Hypotension after Prehospital Emergency Anaesthesia for Isolated Traumatic Brain Injury

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Introduction & Background

- Traumatic Brain Injury (TBI) is a leading cause of death and disability in the Australian pre-hospital trauma patient. [1]
- Primary neurological injury is compounded by secondary insults to the brain; those sustained during treatment if key neuroprotective parameters (for example, blood pressure) are not maintained. [2]
- Peer-reviewed literature indicates systolic blood pressure below 110mmHg in isolated moderate-to-severe TBI is associated with worsened morbidity and mortality. [3]
- PreHospital Emergency Anaesthesia (PHEA) is key to neuroprotection in many patients with moderate to severe TBI, but hypotension is a frequent complication. [4]

Aims

- This study examines the rates and determinants of hypotension (SBP<110mmHg) within the first 10minutes following PHEA, in a mature Australian Prehospital & Retrieval Medicine organisation, operating a physician-paramedic/nurse model.

Methods

- Retrospective, Observational Cohort Study
- 10yrs of data (1st May 2015-1st May 2025)
- Data from LifeFlight Medical Services AirMaestro Database,
- AM entry and Casesheet/Zoll printout data collection
- Ethics Approval (HREC/2025/QTDD/117614)

Inclusion Criteria

- Adult patient ≥18yrs
- PHEA performed by LifeFlight Team
- Isolated Moderate-to-Severe TBI suspected on prehospital clinician assessment, by:
  - Findings indicating head trauma
    AND
  - GCS 3-12
    AND
  - Low suspicion of other major vital organ injury

Exclusion Criteria

- Paediatric patient <18yrs
- Patients in cardiac arrest or with Non-drug assisted intubation
- Polytrauma patients

Results

Demographics

Number of patients included	391		
Mean Age (yrs)	43.6 (19)		
Gender M:F:Unknown	294 (75.2%)	94 (24.0%)	3 (0.8%)
Primary : Interfacility Transfer	286 (73.1%)		105 (26.9%)
Rotary wing : Road : Fixed Wing	298 (76.2%)	65 (16.6%)	28 (7.2%)
Mean treatment time before intubation (mins)	30.1 (15)		
Mean treatment time after intubation (mins)	55.5 (26)		
Mean total mission duration (hrs)	4.2 (1.95)		

Indication for PHEA	
Threatened airway	291 (74.4%)
Agitation	118 (30.1%)
Anticipated clinical course	116 (29.7%)
Face/neck trauma	93 (23.7%)

Mechanism of Injury	n (%)
MVA	118 (30.3%)
Fall from standing height	55 (14.1%)
Fall from >2 m	39 (10.0%)
Hanging	31 (7.9%)

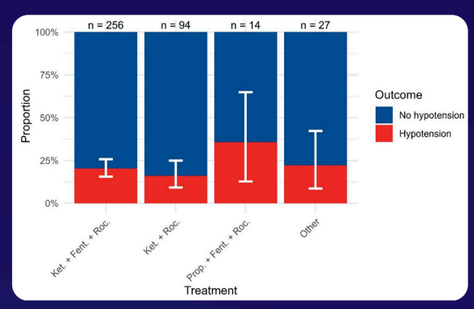
Results Cont.

Primary Outcome

Rates of Hypotension (SBP <110mHg) within 10mins following PHEA for isolated TBI according to drug dose combinations and weight-based dosing

Hypotension (SBP<110mmHg)	N N = 313[1]	Y N = 78[1]	p-value[2]
Treatment			0.3
Ket. + Fent. + Roc.	204 / 256 (80%)	52 / 256 (20%)	
Ket. + Roc.	79 / 94 (84%)	15 / 94 (16%)	
Prop. + Fent. + Roc.	9 / 14 (64%)	5 / 14 (36%)	
Other	21 / 27 (78%)	6 / 27 (22%)	

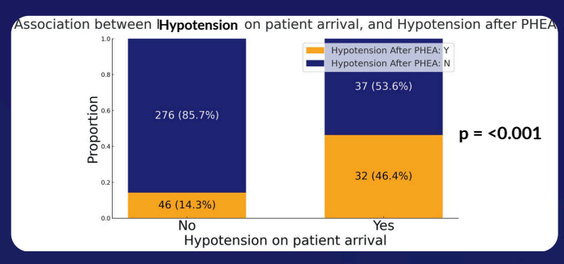
[1] n / N (%)
[2] Fisher's exact test

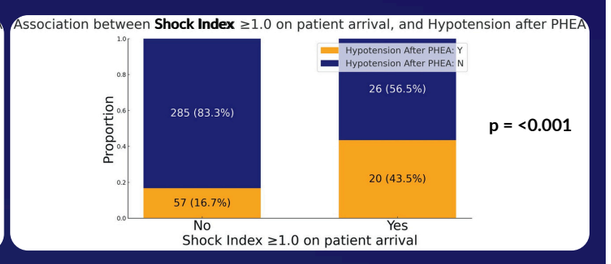


No statistically significant association between induction drug combination and hypotension after PHEA. Multivariate regression analysis found no statistically significant association between drug combination, weight based dosing and hypotension after PHEA.

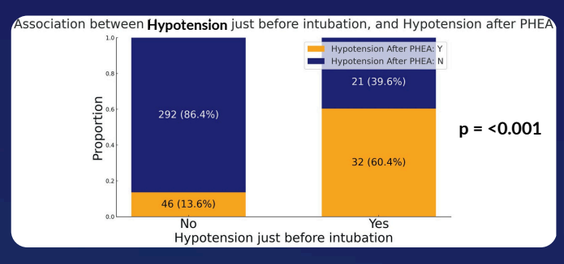
Secondary Outcomes

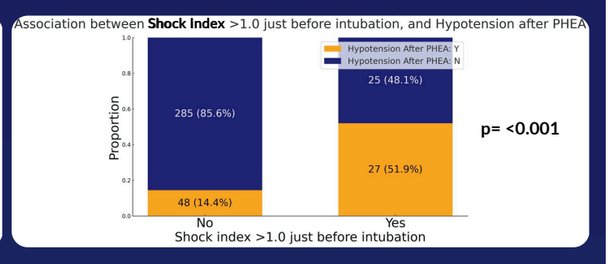
At patient arrival, association between Hypotension or Shock Index ≥1.0 with Hypotension after PHEA





Just before intubation, association between Hypotension or Shock Index ≥1.0 with Hypotension after PHEA





In addition to the above, initial analysis demonstrated statistically significant association between Raised ICP and female gender with hypotension after PHEA.

However significant associations between these cases was explored in a multivariate regression analysis. This reported that the below variables demonstrated statistical significance in their association with hypotension after PHEA:

Variable	Odds Ratio	CI	P-value
Hypotension on Patient Arrival	2.08	(0.981-4.24)	0.048
Hypotension just Before Intubation	4.75	(2.16-10.5)	<0.001
Shock index >1.0 just Before Intubation	3.36	(1.60-6.95)	<0.001

Discussion & Conclusion

Drugs, doses and haemodynamics

- There was no association between drug combination, weight based dosing, and hypotension after PHEA.

- Likely represents non-interventional nature of the study, with non-standardised, clinician elected drug choices and doses tailored to the patient as a confounder. Rather than indicating no impact of induction agent on haemodynamics, this likely highlights the product of careful clinician-tailored drug and dose decisions in a critically ill patient cohort.

Early Hypotension, Shock index risk hypotension after PHEA

- Significant association between Hypotension at patient arrival, and Hypotension & Shock Index >1.0 just prior to intubation, with hypotension after PHEA. Odds Ratios for hypotension after PHEA of 2.08, 4.75 and 3.36, respectively, were demonstrated.

- Both highlight a critical priority - The sickest TBI patients require utmost efforts to optimise haemodynamics prior to PHEA. Further study is required to identify if haemodynamic optimisation or raised ICP treatment prior to PHEA can avoid hypotension after induction.

Study Limitations

- Retrospective observational studies cannot elucidate causation, and positive findings are hypothesis generating. Care should be taken interpreting and extrapolating these results.
- Efforts have been taken to control for known confounders during data and statistical analysis, but unseen confounders can impact results due to a lack of randomisation.
- Database and CaseSheet data collection can introduce recall bias, particularly in unblinded studies.

Financial Declaration:
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