



IRWAYS₃

IN-HOSPITAL CARDIAC ARREST CPD WEBINAR

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Airway management during cardiac arrest

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i-gel



Laryngeal Tube

Tracheal intubation during CPR: disadvantages



- Operator dependent++
- Interrupts chest compressions
- Excessive ventilation once intubated?
- Does not 'fail-safe'
 - Unrecognised oesophageal intubation (2–16%)
 - Bronchial intubation

Effect of Bag-Mask Ventilation vs Endotracheal Intubation During Cardiopulmonary Resuscitation on Neurological Outcome After Out-of-Hospital Cardiorespiratory Arrest: A Randomized Clinical Trial

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Editorial page 771

Supplemental content

CME Quiz at

jamanetwork.com/learning

IMPORTANCE Bag-mask ventilation (BMV) is a less complex technique than endotracheal intubation (ETI) for airway management during the advanced cardiac life support phase of cardiopulmonary resuscitation of patients with out-of-hospital cardiorespiratory arrest. It has been reported as superior in terms of survival.

OBJECTIVES To assess noninferiority of BMV vs ETI for advanced airway management with regard to survival with favorable neurological function at day 28.

DESIGN, SETTINGS, AND PARTICIPANTS Multicenter randomized clinical trial comparing BMV with ETI in 2043 patients with out-of-hospital cardiorespiratory arrest in France and Belgium. Enrollment occurred from March 9, 2015, to January 2, 2017, and follow-up ended January 26, 2017.

INTERVENTION Participants were randomized to initial airway management with BMV (n = 1020) or ETI (n = 1023).

MAIN OUTCOMES AND MEASURES The primary outcome was favorable neurological outcome at 28 days defined as cerebral performance category 1 or 2. A noninferiority margin of 1% was chosen. Secondary end points included rate of survival to hospital admission, rate of survival at day 28, rate of return of spontaneous circulation, and ETI and BMV difficulty or failure.

RESULTS Among 2043 patients who were randomized (mean age, 64.7 years; 665 women [32%]), 2040 (99.8%) completed the trial. In the intention-to-treat population, favorable functional survival at day 28 was 44 of 1018 patients (4.3%) in the BMV group and 43 of 1022 patients (4.2%) in the ETI group (difference, 0.11% [1-sided 97.5% CI, -1.64% to infinity]; *P* for noninferiority = .11). Survival to hospital admission (294/1018 [28.9%] in the BMV group vs 333/1022 [32.6%] in the ETI group; difference, -3.7% [95% CI, -7.7% to 0.3%]) and global survival at day 28 (55/1018 [5.4%] in the BMV group vs 54/1022 [5.3%] in the ETI group; difference, 0.1% [95% CI, -1.8% to 2.1%]) were not significantly different. Complications included difficult airway management (186/1027 [18.1%] in the BMV group vs 134/996 [13.4%] in the ETI group; difference, 4.7% [95% CI, 1.5% to 7.9%]; *P* = .004), failure (69/1028 [6.7%] in the BMV group vs 21/996 [2.1%] in the ETI group; difference, 4.6% [95% CI, 2.8% to 6.4%]; *P* < .001), and regurgitation of gastric content (156/1027 [15.2%] in the BMV group vs 75/999 [7.5%] in the ETI group; difference, 7.7% [95% CI, 4.9% to 10.4%]; *P* < .001).

CONCLUSIONS AND RELEVANCE Among patients with out-of-hospital cardiorespiratory arrest, the use of BMV compared with ETI failed to demonstrate noninferiority or inferiority for survival with favorable 28-day neurological function, an inconclusive result. A determination of equivalence or superiority between these techniques requires further research.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT02327026

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779

Effect of a Strategy of Initial Laryngeal Tube Insertion vs Endotracheal Intubation on 72-Hour Survival in Adults With Out-of-Hospital Cardiac Arrest: A Randomized Clinical Trial

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Visual Abstract

Editorial page 761

Related article page 779

Supplemental content

CME Quiz at jamanetwork.com/learning and CME Questions page 834

IMPORTANCE Emergency medical services (EMS) commonly perform endotracheal intubation (ETI) or insertion of supraglottic airways, such as the laryngeal tube (LT), on patients with out-of-hospital cardiac arrest (OHCA). The optimal method for OHCA advanced airway management is unknown.

OBJECTIVE To compare the effectiveness of a strategy of initial LT insertion vs initial ETI in adults with OHCA.

DESIGN, SETTING, AND PARTICIPANTS Multicenter pragmatic cluster-crossover clinical trial involving EMS agencies from the Resuscitation Outcomes Consortium. The trial included 3004 adults with OHCA and anticipated need for advanced airway management who were enrolled from December 1, 2015, to November 4, 2017. The final date of follow-up was November 10, 2017.

INTERVENTIONS Twenty-seven EMS agencies were randomized in 13 clusters to initial airway management strategy with LT (n = 1505 patients) or ETI (n = 1499 patients), with crossover to the alternate strategy at 3- to 5-month intervals.

MAIN OUTCOMES AND MEASURES The primary outcome was 72-hour survival. Secondary outcomes included return of spontaneous circulation, survival to hospital discharge, favorable neurological status at hospital discharge (Modified Rankin Scale score ≤3), and key adverse events.

RESULTS Among 3004 enrolled patients (median [interquartile range] age, 64 [53-76] years, 1829 [60.9%] men), 3000 were included in the primary analysis. Rates of initial airway success were 90.3% with LT and 51.6% with ETI. Seventy-two hour survival was 18.3% in the LT group vs 15.4% in the ETI group (adjusted difference, 2.9% [95% CI, 0.2%-5.6%]; *P* = .04). Secondary outcomes in the LT group vs ETI group were return of spontaneous circulation (27.9% vs 24.3%; adjusted difference, 3.6% [95% CI, 0.3%-6.8%]; *P* = .03); hospital survival (10.8% vs 8.1%; adjusted difference, 2.7% [95% CI, 0.6%-4.8%]; *P* = .01); and favorable neurological status at discharge (71% vs 5.0%; adjusted difference, 2.1% [95% CI, 0.3%-3.8%]; *P* = .02). There were no significant differences in oropharyngeal or hypopharyngeal injury (0.2% vs 0.3%), airway swelling (1.1% vs 1.0%), or pneumonia or pneumonitis (26.1% vs 22.3%).

CONCLUSIONS AND RELEVANCE Among adults with OHCA, a strategy of initial LT insertion was associated with significantly greater 72-hour survival compared with a strategy of initial ETI. These findings suggest that LT insertion may be considered as an initial airway management strategy in patients with OHCA, but limitations of the pragmatic design, practice setting, and ETI performance characteristics suggest that further research is warranted.

TRIAL REGISTRATION ClinicalTrials.gov Identifier: NCT02419573

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769

Effect of a Strategy of a Supraglottic Airway Device vs Tracheal Intubation During Out-of-Hospital Cardiac Arrest on Functional Outcome: The AIRWAYS-2 Randomized Clinical Trial

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Editorial page 761

Related article page 769

Supplemental content

IMPORTANCE The optimal approach to airway management during out-of-hospital cardiac arrest is unknown.

OBJECTIVE To determine whether a supraglottic airway device (SGA) is superior to tracheal intubation (TI) as the initial advanced airway management strategy in adults with nontraumatic out-of-hospital cardiac arrest.

DESIGN, SETTING, AND PARTICIPANTS Multicenter, cluster randomized clinical trial of paramedics from 4 ambulance services in England responding to emergencies for approximately 21 million people. Patients aged 18 years or older who had a nontraumatic out-of-hospital cardiac arrest and were treated by a participating paramedic were enrolled automatically under a waiver of consent between June 2015 and August 2017; follow-up ended in February 2018.

INTERVENTIONS Paramedics were randomized 1:1 to use TI (764 paramedics) or SGA (759 paramedics) as their initial advanced airway management strategy.

MAIN OUTCOMES AND MEASURES The primary outcome was modified Rankin Scale score at hospital discharge or 30 days after out-of-hospital cardiac arrest, whichever occurred sooner. Modified Rankin Scale score was divided into 2 ranges: 0-3 (good outcome) or 4-6 (poor outcome; 6 = death). Secondary outcomes included ventilation success, regurgitation, and aspiration.

RESULTS A total of 9296 patients (4886 in the SGA group and 4410 in the TI group) were enrolled (median age, 73 years; 3373 were women [36.3%]), and the modified Rankin Scale score was known for 9289 patients. In the SGA group, 311 of 4882 patients (6.4%) had a good outcome (modified Rankin Scale score range, 0-3) vs 300 of 4407 patients (6.8%) in the TI group (adjusted risk difference [RD], -0.6% [95% CI, -1.6% to 0.4%]). Initial ventilation was successful in 4255 of 4868 patients (87.4%) in the SGA group compared with 3473 of 4397 patients (79.0%) in the TI group (adjusted RD, 8.3% [95% CI, 6.3% to 10.2%]). However, patients randomized to receive TI were less likely to receive advanced airway management (3419 of 4404 patients [77.6%] vs 4161 of 4883 patients [85.2%] in the SGA group). Two of the secondary outcomes (regurgitation and aspiration) were not significantly different between groups (regurgitation: 1268 of 4865 patients [26.1%] in the SGA group vs 1072 of 4372 patients [24.5%] in the TI group; adjusted RD, 1.4% [95% CI, -0.6% to 3.4%]; aspiration: 729 of 4824 patients [15.1%] vs 647 of 4337 patients [14.9%], respectively; adjusted RD, 0.1% [95% CI, -1.5% to 1.8%]).

CONCLUSIONS AND RELEVANCE Among patients with out-of-hospital cardiac arrest, randomization to a strategy of advanced airway management with a supraglottic airway device compared with tracheal intubation did not result in a favorable functional outcome at 30 days.

TRIAL REGISTRATION ISRCTN Identifier: 08256118

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779

Airway management during CPR

- Bag-mask vs. tracheal tube Jabre P. JAMA 2018;319:779–87

- N = 2040 28d CPC 1–2 4.3% vs. 4.2%

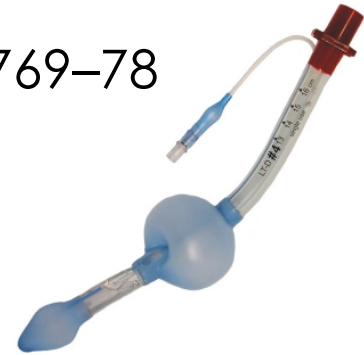
- Intubation success 98%



- Laryngeal tube vs. tracheal tube Wang HE. JAMA 2018;320:769–78

- N = 3004 72 h survival 18.2% vs. 15.3% (P=0.04)

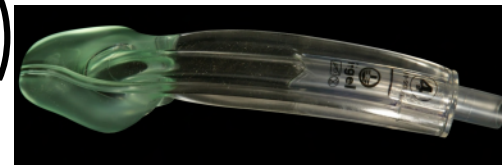
- Intubation success 51%



- Igel vs. tracheal tube Bengner JR. JAMA 2018;320:779–91

- N = 9296 30 d mRS ≤ 3 6.4% vs. 6.8% (P=0.33)

- Intubation success 70%



Association Between Tracheal Intubation During Adult In-Hospital Cardiac Arrest and Survival

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- Get With the Guidelines[®] - Resuscitation registry 2000–14
- 108,079 adult patients from 668 hospitals
- 66% intubated within the first 15 min
- 22.4% of entire cohort survived to hospital discharge
- Time dependent propensity score + risk set matching

Association Between Tracheal Intubation During Adult In-Hospital Cardiac Arrest and Survival

Andersen LW. JAMA 2017;317:494–506

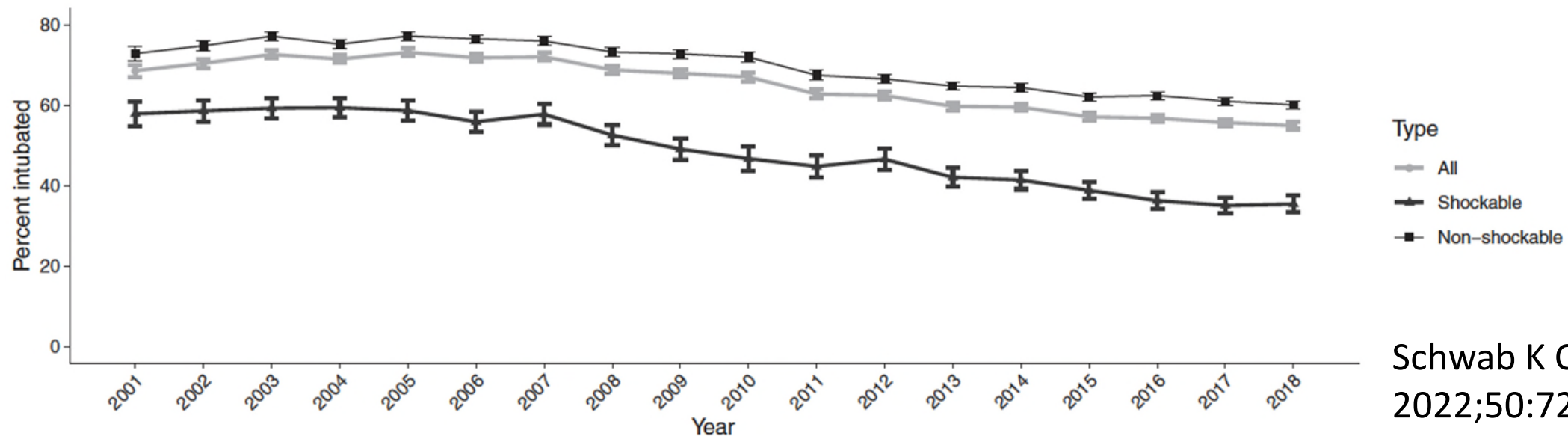
Outcome	Propensity Score-Matched Analysis ^a		
	No. of Patients With Outcome/Total Patients (%)		Risk Ratio (95% CI)
	No Intubation	Intubation	
ROSC	25 685/43 310 (59.3)	25 022/43 311 (57.8)	0.97 (0.96-0.99)
Survival to hospital discharge	8407/43 314 (19.4)	7052/43 314 (16.3)	0.84 (0.81-0.87)
Favorable functional outcome ^b	5672/41 733 (13.6)	4439/41 868 (10.6)	0.78 (0.75-0.81)

86,628 patients matched based on propensity score

Trends in Endotracheal Intubation During In-Hospital Cardiac Arrests: 2001–2018

Get with the Guidelines-Resuscitation Registry

Variables	Overall (n = 166,849)	Group 1: 2001–2010 (n = 75,892)	Group 2: 2011–2018 (n = 90,957)	p (Group 1 vs Group 2)
Intubated during arrest, %	64	71	58	≤ 0.001
Airways used, %				
Laryngeal mask airway	0.3	0.1	0.4	≤ 0.001
Endotracheal tube	63	70	58	≤ 0.001
Time to intubation from onset of pulselessness in minutes, median (IQR)	5 (3–9) ^a	5 (2–8) ^a	6 (3–9) ^a	≤ 0.001

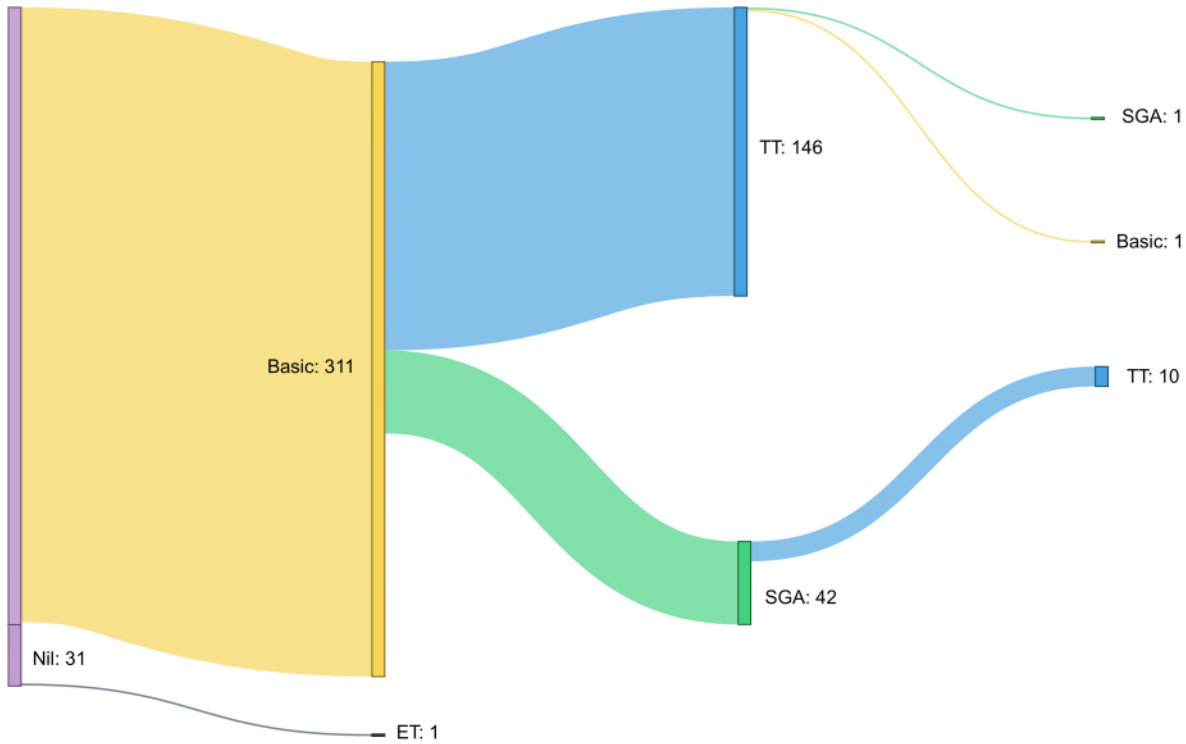
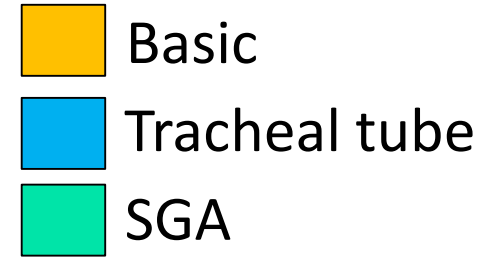


Schwab K Crit Care Med
2022;50:72–80

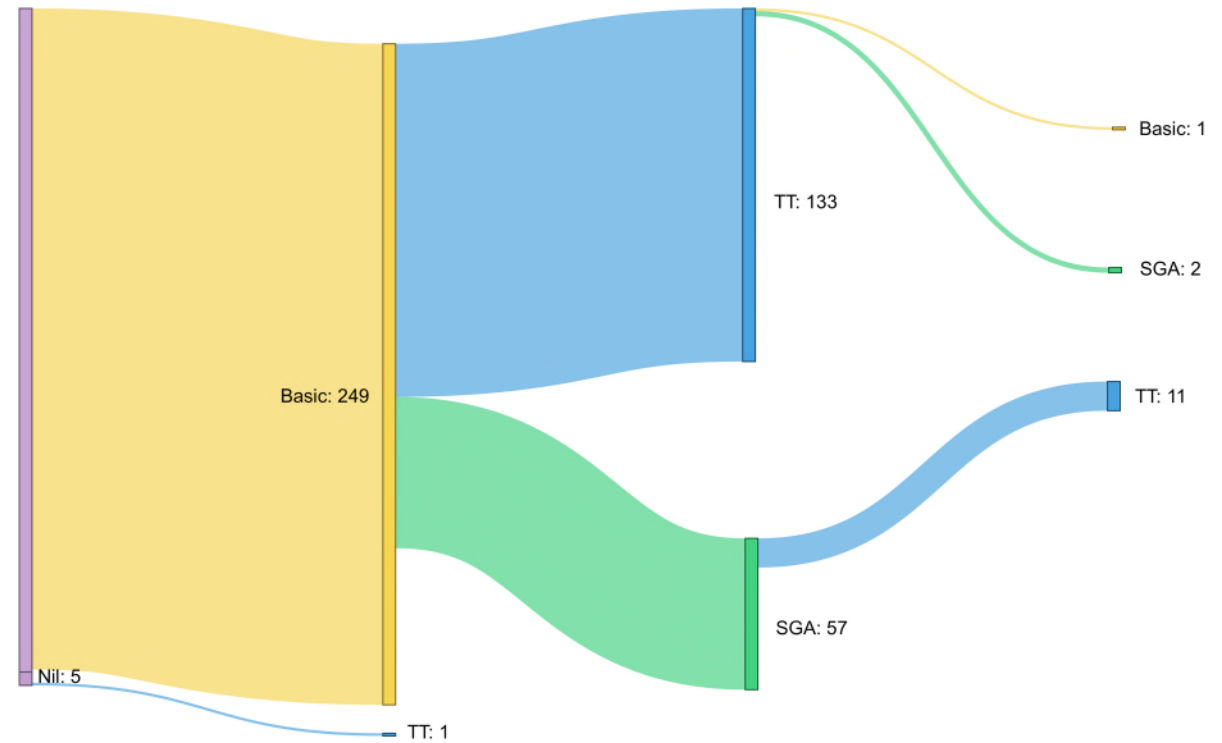
The stepwise approach to airway management



Airway management during in-hospital cardiac arrest: An international, multicentre, retrospective, observational cohort study



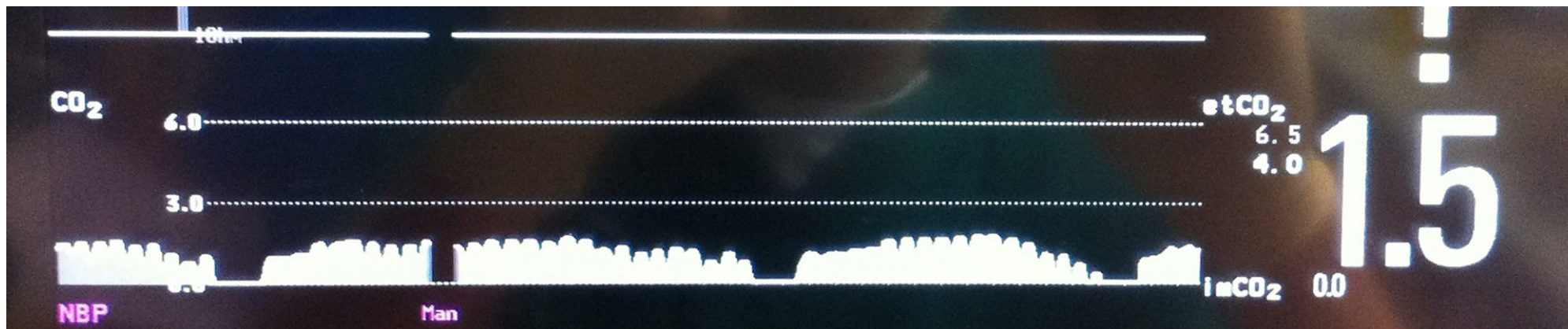
Patients achieving ROSC N = 343



Patients not achieving ROSC N = 255

Waveform capnography

- **Must** be used to confirm correct tracheal tube placement.
- After 7 breaths an $\text{ETCO}_2 > 5 \text{ mmHg}$ (0.67 kPa) or rising ETCO_2 values indicates tracheal placement. (Grmec ICM 2002;28:701–4)
- Project for Universal Management of Airways (PUMA) suggest 1 kPa threshold (Chrimes N. Anaesthesia 2022;77:1395–1415)
- Useful for monitoring the quality of CPR.



2019 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations^{☆,☆☆}

- We suggest using bag-mask ventilation or an advanced airway strategy during CPR for adult cardiac arrest in any setting (*weak recommendation, low to moderate-certainty evidence*).
- If an advanced airway is used, we suggest an SGA for adults with OHCA in settings with a low tracheal intubation success rate (*weak recommendation, low certainty of evidence*).

2019 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations^{☆,☆☆}

- If an advanced airway is used, we suggest an SGA or tracheal intubation for adults with OHCA arrest in settings with a high tracheal intubation success rate^{*} (*weak recommendation, very low certainty of evidence*).
- If an advanced airway is used, we suggest an SGA or tracheal intubation for adults with IHCA (*weak recommendation, very low certainty of evidence*).

^{*}ERC Guidelines = > 95% intubation success within 2 attempts

Randomised trial of the clinical and cost effectiveness of a supraglottic airway device versus tracheal intubation during in-hospital cardiac arrest (AIRWAYS-3)

- 4200 patients across 120 UK hospitals
- Randomisation using a Progressive Web Application (PWA)
- Primary outcome mRS at hospital discharge
- Powered for absolute difference of 3% in primary outcome
- Data collection linked to UK National Cardiac Arrest Audit (NCAA)
- Enrolment started Dec 2022.
- Completion 2025

ISRCTN17720457

☰ AIRWAYS-3 Randomisation

AIRWAYS-3 RANDOMISATION FORM

🔄 REFRESH

Randomising site
ROYAL UNITED HOSPITALS BATH NH... ▾

Day or Night
Day (08:00-17:59) ▾

Date of randomisation
📅 22/03/2023

Time of randomisation (24hr)
🕒 16:42

Please confirm the randomisation details above and be sure they are correct before clicking the RANDOMISE PARTICIPANT button. Many thanks.
Proceed to randomise?

NO

RANDOMISE PARTICIPANT

Hospital Airway Resuscitation Trial (HART)

- SGA versus tracheal intubation
- Cluster randomised across 4 hospitals in New York City with monthly cross over
- Primary outcome: alive-and-ventilator free days over first 28 days after cardiac arrest
- Target sample size: 1060

Airway management in cardiac arrest - summary

- Several OHCA RCTs – generally showing no difference in primary outcomes
- Stepwise approach may be optimal?
- Waveform capnography mandatory to confirm tracheal intubation
- Airways-3 and HART trials to determine optimal approach for in-hospital cardiac arrest

