Challenging Convention: A Secondary Data Analysis of Circulation-First Versus Airway-First Triage in Trauma Patients Receiving Blood Transfusions

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INTRODUCTION

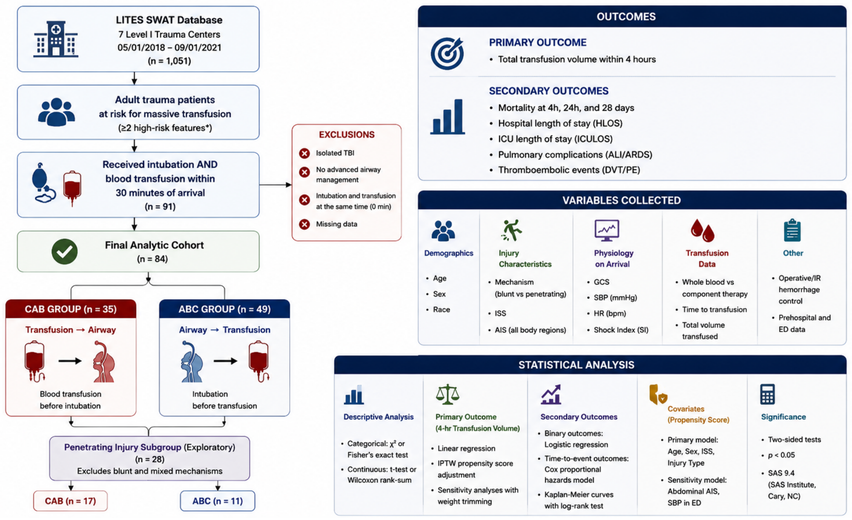
TRADITIONAL ABC *Airway, Breathing, Circulation*		CAB APPROACH *(Catastrophic Hemorrhage First*		MARCH (MILITARY) *Military Trauma Life Support Priorities*	
A AIRWAY	• Ensure patent airway • Cervical spine protection	**C** CATASTROPHIC HEMORRHAGE CONTROL	• Identify and control life-threatening hemorrhage • Tourniquet / Direct pressure • Pelvic binder • Hemostatic agents	**M** MASSIVE HEMORRHAGE	• Identify life-threatening bleeding • Control with direct pressure, tourniquet, hemostatic dressings, or pelvic binder
B BREATHING	• Assess breathing • Provide oxygen • Treat life-threatening thoracic injuries	**A** AIRWAY	• Ensure patent airway • Cervical spine protection	**A** AIRWAY	• Open and maintain airway • Consider c-spine control
C CIRCULATION	• Control external bleeding • Establish IV/IO access • Assess perfusion • Fluid/blood resuscitation	**B** BREATHING	• Assess breathing • Provide oxygen • Treat life-threatening thoracic injuries	**R** RESPIRATION	• Assess and treat breathing • Ventilate as needed, decompress chest if indicated
				C CIRCULATION	• Assess perfusion (pulse, BP, cap refill) • IV/IO access, fluids, blood products as needed
				H HYPOTHERMIA / HEAD INJURIES	• Prevent heat loss • Evaluate and treat head injuries

- Hemorrhage is the leading cause of preventable trauma death, accounting for up to 80% of such deaths in both civilian and military settings. [3-9]
- Intubation and sedation can worsen hemorrhagic shock — mechanical ventilation reduces preload, and induction agents/analgesics blunt compensatory vasoconstriction.[12-14]
- A 2025 meta-analysis found CAB reduced mortality vs. ABC in patients with exsanguinating injuries.[15]
- Injury mechanism matters → penetrating injuries often see faster transport/fewer field interventions and differ physiologically from blunt trauma, suggesting CAB/MARCH may already suit penetrating injury.[18,20]

HYPOTHESIS

Injured patients resuscitated with a circulation-first approach would require fewer blood transfusions within the first four hours and would have lower mortality over those managed with an airway first approach.

MATERIALS AND METHODS



Demographic and injury characteristics for all injury patterns

Characteristic	CAB (n = 35)	ABC (n = 49)	p
Age, y, median	29	26.5	0.92
Sex, m, n (%)	62.9	73.4	0.3
Injury			0.02
Blunt (%)	42.9	73.5	
Penetrating (%)	48.6	22.5	
Both (%)	8.57	4.08	
Transfer origin			0.06
Scene (%)	71.4	87.8	
Outside emergency department (%)	28.6	12.2	
ISS, median [IQR]	27.0 [22.0 – 35.0]	34.0 [25.0 – 45.0]	0.2
Traumatic brain injury (CT diagnosed), (%)	34.3	65.7	0.25
Glasgow Coma Scale, median [IQR]	3.0 [3.0 – 3.0]	3.0 [3.0 – 3.0]	0.34
Systolic blood pressure in ED, mmHg, median [IQR]	92.0 [80.0 – 125]	82.0 [60.0 – 109]	0.31
Heart rate, bpm, median [IQR]	119 [100 – 137]	125 [99 – 142]	0.86
Whole blood in the receiving hospital (remainder had component blood), (%)	74.3	73.5	0.93
Whole blood before the receiving hospital (remainder had component blood), (%)	48.6	75.5	0.02

Demographic and injury characteristics for penetrating injuries

Characteristic	CAB (n = 17)	ABC (n = 11)	p
Age, y, median	33	37	0.85
Sex, m, n (%)	58.8	81.8	0.25
Transfer origin(%)			1
Scene	70.6	72.7	
Outside emergency room	29.4	27.3	
ISS, median [IQR]	25.0 [16.0 – 33.0]	26.0 [16.0 – 33.0]	1
Traumatic brain injury (CT diagnosed), (%)	5.88	0	1
Glasgow Coma Scale, median [IQR]	3.0 [3.0 – 3.0]	3.0 [3.0 – 3.0]	0.45
Systolic blood pressure in ED, mmHg, median [IQR]	122.5 [83.0 – 134]	109 [90.0 – 121]	0.68
Heart rate, bpm, median [IQR]	119.5 [109 – 137.5]	125 [77 – 135]	0.75
Whole blood in the receiving hospital (remainder had component blood), (%)	70.6	63.6	1
Whole blood before the receiving hospital (remainder had component blood), (%)	64.7	27.3	0.12

RESULTS

Primary outcomes

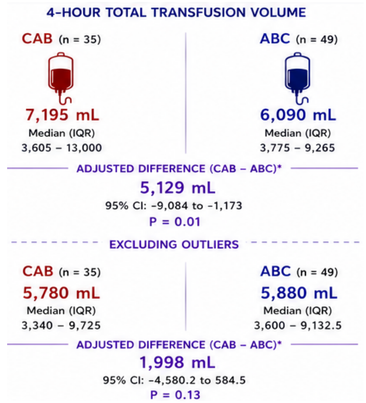


Table 1 Primary outcome of interest by resuscitation sequence, excluding patients with isolated TBI

Secondary outcomes

Outcome	CAB (n = 35) Median (IQR) or n (%)	ABC (n = 49) Median (IQR) or n (%)	Unadjusted OR / HR (95% CI)	P Value
4-h mortality, n (%)	2 (6.06%)	5 (10.6%)	0.54 (0.09 – 3.13)	0.49
24-h mortality, n (%)	4 (12.1%)	6 (12.8%)	0.94 (0.24 – 3.78)	0.93
28-d mortality, n (%)	6 (17.1%)	14 (28.6%)	0.52 (0.17 – 1.56)	0.24
ICU length of stay, days Median (IQR)	7.5 (3.0 – 28.0)	8.0 (3.0 – 15.0)	0.96 (0.06 – 6.04)	0.78
Hospital length of stay, days Median (IQR)	18 (7 – 42)	14 (7 – 31)	1.06 (0.63 – 1.80)	0.82
Pulmonary complications (ALI/ARDS), n (%)	6 (17.1%)	6 (12.2%)	0.69 (0.15 – 3.08)	0.62
Thromboembolic events (DVT/PE), n (%)	6 (17.1%)	8 (16.3%)	0.94 (0.27 – 3.10)	0.92

Table 2 Secondary Outcomes by Resuscitation Sequence, excluding patients with isolated TBI

Primary and secondary outcomes for penetrating trauma

Outcome	CAB (n = 17) Median (IQR) or n (%)	ABC (n = 11) Median (IQR) or n (%)	Unadjusted OR / HR (95% CI)
4-h blood volume, mL	5,780 (3,340 – 10,155)	4,930 (3,425 – 7,985)	5,604 (-938.0 – 12,145)
4-h mortality, n (%)	1 (6.25%)	1 (9.09%)	1.5 (0.07 – 34.8)
24-h mortality, n (%)	1 (6.25%)	1 (9.09%)	1.5 (0.07 – 34.8)
28-d mortality, n (%)	2 (11.8%)	1 (9.09%)	0.75 (0.05 – 11.7)
ICU length of stay, d Median (IQR)	5.0 (2.5 – 27.0)	4.0 (2.0 – 6.0)	8.44 (1.10 – 15.8)
Hospital length of stay, d Median (IQR)	13.0 (7.0 – 36.0)	10.5 (7.0 – 14.0)	2.67 (0.97 – 7.33)
Lung-related events (includes Acute Lung Injury and ARDS), n (%)	3 (17.7%)	0 (0%)	--
Thromboembolic events (includes DVT and PE), n (%)	2 (11.8%)	1 (9.09%)	0.75 (0.05 – 11.7)

Table 3 Primary and Secondary Outcomes by Resuscitation Sequence in the subgroup of penetrating trauma patients, excluding subjects with isolated TBI

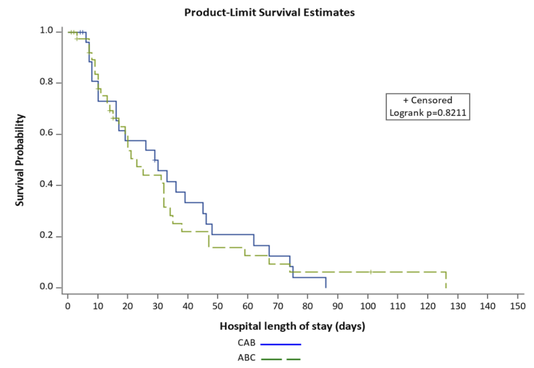


Figure 1: Kaplan Meier survival analysis for hospital length of stay

DISCUSSION AND FUTURE DIRECTIONS

- No significant outcome differences between CAB and ABC resuscitation → but a trend favored CAB across all mortality timepoints and ICU stay.
- CAB utilization was more common at centers participating in LITES Task Order 2 (SWAT) on patients with penetrating trauma and strongly associated with prehospital whole blood administration.
  → Findings support the new ATLS 11th edition, which now prioritizes hemorrhage control before airway management.[23]
- CAB may protect against secondary brain injury — penetrating patients with severe head trauma were preferentially treated with CAB and arrived with more stable hemodynamics.
- Results are consistent with a 440-patient AAST study that also found no significant CAB vs. ABC differences in transfusion, LOS, or mortality.[24]
- CAB/ABC choice appears largely prehospital-provider driven.
- Large prospective and multicenter trials are required to evaluate algorithms and refine guidelines for the triage and management of hemorrhagic shock.

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