Out-of-Hospital Intubation of Children

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In this issue of The Journal, Gausche and colleagues1 report survival and neurological outcomes for pediatric patients treated out of hospital with bag-valve-mask ventilation (BVM) compared with patients treated with BVM followed by endotracheal intubation (ETI). The authors found no difference in the outcomes of the 2 groups and identified significant complications in patients receiving ETI. These findings challenge national consensus that ETI should be in the scope of practice of the emergency medical services (EMS) provider.

The peer-reviewed publication of this study has been eagerly anticipated by the EMS community. Its results have been published in abstract form,2 debated at national emergency medicine forums,3 and included for consideration at a recent consensus conference on prehospital care.4

The study is noteworthy for a number of reasons. First, the magnitude of effort invested in this study is herculean. The investigators obtained institutional review board approval from 115 separate institutions, obtained funding from 6 state and federal grants, and procured equipment donations from multiple manufacturers. It took 2 years and 614 six-hour courses to train more than 3000 paramedics from 56 provider agencies staffing 325 rescue units.5,6 Second, while many will describe the results as counterintuitive, this study bravely questions an assumption on which out-of-hospital emergency care is weakly based, that the advanced life support skills performed in hospital can be performed safely and effectively out of hospital and should be included in the scope of practice of out-of-hospital medical personnel. Third, the investigators used, and demonstrated the importance of, the principal of intention-to-treat for categorization and comparison of outcomes. Finally, the investigators used a multidimensional approach; in addition to the clinical questions addressed in the article, the project evaluated the effects of a specific educational model on paramedic skills, skill retention, and self-efficacy, and also assessed the cost of providing the education.

It is particularly encouraging to see educational research being performed along with clinical research. The Pew Commission has recommended that health professional "schools' missions should be broadened beyond biomedical questions to include inquiry in health services and education issues."6 More assumptions may be made about the outcomes of educational interventions than about clinical interventions. The study by Gausche et al offers insight on how one may impact the other.

The results of one aspect of the study raise a question about the strength or validity of the conclusions regarding the primary clinical question. In a separate article, the researchers reported that paramedics' skills in performing BVM and ETI "deteriorated substantially within 6 months after training."7 Considering that it took 2 years to provide the necessary training prior to beginning the clinical study, it is possible that the majority of the 3000 paramedics who were trained were no longer competent to perform either ETI or BVM in children. Most of those who were trained did not have the opportunity to use these skills in the nearly 3 years of the study. Other than self-report, there was no formal evaluation of the paramedics' BVM skill performance. Moreover, only 83% of the patients who received BVM and 82% of those who received ETI were reported to have good chest rise, suggesting inadequate ventilation for some patients in both groups. If both BVM and ETI were performed poorly, it may be expected that no difference would be seen when comparing them. In addition, end-tidal carbon dioxide monitors were used in only 77% of patients who were intubated and were not used continuously during transport.

An additional concern is that there was no evaluation of the method used to secure the endotracheal tubes. The authors also note a relatively low ETI success rate and suspect that the number of esophageal intubations was underreported. In a review of invasive airway techniques, Pepe et al8 noted that "regardless of the device used, recognition of proper placement remains the most important aspect of using any invasive airway device. Therefore, proper training and expert medical supervision probably have more influence on the successful use and impact of these devices than any other method."

See also p 783.

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factors related to the devices themselves. Consensus from a prehospital care conference was that “it is essential that emergen-
cy medical personnel not only use verification devices to
check initial tube placement, but also use ongoing monitor-
ing to be sure that the tube remains in place during transport.”

In addition, the investigators assumed that competence dem-
strated on mannequins in a classroom setting predicts com-
petence in the practice environment of a paramedic. How-
ever, it is unclear whether paramedics are able to perform
single-person BVM for a child in a moving ambulance simply
by having demonstrated competency on a stationary rigid man-
nequin. The authors state that “mannequin-based training has
been previously validated for adult intubation.” However, the
single study referenced, performed in the Los Angeles sys-

tem by many of the same investigators, specifically stated that
the data were not adequate to reach this conclusion and com-
pared mannequin to human cadaver intubation training. The
recent consensus conference concluded that “there is no cur-
rent replacement for training experience with living human
beings.” However, there is little if any evidence to support
this belief. Moreover, while the cited mannequin vs cadaver
study had the same rate of esophageal intubation in adults as
Gausche et al found in children, these results did not cause
the authors to question whether adult ETI should be in the
scope of practice for the paramedic.

Like most important studies, that of Gausche et al gener-

ates more difficult questions than solid answers. Do these
results apply to the airway management of children only?
Katz et al found that 25% of adult patients transported to
a level I trauma center following out-of-hospital intuba-
tion by paramedics had improperly placed endotracheal
tubes, 67% of which were placed in the esophagus. This
alarming finding resulted in a “local reevaluation of out-of-
hospital intubation protocols, training, and practices.”

Whether there is an “acceptable” rate of complications, in-
cluding esophageal intubation, and if so, how such a rate is
determined, remains unanswered.

Other important questions generated from the study of
Gausche et al include: Can these findings be generalized to
all EMS systems? If not, what are the characteristics of the
systems that create differences in the skills that are within
the scope of practice and the competence of its out-of-
hospital personnel? Is it possible to maintain competency in
invasive procedures that are performed infrequently? Is pos-
ible, is it cost-effective to do so? Is there a willingness to ac-
ccept the inevitable complications of performing or withhold-
ing treatment? Does training and experience in one invasive
skill (ETI) increase competency in another, such as use of
Magill forceps for foreign body removal? The public might
be surprised to learn that EMS provider training is not stan-
dardized from one locale to the next, that EMS personnel are
not required in most states to graduate from a nationally ac-
ccredited school, and that all program graduates are not re-
quired to pass a national “board” or credentialing examina-
tion to demonstrate competency. Assuming that standardized

quality education and credentialing provide a sound basis for
licensure, it would seem that the absence of these factors cre-
ates a “buyer beware” position for many communities. The
National Highway Traffic Safety Administration has re-
cently emphasized the need to address this issue.11,12

A related issue is whether competence and skill mainte-
nance for airway management in children is a problem only
in the out-of-hospital environment. If this study were re-
peated in the emergency departments of the many hospi-
tals involved in this study, would the results be different?
Care provided in the emergency department, during inter-
hospital transfers, and during subsequent hospitalization cer-
tainly may have influenced outcomes. Literally hundreds of
emergency physicians evaluated the success and complica-
tion rates of the intubations performed by paramedics. There
was no standardized approach or evaluation tool used by
these physicians and little is known about the abilities or
biases of the physicians involved, suggesting a potential for
interrater reliability concerns.

Although the study by Gausche et al does not definitively
answer the question for every EMS system, it does provide
evidence suggesting that out-of-hospital ETI should not be
performed for children in EMS systems with characteristics
similar to those in the study. However, to conclude that out-
of-hospital ETI for children should not be performed in any
system based on this single study is premature. The investi-
gators deserve much credit for pointing out that the onus is
on the medical directors of EMS systems that continue per-
forming ETI and other invasive skills out of hospital to dem-
strate to the public through research that each of these
procedures is reasonably safe and effective.

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