Supraglottic Airway

Mammoth EM Conference 2019

Shahram Lotfipour, MD, MPH
Professor
Department of Emergency Medicine
Thank you: 
Dr. Robert Katzer, Dr. Shannon Toohey and Dr. Alisa Wray
Disclosure Statement

No financial conflicts with the presentation topic or content covered today.
Objectives

- Be able to state if the literature recommends **BVM vs. Endotracheal Intubation (ETI)** for out of hospital cardiac arrest
- Be able to state if the literature recommends **Endotracheal Intubation (ETI) vs. Supraglottic Airway (SGA)** for out of hospital cardiac arrest
- Be able to compare some of the advantages of the **SGA devices** based on the latest **adult and pediatric** available medical literature
- Be able to state if the literature recommends **BVM vs. Endotracheal Intubation (ETI)** for Pediatric resuscitation
- Workshop - Be able to identify and utilize the common SGAs including **King Airway, I-gel, AirQ and traditional LMA**
Engine 32 and Rescue 4 respond

**Person not breathing** at a youth sports complex

Arrive to see bystanders performing CPR and applying AED

While exiting the vehicle, paramedics hear the AED deliver a shock

Because of the large crowd gathered around, paramedics and EMTs quickly load the patient into the ambulance

Patient has a short neck and a small mouth, making intubation very difficult
Case continued

- Medic attempts laryngoscopy three times to visualize the cords, each time with up to a 45 second break in chest compressions
- Partner steps in and inserts a laryngeal tube (SGA) airway
- Resuscitation continued in the local ED for 30 min
- Patient is declared dead
- What is the best airway management strategy for patients in cardiac arrest?
Background

- Out-of-hospital cardiac arrest - a **major public health problem**
- **424,000 persons annually** in the United States
- 10.4% surviving to discharge from the hospital
- **Endotracheal intubation** is one of the most common procedures performed by paramedics during resuscitation
- Several studies have highlighted pitfalls, misplacement of ET tube and challenge of failed intubation attempts
- **Intubation will likely interfere** with other key resuscitation tasks, frequent and prolonged interruption in CPR
Airway Management During Out-of-Hospital Cardiac Arrest

Roger J. Lewis, MD, PhD; Marianne Gausche-Hill, MD

JAMA February 27, 2018 Volume 319, Number 8
ETI and scope of practice of out-of-hospital rescue personnel

- Has been an **area of controversy** due to contradictory and inconclusive evidence.
- Inclusion of ETI based on premise- **hospital-based resuscitation practices** extended
- Considerations for **training burden** with ETI, equipment costs, maintenance of skills, potential for unrecognized complications
- If BMV is equivalent to ETI, **BMV would be preferred** due to greater ease in implementation and training.
ETI and scope of practice of out-of-hospital rescue personnel

- ETI is a relatively uncommon procedure in the out-of-hospital setting and most paramedics might not have sufficient opportunities to use this skill in practice.
Effect of Bag-Mask Ventilation vs Endotracheal Intubation During Cardiopulmonary Resuscitation on Neurological Outcome After Out-of-Hospital Cardiorespiratory Arrest: A Randomized Clinical Trial

Objective and design

- Objective - to assess noninferiority of BMV vs. ETI for advanced airway management with regard to survival with favorable neurologic function at day 28
- Design - Multicenter randomized clinical trial comparing BMV with ETI in 2043 patients with out of hospital cardiorespiratory arrest in France and Belgium
Outcome and measures

- **Primary outcome** - favorable neurologic outcome at 28 days
  - Cerebral performance category 1 or 2
  - Non-inferiority margin of 1%

- **Secondary end point** - rate of survival to hospital admission, rate of survival at day 28, return of spontaneous circulation, and ETI and BMV difficulty or failure
Conclusion

- Failed to demonstrate non-inferiority or inferiority for survival with favorable 28-day neurologic function (4.3% in BMV and 4.2% in ETI) - *inconclusive result*, did not meet the non-inferiority margin of 1% (underpowered non-inferiority trial)
- Determination of equivalence or superiority between these techniques *requires further research*
- Important to note, in much of Europe, *physicians are part of ambulance crew* and perform resuscitation in OFHCA
- Not sure if this can be applied to the U.S. environment
**Important to note:**

- Systems that have physicians working in the out-of-hospital setting might seem optimal, they have not demonstrated superior skill performance or improved outcomes for patients with cardiac arrest compared with systems using only paramedics.
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

Jonathan R. Benger, MD, Kim Kirby, MRes, Sarah Black, DClinRes, Stephen J. Brett, MD, Madeleine Clout, BSc, Michelle J. Lazarro, MSc, Jerry P. Nolan, MBChB, Barnaby C. Reeves, DPhil, Maria Robinson, MOst, Lauren J. Scott, MSc, Helena Smart, PhD, Adrian South, BSc (Hons), Elizabeth A. Stokes, DPhil, Jodi Taylor, PhD, Matthew Thomas, MBChB, Sarah Voss, PhD, Sarah Wordsworth, PhD, and Chris A. Rogers, PhD
Objective and Design

- Determine whether a SGA device is superior to ETI as initial advanced airway management strategy in adults with nontraumatic out-of-hospital cardiac arrest of 9296 patients
- Multicenter, cluster randomized clinical trial of 1523 paramedics from 4 ambulance services in England
- 18 years or older
- Waiver of informed consent
Main outcome and measure

- Primary outcome - **modified Rankin Scale score** (neurologic disability) at hospital discharge, or 30 days after out-of-hospital cardiac arrest (whichever occurred sooner)
- Secondary outcomes included **ventilation success**, regurgitation, and aspiration
Results

- Favorable functional outcome at hospital discharge or after 30 days occurred in:
  - 6.4% of patients in the SGA group
  - 6.8% of patients in the ETI group
  - Difference not statistically significant

- **AIRWAYS-2** - Strategy of using a SGA device for advanced airway management did not provide a superior functional outcome
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

Henry E. Wang, MD, MS; Robert H. Schmicker, MS; Mohamud R. Daya, MD, MS; Shannon W. Stephens, EMT-P; Ahamed H. Idris, MD; Jestin N. Carlson, MD, MS; M. Riccardo Colella, DO, MPH; Heather Herren, MPH, RN; Matthew Hansen, MD, MCR; Neal J. Richmond, MD; Juan Carlos J. Puyana, BA; Tom P. Aufderheide, MD, MS; Randal E. Gray, MEd, NREMT-P; Pamela C. Gray, NREMT-P; Mike Verkest, AAS, EMT-R; Pamela C. Owens; Ashley M. Brienza, BS; Kenneth J. Sternig, MS-EHS, BSN, NRP; Susanne J. May, PhD; George R. Sopko, MD, MPH; Myron L. Weisfeldt, MD; Graham Nichol, MD, MPH

Objective and Design

- Compare the effectiveness of initial laryngeal tube insertion vs. initial endotracheal intubation in adults with non-traumatic out-of-hospital cardiac arrest (OHCA)
- Multicenter cluster-crossover clinical trial
- 27 EMS agencies in the Resuscitation Outcomes Consortium
- 3004 adults, with crossover to the alternate strategy at 3-5-month intervals
Main Outcome and Measures

- Primary outcome was **72-hour survival**
- Secondary outcomes included **return of spontaneous circulation**, survival to hospital discharge, favorable neurological status at discharge and key adverse events
Results and Conclusion

- 72-hour survival was 18.3% for King laryngeal tube (LT) insertion and 15.4% for endotracheal intubation, significant difference.
- King-LT insertion may be considered as an initial airway management strategy in patients with OHCA
- Limitations of the design, practice setting and ETI performance characteristics suggest that further research is warranted.
Comparative study of various supraglottic devices with clinical and fiber optic assessment in elective laparoscopic procedures

Bhushan M. Ambare¹*, S. P. Manjrekar¹, Monika S. Masare²

¹Department of Anaesthesiology, Shri Vasantrao Naik Government Medical College, Yavatmal, Maharashtra, India
²Department of Community Medicine, Shri Vasantrao Naik Government Medical College, Yavatmal, Maharashtra, India

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Background and Methods

- Compare efficacy and safety of SGA devices - LMA supreme, LMA proseal and I-Gel
- During laparoscopic surgery under general anesthesia
- **Prospective, randomized** study of 105 patients
- Compared with regards to insertion parameters, adequacy of ventilation (oxygen saturation, end tidal carbon dioxide and air leak), fiberoptic vision and intra or postoperative complications
Results

- Overall **ease of insertion of LMA Supreme** was better
- Adequacy of ventilation, Safety of devices, fiberoptic view was comparable in all
- LMA Proseal better at oropharyngeal leak pressure
- Fiberoptic view better in I-gel
Caring for the Critically Ill Patient

February 9, 2000

Effect of Out-of-Hospital Pediatric Endotracheal Intubation on Survival and Neurological Outcome: A Controlled Clinical Trial

Marianne Gausche, MD; Roger J. Lewis, MD, PhD; Samuel J. Stratton, MD, MPH; et al

Objective and Design

- Compare survival and neurologic outcome of pediatric patients with BVM vs. BVM followed by ETI
- **Controlled clinical clinical trial**, assigned to interventions by calendar day
- Two large, **urban, rapid-transport EMS systems**
- **830 consecutive patients 12 years and younger**, less than 40kg
- 820 had follow-up
Result

- **No significant difference** in survival between the BVM group (30%) and ETI group (26%) or rate of good neurologic outcome BVM group (23%) vs. ETI (20%)
- Addition of out-of-hospital ETI to a paramedic scope of practice that already includes BVM **did not improve survival or neurologic outcome** of pediatric patients in an urban EMS system
RESEARCH ARTICLE

Pediatric supraglottic airway devices in clinical practice: A prospective observational study

Maren Kleine-Brueggeney1,2*, Anne Gottfried1, Sabine Nabecker1, Robert Greif1, Malte Book1,3 and Lorenz Theiler1
Background and Methods

The purpose of this study was to evaluate the performance of the pediatric LMA Supreme™, Air-Q® and Ambu® Aura-i™.
Background and Methods

- Primary outcome parameter was **airway leak pressure**.
  - This leak pressure is the pressure at which a gas leaks around the airway, which is a key marker of efficacy and safety of its use; a higher leak pressure suggests a better seal between the artificial airway and patient's airway.

- Secondary outcome parameters included **first attempt and overall success rate, insertion time, fiberoptic view** through the SGA, and adverse events.

- Primary hypothesis was that the mean airway leak pressure of each tested SGA was 20 cmH2O+-10%.
Results

- None of the SGA showed a mean airway leak pressure of 20 cmH2O ± 10%
- Mean airway leak pressures differed significantly between devices [LMA Supreme™ 18.0 (3.4) cmH2O, Air-Q® 15.9 (3.2) cmH2O, Ambu® Aura-i™ 17.3 (3.7) cmH2O, p < 0.001].
- First attempt success rates (LMA Supreme™ 100%, Air-Q® 90%, Ambu® Aura-i™ 91%, p = 0.02)
- **Overall success rates** (LMA Supreme™ 100%, Air-Q® 91%, Ambu® Aura-i™ 95%, p = 0.02) also differed significantly. Insertion times ranged from 20 (7) seconds (Air-Q®) to 24 (6) seconds (LMA Supreme™, <p = 0.005).
Results and Conclusion

- Insertion was rated easiest with the LMA Supreme™ (very easy in 97% vs. Air-Q® 70%, Ambu® Aura-i™ 72%, p < 0.001).
- Fiberoptic view was similar between the SGA. Adverse events were rare.
- Airway leak pressures ranged from 16 to 18 cmH2O, enabling positive pressure ventilation with all successful SGA.
- The highest success rates were achieved by the LMA Supreme™, which was also rated easiest to insert.
Comparison of the performance of the self-pressurized air-Q intubating laryngeal airway with the LMA–ProSeal in pediatric patients under general anesthesia: a randomized controlled trial
Amani A. Aly, Mohamed T. Ghanem

Department of Anesthesia and Intensive Care, Faculty of Medicine, Zagazig University, Zagazig, Egypt

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The Tethered Connector avoids misplacing the connector.

New Blocker Channel accepts NG Tubes for managing the esophagus.

Built up Mask Heel for improved seal.

Integrated Bite Block:
- Easier to place
- Reinforces the tube
- Diminishes the need for separate bite block

Removable Color Coded Connector allows intubation through the airway tube with any standard ET tubes.

Color Coding sets the standard for Masked Laryngeal Airways.

Elevation Ramp... Facilitates intubation. Directs the ET tube towards the Laryngeal Inlet.
AirQ

Removable Connector
- allows for entry of a standard size endotrachial tube

Hyper-Curved Airway Tube
- allowing neutral position of airway
- won’t kink!

Improved Design
- elevates epiglottis and centers larynx
- maximizing space for trachial tube and breathing conduit
ProSeal LMA
Air-Q SP vs. ProSeal LMA

- Self-pressurized air-Q intubating laryngeal airway (air-Q SP)
  - Supraglottic airway device
  - Non-inflatable cuff - no monitoring

- ProSeal laryngeal mask airway (PLMA)
  - Supraglottic airway
  - State-of-the-art, safest and most reliable
  - Superior ability for airway sealing even under high pressure
air-Q SP vs. original air-Q

- air-Q SP allows communication between airway tube and mask cuff
- Cuff inflation self-regulated
- Cuff pressure to be determined by airway pressure
- Optimal airway seal at lower pressure levels
- Should optimally decrease cuff overinflation, laryngopharyngeal complications and gastric unsufflation
Comparison of the performance of the self-pressurized air-Q intubating laryngeal airway with the LMA–ProSeal in pediatric patients under general anesthesia: a randomized controlled trial
Amani A. Aly, Mohamed T. Ghanem

Department of Anesthesia and Intensive Care, Faculty of Medicine, Zagazig University, Zagazig, Egypt

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Patients and methods

- 70 pediatric patients
- Aged 4-15 years
- Undergoing elective surgery for general anesthesia
- Randomized to either air-Q SP or the ProSeal LMA
- Primary outcome - oropharyngeal leak pressure
- Secondary outcome - ease of insertion, time of insertion, first attempt success rate, number of gastric insufflations, fiberoptic glottic view, and complications related to use
Results and Conclusion

- No difference between air-Q SP and ProSeal LMA in all factors except the two following factors
- **Time to insertion for air-Q SP significantly shorter than ProSeal LMA**
- Fiberoptic view was significantly better with air-Q SP than ProSeal LMA
Review Article:
Comparing Supraglottic Airway Devices for Airway Management During Surgery in Children: A Review of Literature

Mir Ahmad Hendinezhad¹, Anahita Babaei¹*, Afshin Gholipour Baradari², Alieh Zamani²

1. Department of Anesthesiology, Nimeshaban Hospital, Mazandaran University of Medical Sciences, Sari, Iran.
2. Department of Anesthesiology, Emam Khomeini Hospital, Mazandaran University of Medical Sciences, Sari, Iran.
Objective and Data Sources

● This review study aimed to examine the literature regarding pediatric supraglottic airway devices, to introduce the optimal devices in terms of Oropharyngeal Leak Pressure (OLP), risk of insertion failure on the first attempt and risk for blood staining of the device.

● An electronic search was conducted on MEDLINE, EMBASE, CINAHL, PubMed databases, also the Cochrane database (CENTRAL) and Web of Science up to July 1, 2017.

● In total, 30 papers were identified related to the children supraglottic devices.
Results and Conclusion

- The **LMA ProSeal may be the best supraglottic airway device for children** due to its high oropharyngeal leak pressure and low risk of insertion failure. It seems that **i-gel is a very functional tool as well**.

- **Further research is recommended** to investigate the most appropriate supraglottic airway in diverse clinical situations and various conditions among children.
Summary and Take Away Points

- JAMA Belgium France - Failed to show BVM not inferior to ETI
- AIRWAYS-2 - SGA vs. ETI did not provide superior survival and neurologic outcome
- JAMA Wang - King LTA can be considered as initial airway device for Out of Hospital Cardiac Arrest.
- JAMA 2000 - No significant difference in pediatric survival and neurologic outcome between the BVM and ETI
- Data on which type of SGA is better with pediatric (or adult) is not clear and requires further study. Maybe LMA ProSeal and i-gel better in children.
Questions?
shl@uci.edu
Airway SGA Workshop

- i-gel
- King LTS
- Air-q
- Standard LMA
i-gel
Airway SGA workshop

- i-gel
- King LTS
- Air-q
- Standard LMA