

PaCO₂-EtCO₂ gradient and misclassification in trauma patients with prehospital arterial catheters: A UK Helicopter Emergency Medical Service case series.

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Improving patient outcomes

Introduction

Current guidance recommends using end-tidal carbon dioxide (EtCO₂) as a surrogate for PaCO₂ to guide ventilation strategy when arterial blood gas (ABG) sampling is less readily available in resource-constrained settings, such as prehospital. The EtCO₂ is recommended to be maintained between 4.0-4.5 kPa, and the accepted gradient between the PaCO₂-EtCO₂ is 0.5-1.0 kPa. This study aimed to **quantify the PaCO₂-EtCO₂ gradient in trauma patients receiving prehospital arterial catheterisation** and assess the frequency of clinically relevant misclassification of PaCO₂ based on the EtCO₂.

Methods

This retrospective observational study included adult patients (≥18 years old) who underwent prehospital arterial catheterisation following trauma and who were subsequently conveyed to the Emergency Department (ED) of the regional Major Trauma Centre (MTC), 01.02.2015-17.04.2023.

EtCO₂ measurements were matched within five minutes of the prehospital ABG sample. Hypocapnoea was defined as <4.0 kPa, normocapnoea as 4.0-6.0 kPa, and hypercapnoea as >6.0 kPa. Misclassification was defined as a discrepancy between the EtCO₂ and PaCO₂ categories (e.g., one indicating normocapnoea and the other hypocapnoea or hypercapnoea).

Results

53 trauma patients with prehospital arterial catheter placement and a corresponding prehospital ABG were identified. Pre-hospital sampling was undertaken within two hours of injury, and on average, this occurred approximately an hour earlier than ED ABG sampling (Table 1). **The PaCO₂-EtCO₂ gradient was more than 1.0 kPa different in most patients (43/53, 81.1%), and the EtCO₂ misclassified the PaCO₂ in over two-thirds of patients (38/53, 71.7%).**

Conclusion

This study observed that PaCO₂-EtCO₂ gradient was frequently greater than the accepted gradient of 0.5-1.0 kPa, and the EtCO₂ often misclassified the PaCO₂. **Overall, EtCO₂ is not a reliable surrogate for PaCO₂ in guiding ventilator settings in trauma.** Clinicians should be mindful of this and consider ABG sampling when available.

 **53** Patients  **42** (79.2%) Male **57** Median age

Clinical need	Descriptive statistics
ISS, median [IQR]	29 [25-38]
Pre-hospital shock index, median [IQR]	0.95 [0.64-1.22]
Head and neck, n (%)	46 (86.7%)
Isolated head injury, n (%)	17 (32.1%)
Intubated at time of blood gas, n (%)	51 (96.2%)
Mortality, n (%)	16 (30.2%)
Timings	
Injury time to blood gas measurement in minute, median [IQR]	86 [75 -114]
Injury time to hospital blood gas measurement in minutes, median [IQR]	147 [131 -178]
Pre-hospital CO ₂ values	
PaCO ₂ , median [IQR]	5.8 [5.3-6.9]
EtCO ₂ , median [IQR]	4.1 [3.8-4.5]
PaCO ₂ -EtCO ₂ gradient, median [IQR]	1.7 [1.2-2.6]



43 (81.1%)
>1.0 kPa difference



38 (71.7%)
misclassified

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