Prehospital End Tidal CO2 as a predictor of Mortality and Massive Transfusion in Trauma

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Retrospective

The determination of injury severity has been the subject of many studies in the hospital setting. Unfortunately, many of these risk scores require diagnostic and laboratory testing that is not available or practical in the prehospital setting. Despite significant effort, sensitive and specific indicators of injury severity in the prehospital setting are still lacking. Traditional vital signs and calculations of such (such as shock index) remain the mainstay of prehospital risk assessment. Prehospital end tidal carbon dioxide (ETCO2) is a quick and easy technology with equipment readily available on most ground and all air ambulances in the United States. This would make this potentially an ideal modality for risk assessment if predictive.

Low levels of expired end tidal carbon dioxide have been shown to be predictive of mortality and massive transfusion in trauma patients in the hospital setting. Recent small single center trials suggest that ETCO2 measured in the prehospital setting are predictive of mortality. Unfortunately, these studies have not been large enough to determine if these deaths are due to hemorrhage, traumatic brain injury, or other causes. A multicenter study would be ideal to elucidate any predictive value in ETCO2 for the need for massive transfusion and death with the ability to control for traumatic brain injury. A multicenter trial would also add external validity to these single center studies. This study would also identify appropriate cutoff values to be used in future prospective studies.

Determine if prehospital end tidal carbon dioxide values are predictive of mortality in trauma patients.
1. Determine if prehospital end tidal carbon dioxide values are predictive of hemorrhagic death in trauma patients.

2. Determine if prehospital end tidal carbon dioxide values are predictive of massive transfusion in trauma patients.

Inclusion Criteria
All patients intubated in the prehospital setting for trauma
Age <15, prisoners

Exclusion Criteria

Therapeutic Interventions
None, retrospective observational study only.

Primary Outcome
Mortality
Number of blood products transfused in first 24 hours
Mortality from hemorrhage

Secondary Outcomes
Need for emergent operative intervention for hemorrhage control

List specific variables to be collected & analyzed
Demographics; prehospital, admission and OR physiology; admission and first 24 hour lab values; prehospital ETCO2 values; ED ETCO2 values; operative procedures; hospital outcomes; ventilator days; ICU days; blood product transfusion data; injury severity scores; ventilator data

Outline the data collection plan and statistical analysis plan succinctly
We hypothesized that prehospital EtCO2 is predictive of death and massive transfusion. The lowest EtCO2 value collected prehospital will be assessed for predictive performance for MT and mortality using generalized estimating equations to account for clustered data by hospital. The Youden Index will be used to determine the best cutoff of prehospital EtCO2 to predict these outcomes and estimate predictive values of a positive and negative. We will conduct stratified analysis by shock, TBI, higher ISS, sex, and advanced age.

Outline consent procedures here, if applicable
Not Applicable, this is a retrospective study with minimal risk, data will be collected under Consent and HIPAA Waiver as it would be unfeasible to consent all past patients. Many of these patients have expired, and all have been discharged from the hospital.

Succinctly outline a risk/benefit analysis
Institutional Review Board will be obtained by all institutions individually participating in this study. This is a retrospective, minimal risk study. There is no intervention conducted. The only risk is therefore that of a breach of confidentiality, which is small. This will be minimized by sites obtaining Data Use Agreements (at the discretion of their privacy/research offices) if applicable, and transmitting a Limited Data Set including date of injury as the single PHI variable.

Include a brief listing of key references
