5) and decreases mortality (6). The potential benefit of ALS care may be attributed to prehospital providers having more expertise to read electrocardiograms and activate the catheterization laboratory earlier.

This study raises important questions about the effectiveness of prehospital care, but the conclusions must be viewed with caution. First, prehospital care was determined using Medicare billing codes and not the actual prehospital care provided. The authors postulate iatrogenic injury or delayed care due to ALS providers staying on the scene longer, but none of this information was included. Second, although geographic distance from site to hospital was included, the actual response, scene, and transport times were unknown. Third, the only clinical information included in the analysis was adjustment for comorbidities (based on diagnosis codes) and injury severity score. Procedure codes for cardiopulmonary resuscitation, defibrillation, or intubation were not included. These codes may be important surrogates for the severity of illness and other potential confounders between prehospital care and mortality. Fourth, only Medicare beneficiaries were included, with a mean age of 80 years, which makes it difficult to generalize the results to the population at large. Finally, all patients were in nonrural settings in which prehospital care accounts for approximately 20 to 30 minutes of the entire timeline (from the 911 call to 2-year survival in this study).

Although the authors conclude that there may be harm with prehospital ALS, we believe that there may not be added benefit of ALS over BLS based on the study's limitations and prior research. Further, it is very unlikely that ALS is harmful. Prior prospective, implementation research by Stiell and colleagues (7, 8) showed no additional benefit (but no harm) of ALS

compared with BLS for patients with cardiac arrest or trauma. Sanghavi and colleagues further postulate that BLS may be sufficient and more cost-effective, even for patients with potentially life-threatening conditions. In urban settings, where EMS volume is high and transport intervals are short, many patients probably do not benefit from prehospital treatment. In contrast, those who benefit probably do so from basic interventions that BLS providers can perform, such as defibrillation or basic airway management. Although these basic interventions improve patient outcomes, it is difficult to find advanced interventions that do the same, especially in urban areas with short transport times. The benefits of ALS may be more apparent in rural areas with longer transport times.

Therefore, relatively little is known about the added effectiveness, if any, of prehospital ALS over BLS in urban settings. The current study highlights the need for additional research that uses clinical, administrative, and financial data to help EMS systems better determine the appropriate level of care for patients before hospital arrival. It is unlikely that ALS truly harms patients; rather, such care may be useful to patients who are more ill and unstable or whose conditions deteriorate rapidly. We must further refine the use of ALS transport to match the right level of care to the right patient at the right time.

Acknowledgments

The authors thank Christopher B. Colwell, MD; Kevin E. McVane, MD; Peter T. Pons, MD; and Rose Marie Robertson, MD, for their input during the conceptual development of this article.

Grant Support: In part by the National Institutes of Health (R01AI106057; Dr. Haukoos).

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