Traumatic injuries result in more years of productive life lost than any other disease and represent the main cause of death among young people. Despite the public health importance of trauma, there have been few advances in early resuscitative care over the past several decades. In this issue, Stiell and colleagues provide us with an important investigation into the relation between advanced prehospital care and outcomes from traumatic injury. Stiell and colleagues used a before-and-after design to document the change in survival with implementation of an advanced life-support program. Their analysis is part of the Ontario Prehospital Advanced Life Support (OPALS) project, which has emerged as perhaps the most important and comprehensive investigation into prehospital resuscitation yet performed.

Advanced life-support includes the theoretical advantages of advanced assessment, invasive management of airways and administration of intravenous fluids and medications. However, the first OPALS analysis failed to document a survival benefit with advanced life-support among patients with cardiac arrest. The second analysis documented improved survival following implementation of an advanced life-support program among prehospital patients with respiratory distress. In the present analysis, involving trauma patients, Stiell and colleagues found no significant change in overall survival to hospital after implementation of the advanced life-support program (82% among 1373 patients during the basic life-support phase and 81% among 1494 patients during the advanced life-support phase), a finding confirmed by their logistic regression analysis. Furthermore, their planned subgroup analyses showed a significant increase in mortality during the advanced life-support phase among patients with suspected head injury, as defined by a Glasgow Coma Scale (GCS) score of 3–8 (40% with basic life-support v. 49% with advanced life-support).

Stiell and colleagues speculate that endotracheal intubation and positive-pressure ventilation associated with advanced life-support may be partly responsible for the increase in mortality. So, should prehospital intubation in patients with severe traumatic injuries be removed from the paramedic scope of practice?

Although the axiom “GCS 8, intubate” is ubiquitous in emergency medicine, this concept has little substantive evidence to support such an aggressive approach to airway management. Early animal studies and postmortem pathological investigations revealed ventilatory dysfunction to be an important mediator of morbidity and mortality in patients with head injury. Observational analyses using large trauma registries, such as the seminal work by Chesnut and colleagues in 1993, confirmed an association between early hypoxia and death from traumatic brain injury. However, it is less clear that these associations justify early intubation in the presence of traumatic coma.

Several authors have used registry data to explore the relation between prehospital intubation and outcome from traumatic brain injury. Eckstein and colleagues documented increased mortality among patients with severe head injury who underwent prehospital intubation compared with patients who received bag-valve-mask ventilation before being transported to an urban trauma centre. Murray and associ-
Commentary

Physiologic impact of early airway events

To understand the apparent discrepancies with regard to the role of intubation, with or without the use of medications, in the early management of traumatic brain injury, it is useful to consider the physiologic impact of early airway events and how they might affect the injured brain. Although early respiratory dysfunction is certainly part of severe head injury, it is unclear whether emergency medical services can perform intubation and reverse hypoxemia before significant hypoxic injury has occurred. In addition, noninvasive modalities to improve oxygenation may be as effective as intubation in most patients. Similarly, the loss of airway-protective reflexes is likely associated with severe head injury. However, aspiration events appear to occur immediately following the injury, before the arrival of paramedics, and recent evidence suggests that the presence of an endotracheal tube itself may increase the risk of aspiration pneumonia. Furthermore, the act of performing laryngoscopy may lead to a rise in intracranial pressure that can exacerbate the primary injury.

The way forward

Although the article by Stiell and colleagues represents a provocative challenge to our assumptions about resuscitation, I would caution against concluding that advanced life-support protocols have been postulated as an explanation for the apparent adverse effect of intubation on survival from traumatic brain injury is the potentially harmful effects of supranormal oxygen levels. A recent analysis using data from our trauma registry revealed an association between both hypoxemia and hyperoxemia and increased mortality (unpublished data). This relation was independent of intubation and ventilation status, although the partial pressure of oxygen on arrival was higher in patients in whom intubation had been performed than in patients who did not undergo intubation. Improved equipment, such as the use of quantitative capnometry or mechanical ventilators, may avoid hypocapnia or hyperoxemia. Finally, inadequate training and the relative infrequency with which intubation is performed by prehospital providers has been postulated as an explanation for the apparent adverse effect on survival. How these factors affect optimal performance of the technique or how they influence the frequency of physiologic insults, such as hyperventilation, is unclear.
plain these associations and work toward optimizing performance before contracting the scope of practice for ourprehospital providers. Perhaps optimizing performance of the technique through better training or limiting the practice to experienced providers can eliminate the adverse impact and allow patients to benefit from definitive airway control and improved oxygenation. Better selection of patients to undergo prehospital intubation may also help avoid unnecessary exposure to a potentially harmful procedure, and improved equipment may help avoid insults such as desaturation or hyperventilation.

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Correspondence to: Dr. Daniel P. Davis, Department of Emergency Medicine, University of California San Diego, 8676-200 W Arbor Dr., San Diego CA 92007, USA; fax 619 543-3115; davismd@cox.net