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Emergency airway management: Best practices and new innovations for critical care

Sultan Mohammed Alanazi
KSA, National Guard Health Affairs

Hatim Faihan Alotaibi
KSA, National Guard Health Affairs

Ibrahim Mohammed Alanazi
KSA, National Guard Health Affairs

Adel Mohammad Aldukhain
KSA, National Guard Health Affairs

Rakan Faisal Albasri
KSA, National Guard Health Affairs

Salman Abdullah Alharbi
KSA, National Guard Health Affairs

Hamoud Gayyadh Alanizi
KSA, National Guard Health Affairs

Sulaiman Ahmed Almansour
KSA, National Guard Health Affairs

***Abstract*---Background:** Airway management is a crucial component of resuscitating critically ill patients, especially in emergency and out-of-hospital cardiac arrest (OHCA) scenarios. Traditional methods like endotracheal intubation (ETI) face challenges related to skill requirements, resource limitations, and interruptions to CPR. Recent innovations like supraglottic airways (SGA) and the bougie have gained attention as potential alternatives. **Aim:** This article aims to review best practices in emergency airway management, particularly focusing on the comparative effectiveness of ETI, SGAs, and other emerging techniques. **Methods:** This review summarizes findings from randomized clinical trials, including the Bougie Use in Emergency Airway Management (BEAM) trial and other studies comparing ETI with SGAs and bag-valve-mask (BVM) ventilation in OHCA settings. It

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evaluates first-attempt success rates, patient survival outcomes, and complications. **Results:** The BEAM trial found a higher first-attempt success rate for bougie-assisted intubation (98%) compared to conventional methods (87%). Other studies revealed similar neurological outcomes between BVM and ETI, while SGAs showed a survival advantage over ETI in prehospital settings. However, higher ventilation failure rates were noted with BVM. **Conclusion:** SGAs and bougie devices offer promising alternatives to ETI, particularly in resource-constrained or prehospital environments. BVM remains a viable option but presents complications. Further research is needed to confirm the most effective approach across various clinical settings.

***Keywords*---**airway management, endotracheal intubation, supraglottic airways, bag-valve-mask ventilation, out-of-hospital cardiac arrest, bougie.

Introduction

Airway management is a critical aspect of resuscitating patients in critical condition. The primary method for advanced airway management remains endotracheal intubation (ETI). Whether performed in the ICU, emergency department, or prehospital environment, unique challenges arise in managing the airways of patients who are acutely ill or injured. These challenges include the rapid deterioration of the patient's condition, the constrained resources available, and the provider's skill level. Various approaches have been suggested for emergency airway management, incorporating novel tools such as the bougie, video laryngoscopy, and supraglottic airways[3,4]. These recommendations are primarily supported by retrospective reviews, case series, or small-scale studies, with only a few randomized clinical trials conducted[1,2,4]. However, in the past year, several large randomized clinical trials have been completed, providing important insights into critical aspects of emergency airway management [5–8].

The Bougie in Emergency Airway Management:

The tracheal tube introducer, commonly referred to as the 'bougie' or gum-elastic bougie, is a long, flexible device with an angled tip that can be passed through the vocal cords during intubation, aiding the placement of an endotracheal tube. The bougie proves useful, especially in situations where the glottis cannot be fully visualized, offering advantages in anticipated difficult laryngoscopies or intubations. Simulation-based studies and retrospective analyses have demonstrated higher success rates in first-attempt intubations using the bougie compared to traditional methods, which involve endotracheal tube insertion without a bougie. Nonetheless, limited prospective research has assessed the bougie's effectiveness outside of the operating room setting[1,9].

Driver et al. [5] conducted the Bougie Use in Emergency Airway Management (BEAM) trial, a randomized clinical study aimed at comparing the success rates of first-pass intubation between bougie-assisted intubation and conventional intubation using a styletted endotracheal tube. This study was carried out in a

large urban emergency department and level 1 trauma center. Participants were eligible if they were 18 years or older and required endotracheal intubation (ETI) in the emergency department. However, patients with upper airway obstruction (e.g., angioedema), prisoners, and pregnant individuals were excluded. Intubations were performed either by senior emergency medicine residents or attending emergency physicians. Providers noted characteristics that could indicate a difficult airway, such as a large tongue, obesity, or facial trauma. The primary endpoint of the study was the success of the first attempt at intubation, and two groups were evaluated: those with at least one difficult airway characteristic and the overall patient population.

A total of 757 patients participated in the trial, with 381 receiving bougie-assisted intubation and 376 undergoing intubation with a styletted endotracheal tube. The primary analysis focused on patients with at least one difficult airway characteristic, and in this group, the success rate on the first attempt was higher for the bougie group (96%) compared to the standard intubation group (82%) [absolute difference of 14%, 95% CI: 8–20%]. When analyzing the entire patient cohort, the first-attempt success rate was also higher for the bougie group (98%) than for the conventional intubation group (87%) [absolute difference of 11%, 95% CI: 7–14%]. Secondary outcomes, including the duration of the first intubation attempt and instances of hypoxemia, were comparable between the two groups [5].

Despite the promising findings of the BEAM trial, there are notable limitations. The operators involved had substantial experience using the bougie as a primary device for airway management, which could have influenced the results. In settings where practitioners are less familiar with the bougie, the outcomes might differ. Additionally, the study was conducted at a single center, making it uncertain how generalizable the results are to other emergency departments or different clinical environments, such as the ICU or prehospital settings. The operators used only one type of laryngoscope blade (a standard Macintosh blade), and they were not blinded to the group assignments. Furthermore, protocol deviations occurred in 7% of cases, where the bougie was used despite being assigned to the standard intubation group.

Although the bougie has clear potential benefits, it is still underutilized in emergency departments, typically employed in less than 5% of intubations, often reserved for difficult cases [10]. The study by Driver et al. highlights the possible advantages of using the bougie as a primary tool for emergency intubations. Given its low cost and versatility across various clinical situations, the bougie may become a more prominent choice for airway management in emergency settings if further large-scale studies confirm these results. However, its effective use depends on adequate training and maintenance of the necessary skills.

Several recent randomized clinical trials have provided valuable insights into emergency airway management techniques, focusing on comparisons between traditional endotracheal intubation (ETI) and alternative methods. One such trial, conducted by Driver et al. [5], took place in an emergency department (ED) setting and involved 757 patients who required endotracheal intubation. The study compared the success rates of first-attempt intubations using a bougie-facilitated

approach (381 patients) with those using a styletted endotracheal tube (376 patients). The primary outcome was the first-attempt success rate in patients with at least one difficult airway characteristic. The bougie group demonstrated a significantly higher success rate (96%) compared to the styletted endotracheal tube group (82%), with an absolute between-group difference of 14% (95% CI: 8–20%). The study also noted that operators in the trial had considerable prior experience using the bougie, which may have contributed to the positive outcomes.

Another important study by Jabre et al. [6] examined the outcomes of prehospital airway management in 2,043 patients experiencing out-of-hospital cardiac arrest (OHCA). The trial compared the use of bag-valve-mask ventilation (BVM) in 1,020 patients with ETI in 1,023 patients. The primary outcome measured was neurologic function 28 days post-event. The results showed little difference between the two groups, with BVM resulting in a 4.3% rate of good neurologic outcome and ETI yielding a 4.2% rate. The absolute difference between the two groups was 0.11% (one-sided 97.5% CI: -1.64 to infinity), indicating no clear advantage of one method over the other.

Wang et al. [7] also conducted a study in a prehospital OHCA setting, enrolling 3,004 patients. They compared the use of supraglottic airways (SGA) in 1,505 patients with ETI in 1,499 patients. The primary outcome of interest was survival at 72 hours, and the SGA group had an 18.3% survival rate compared to 15.4% in the ETI group. The adjusted difference was 3.6% (95% CI: 0.3–6.8%), favoring the use of SGA. In this study, prehospital physicians managed the airways, and the trial was not powered to evaluate long-term outcomes.

Lastly, Benger et al. [8] conducted another large-scale study in a prehospital OHCA setting, involving 9,296 patients. They compared SGA (4,886 patients) with ETI (4,410 patients) in terms of neurologically intact survival either at hospital discharge or 30 days after the event. The results showed no significant difference between the two groups, with SGA yielding a 6.4% survival rate and ETI yielding a 6.8% survival rate. The adjusted risk difference between the two groups was 0.6% (95% CI: -1.6 to 0.4%). Notably, more than 20% of the patients in the ETI group did not actually receive ETI or SGA, which may have affected the results. These studies collectively emphasize the complexity of airway management in emergency settings and suggest that alternative methods, such as the bougie and SGA, may offer advantages under certain conditions. However, further research is needed to confirm these findings and to determine the most effective techniques for different clinical scenarios.

Airway Management:

Airway management is a crucial element in the resuscitation of patients suffering from out-of-hospital cardiac arrest (OHCA). Despite its importance, there remains uncertainty surrounding the optimal timing and method for advanced airway interventions [11,12]. While endotracheal intubation (ETI) is widely used in paramedic practice in the United States, multiple studies have raised concerns about its use in out-of-hospital settings. Issues such as unrecognized misplacement of the tube, multiple intubation attempts, and interruptions in

cardiopulmonary resuscitation (CPR) chest compressions are among the challenges associated with ETI [13]. In an effort to reduce interruptions to chest compressions, some emergency medical services (EMS) practitioners opt for the use of supraglottic airway devices, such as the laryngeal tube, iGel, or laryngeal mask airway (LMA). However, observational studies indicate that ETI may result in higher survival rates compared to these simpler devices [14,15]. Similarly, retrospective analyses have suggested that bag-valve mask (BVM) ventilation may lead to better survival outcomes than either supraglottic airway devices or ETI [16,17]. These observational studies, however, are limited by confounding factors, particularly the decision to choose a specific airway management technique like ETI, which may influence the outcomes. These limitations underscore the need for randomized controlled trials (RCTs) to clarify the role of BVM, supraglottic airway devices, and ETI in OHCA.

BVM ventilation is a fundamental technique for managing critically ill patients, and a growing body of evidence suggests that BVM may provide better outcomes in OHCA compared to advanced airway techniques [16,17]. Nearly two decades ago, Gausche et al. [18] conducted the only RCT comparing BVM and ETI in critically ill children and found no significant differences in patient outcomes. Given the limitations in the existing literature, there remains a need for further clinical trials to better understand the comparative efficacy of BVM and ETI in airway management for OHCA patients.

A multicenter noninferiority RCT conducted by Jabre et al. [6] in Belgium and France compared BVM with ETI in adult OHCA patients. The airways were managed by prehospital physicians from specialized mobile intensive care units. The primary outcome measured was 28-day survival with a good neurologic outcome, defined as a Glasgow-Pittsburgh Cerebral Performance Category of 2 or less. The trial enrolled 2,043 patients, with 1,020 receiving BVM and 1,023 undergoing ETI. The results indicated similar neurologic outcomes between the two groups, with BVM achieving a 4.3% rate of good neurologic outcome compared to 4.2% in the ETI group [difference 0.11%; one-sided 97.5% CI: -1.64% to infinity]. Other outcomes, such as survival to hospital admission and survival at 28 days, were also comparable between the groups, with similar findings in the per-protocol analysis. However, the study could not definitively establish the noninferiority or inferiority of BVM. Notably, complications were more frequent in the BVM group (18.1%) compared to the ETI group (13.4%) [difference 4.7%; 95% CI: 1.5–7.9%], including higher rates of ventilation failure (BVM 6.7%; ETI 2.1%) and gastric regurgitation (BVM 15.2%; ETI 7.5%).

The Jabre et al. study has some limitations. The noninferiority design of the trial did not provide conclusive results, leaving the question of whether one technique was superior unresolved. A larger study population might have enabled the researchers to draw more definitive conclusions. Additionally, the trial's generalizability is limited by the fact that all airways were managed by prehospital physicians, a staffing model that is rare in most EMS systems globally. Another limitation is that all intubations were performed after the return of spontaneous circulation, and there was limited data on the quality of chest compressions in the two study groups. Despite these limitations, the findings of Jabre et al. provide important insights into the challenges of using BVM ventilation in adult

OHCA. Some experts advocate for BVM to be the default airway management approach in OHCA; however, the study's findings, particularly the higher rates of ventilation failure and gastric regurgitation associated with BVM, call this recommendation into question. BVM is a technically demanding procedure, especially in out-of-hospital settings. As such, EMS providers may consider using BVM as a temporary measure until a more definitive airway, such as a supraglottic airway device or ETI, can be secured.

Supraglottic airways (SGAs):

Supraglottic airways (SGAs) are devices inserted into the posterior pharynx without direct visualization, allowing for rapid placement by providers with varying skill levels. Unlike endotracheal intubation (ETI), SGAs do not require extensive training, making them a favored choice for airway management in out-of-hospital cardiac arrest (OHCA) due to their ease of placement and lower likelihood of interrupting chest compressions [3,19]. Despite these advantages, retrospective analyses have indicated worse outcomes with SGAs compared to ETI in OHCA cases [14,15]. In response to these findings, two large randomized controlled trials (RCTs) were published recently, comparing the effectiveness of SGAs and ETI in OHCA patients.

The Pragmatic Airway Resuscitation Trial (PART) conducted by Wang et al. was a multicenter, cluster-randomized, cross-over trial in the United States. It aimed to compare the 72-hour survival outcomes between patients managed with either the laryngeal tube (King LT, Ambu, Copenhagen, Denmark) or ETI [7,20]. The trial included adults aged 18 years or older and excluded prisoners and patients with do-not-resuscitate orders, following criteria similar to those of other OHCA trials [6,8,20]. EMS agencies were cluster-randomized to use either the laryngeal tube or ETI, with a cross-over to the alternate intervention every 3 to 5 months.

A total of 27 EMS agencies from five cities enrolled 3,004 patients, with 1,505 receiving the laryngeal tube and 1,499 undergoing ETI. The results demonstrated higher 72-hour survival in the laryngeal tube group (18.3%) compared to the ETI group (15.4%), with an adjusted difference of 3.6% [95% CI: 0.3–6.8%]. The laryngeal tube also showed superiority across other secondary outcomes, including return of spontaneous circulation, survival to hospital discharge, and favorable neurological outcomes at discharge. Complication rates, such as oropharyngeal injury and pneumonia, were similar between the groups. Notably, the laryngeal tube was inserted approximately 2.5 minutes faster than ETI.

One significant observation from the PART trial was the 51% success rate of ETI insertion compared to 90.6% for the laryngeal tube. Most failed intubations were successfully rescued with laryngeal tube insertion. Many EMS medical directors support early laryngeal tube use following failed intubation attempts, and the trial's findings align with common clinical practices. The pragmatic design of the study, which focused on real-world applicability, did not include modifications to other aspects of care, such as additional ETI training or changes to existing intubation techniques. However, adding specialized ETI training would have limited the generalizability of the study, as most EMS agencies do not have access to such resources.

The PART trial has several limitations. The pragmatic design restricted adjustments to care beyond the allocated interventions (e.g., further education on airway management techniques or changes to EMS protocols). Additionally, the study was not sufficiently powered to assess longer-term outcomes, such as neurologically intact survival at 30 days. There were minor differences between the groups due to the cluster-randomization method, and the quality of chest compressions was not evaluated. Providers were also not blinded by the intervention arm. First-attempt success with ETI was 51.3%, compared to 90.6% for SGAs, raising questions about how these results might apply to EMS agencies with higher ETI success rates.

The AIRWAYS-2 Trial:

The AIRWAYS-2 trial, conducted by Benger et al., was a multicenter randomized controlled trial (RCT) in England that compared the functional outcomes of out-of-hospital cardiac arrest (OHCA) patients managed with either the i-gel supraglottic airway (Intersurgical, Workingham, Berkshire, UK) or endotracheal intubation (ETI) [8]. Randomization occurred at the paramedic level (ETI n=764 vs. SGA n=759), and only patients treated by study paramedics were included. The trial enrolled 9,296 patients, with 4,886 receiving the i-gel and 4,410 receiving ETI. The primary outcome, favorable functional status at either hospital discharge or 30 days, was similar between the i-gel (6.4%) and ETI (6.8%) groups, showing an adjusted risk difference of -0.6% (95% CI -1.6% to 0.4%). Other outcomes, including regurgitation and aspiration rates, were also comparable. Interestingly, 22.4% of patients in the ETI group and 14.8% in the i-gel group received only bag-valve-mask (BVM) ventilation. In a "per protocol" analysis that included only patients with either ETI or i-gel placement, those managed with the i-gel showed better neurologically intact survival (i-gel 3.9% vs. ETI 2.6%; risk difference 1.4%; 95% CI 0.5–2.2%).

The AIRWAYS-2 trial had several limitations. Paramedics were randomized to either ETI or SGA for the entire two-year study period, which may have caused skill decay in ETI or i-gel techniques. Additionally, a significant portion of patients in both groups received only BVM ventilation, and the quality of chest compressions was not thoroughly assessed. Nevertheless, AIRWAYS-2 is the largest OHCA airway trial to date, and its findings suggest that ETI is not superior to i-gel placement in OHCA patients. Taken together, the PART and AIRWAYS-2 trials provide crucial evidence on airway management strategies in OHCA. Despite design differences, the findings are consistent, indicating that supraglottic airways (SGAs) may be superior or at least as effective as ETI, especially in EMS settings with limited training in advanced intubation techniques. For EMS agencies with fewer resources or experience with ETI, adopting SGAs could be a viable alternative, while agencies with robust ETI training may choose to continue their current practices. Both trials highlight the significance of advanced airway management in OHCA and emphasize the need for comprehensive training and quality assurance across EMS practices.

SGA Working:

Supraglottic airways (SGAs) are devices designed to manage a patient's airway during medical emergencies, such as out-of-hospital cardiac arrest (OHCA), without the need for traditional endotracheal intubation. They are positioned above the vocal cords (hence "supraglottic") and provide a route for ventilation by sitting in the posterior pharynx, sealing around the glottis. Here's how SGAs work:

1. **Placement**: SGAs are inserted blindly, meaning they do not require visualization of the vocal cords or extensive manipulation, unlike endotracheal intubation. This makes them easier and quicker to insert, which is beneficial in emergency situations. Providers of varying skill levels can usually place SGAs without the need for advanced airway training.
2. **Positioning and Sealing**: Once inserted, the device sits above the larynx (voice box), resting in the back of the throat. The design of SGAs includes a cuff or sealing mechanism that inflates to form a seal around the laryngeal inlet. This helps to keep the airway open while minimizing the risk of air leakage during ventilation.
3. **Ventilation**: After placement, air can be delivered through the device, which allows for the oxygenation of the patient. The SGA channels air directly into the trachea without requiring precise alignment with the tracheal opening, as with endotracheal tubes.
4. **Protection Against Aspiration (Varied)**: Some SGAs (like the i-gel or laryngeal mask airway, LMA) provide partial protection against aspiration by creating a barrier, although they are not as effective as endotracheal tubes (ETI) in completely preventing gastric contents from entering the lungs. Some newer models have gastric drainage ports that allow for the venting of stomach contents to reduce this risk.
5. **Reduced CPR Interruptions**: One advantage of SGAs is that their insertion generally requires less interruption of chest compressions during cardiopulmonary resuscitation (CPR). Because they are faster and easier to insert compared to ETI, SGAs help maintain continuous chest compressions, which is critical for improving outcomes in cardiac arrest.

SGAs are commonly used as a bridge to more definitive airway management or when ETI is not feasible. Their simplicity, rapid insertion, and efficacy in maintaining oxygenation make them a valuable tool in emergency airway management.

SGA risks in OHCA:

Supraglottic airways (SGAs) are widely used in out-of-hospital cardiac arrest (OHCA) due to their ease of insertion and ability to maintain ventilation. However, they come with certain risks and limitations in this context:

1. **Aspiration Risk**: SGAs do not fully protect against the aspiration of gastric contents. Unlike endotracheal intubation (ETI), which seals off the trachea, SGAs provide only partial protection. This can lead to aspiration of stomach contents into the lungs, increasing the risk of pneumonia or other respiratory complications, especially in patients who regurgitate during resuscitation.

2. **Ventilation Failure**: Although SGAs are relatively simple to use, there can be instances of ventilation failure, where the device does not provide adequate oxygenation. This could be due to poor placement, a large leak around the device, or obstruction caused by anatomical factors such as a swollen airway. This is particularly critical during OHCA, where maintaining oxygenation is essential for survival.
3. **Gastric Insufflation**: SGAs can increase the risk of gastric insufflation, where air is forced into the stomach during ventilation. This may occur due to improper device placement or excessive ventilation pressures. Gastric insufflation increases the risk of regurgitation and aspiration, compounding the risk of lung injury.
4. **Airway Obstruction or Displacement**: The risk of improper placement or displacement of the device is also present. An SGA may move out of position, especially during patient handling or transport, leading to ineffective ventilation. Since SGAs are not as secure as ETIs, they are more likely to become dislodged.
5. **Reduced Efficacy in Prolonged Resuscitation**: In cases where resuscitation efforts extend for a long time, SGAs may become less effective compared to ETI. As time progresses, issues such as air leaks or aspiration could worsen, and the SGA might not provide the same level of airway protection or ventilation efficiency as ETI.
6. **Limited Airway Control**: While SGAs allow for relatively rapid placement, they do not provide the level of airway control seen with ETI. For patients with difficult airways or significant airway obstruction, an SGA may not be adequate for establishing and maintaining a patent airway.
7. **Complications Due to Anatomical Variations**: In some patients, anatomical variations such as an enlarged tongue, facial trauma, or a swollen airway can make SGA placement more difficult or ineffective. In these cases, the device might not seal properly, leading to ventilation failure.

These risks highlight the need for proper training in the use of SGAs, careful patient selection, and monitoring of ventilation efficacy during resuscitation in OHCA.

Bougie Over Endotracheal Intubation (ETI):

The choice between using a bougie versus traditional endotracheal intubation (ETI) is influenced by the specific context of airway management, particularly in emergency settings. Here's a detailed explanation of why a bougie might be preferred over conventional ETI in certain scenarios:

1. Enhanced Success Rates in Difficult Airway Scenarios

- **Visualization Challenges**: In situations where the vocal cords are not easily visible, such as in patients with facial trauma, obesity, or limited neck mobility, the bougie provides a valuable advantage. Its flexible design allows it to navigate around anatomical obstructions, enabling successful intubation even when direct visualization is poor.
- **Improved First-Attempt Success**: Studies, including the Bougie Use in Emergency Airway Management (BEAM) trial, have demonstrated that bougie-assisted intubation results in higher first-pass success rates

compared to traditional ETI methods. In challenging airway cases, the bougie can facilitate tube placement with greater accuracy.

2. Reduced Risk of Complications

- **Minimized Trauma**: The bougie's design minimizes trauma to the airway structures during intubation attempts. It is less likely to cause mucosal damage or exacerbate existing airway injuries compared to repeated ETI attempts.
- **Decreased Incidence of Failed Intubations**: By improving the chances of successful intubation on the first attempt, the bougie helps reduce the likelihood of multiple intubation attempts, which can lead to complications such as hypoxemia and airway trauma.

3. Ease of Use and Training

- **Training Requirements**: While both bougies and ETI require skill, the bougie can be advantageous in emergency settings where rapid and effective airway management is critical. The bougie may be easier to use in cases of difficult airways, particularly when practitioners have varying levels of experience with advanced airway management.
- **Familiarity and Versatility**: In many emergency departments, practitioners are more familiar with the bougie and its use in challenging intubation scenarios. Its versatility in navigating difficult airways makes it a preferred tool in such environments.

4. Cost and Availability

- **Cost-Effective**: Bougies are generally less expensive than high-tech video laryngoscopes or other advanced intubation devices. This cost-effectiveness makes them an attractive option for resource-limited settings or when budget constraints are a concern.
- **Widespread Availability**: Bougies are widely available and easy to incorporate into existing airway management protocols, making them a practical choice in diverse clinical settings.

5. Clinical Evidence and Recommendations

- **Supporting Evidence**: Recent trials and studies have reinforced the role of the bougie in improving intubation success rates, especially in difficult airway scenarios. This evidence supports the recommendation of bougie use in emergency airway management protocols.

In summary, the bougie offers several advantages over traditional ETI, particularly in managing difficult airways and reducing complications associated with multiple intubation attempts. Its effectiveness in enhancing first-pass success, coupled with its cost-effectiveness and ease of use, makes it a valuable tool in emergency airway management.

Conclusion

The growing body of research on emergency airway management, particularly in OHCA and other critical care scenarios, underscores the complexity of choosing the best technique for securing the airway. While endotracheal intubation (ETI) has long been the gold standard, it presents significant challenges, particularly in out-of-hospital settings where experienced providers may not always be available, and interruptions to chest compressions can be detrimental to patient outcomes. The introduction of alternatives like supraglottic airways (SGA) and bougie-

assisted intubation offers viable solutions for overcoming these challenges. The Bougie Use in Emergency Airway Management (BEAM) trial demonstrated the advantages of using the bougie for first-attempt intubations, with success rates significantly higher than those of conventional intubation methods. This finding suggests that the bougie should be considered a primary tool in emergency intubations, especially in scenarios where the airway may be difficult to visualize. However, the results are tempered by the fact that the providers in the study had significant experience with the device, potentially limiting its generalizability to less experienced practitioners or different clinical environments. In the prehospital setting, supraglottic airways (SGAs) have shown promising results, particularly in the Pragmatic Airway Resuscitation Trial (PART), which found a higher survival rate at 72 hours in patients managed with SGAs compared to ETI. SGAs also offer the advantage of faster insertion times and reduced interruption of chest compressions, which are critical factors in improving outcomes during cardiac arrest. Despite these benefits, SGAs are not without their drawbacks, as retrospective studies have indicated poorer long-term outcomes compared to ETI in some cases. Bag-valve-mask (BVM) ventilation remains a fundamental technique in airway management, and the study by Jabre et al. suggests that it may be comparable to ETI in terms of neurological outcomes for OHCA patients. However, the higher complication rates, including ventilation failure and gastric regurgitation, raise concerns about its routine use in place of more definitive airway interventions. Ultimately, the decision on which airway management technique to employ should be guided by the clinical setting, the provider's experience, and the available resources. ETI, while effective, requires significant skill and can be difficult to perform without interrupting CPR. SGAs offer a simpler, faster alternative but may not provide the same level of long-term benefit as ETI. The bougie presents a valuable tool for improving intubation success rates, particularly in challenging cases, though its widespread adoption will require further training and research. Future studies should continue to explore these techniques across different clinical environments, with an emphasis on improving training protocols and optimizing patient outcomes. The ideal airway management strategy may vary depending on the specific context, but with the proper tools and training, emergency providers can significantly improve patient survival and neurological outcomes.

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إدارة مجرى الهواء والتنفس في حالات الطوارئ: أفضل الممارسات والابتكارات الجديدة للرعاية الحرجة

الملخص:

الخلفية :إدارة مجرى الهواء تعد عنصرًا حيويًا في إنعاش المرضى المصابين بأمراض حرجة، خاصة في حالات الطوارئ وتوقف القلب خارج المستشفى (OHCA).تواجه الطرق التقليدية مثل أنبوب التنفس الرغامي (ETI) تحديات تتعلق بمتطلبات المهارة، والقيود الموارد، والانقطاعات في الإنعاش القلبي الرئوي. وقد اكتسبت الابتكارات الحديثة مثل المجاري الهوائية فوق المزمار (SGA) والبوجي اهتمامًا كبدائل محتملة.

الهدف :يهدف هذا المقال إلى مراجعة أفضل الممارسات في إدارة مجرى الهواء في حالات الطوارئ، مع التركيز بشكل خاص على فعالية مقارنة بين ETIو SGAsوتقنيات أخرى ناشئة.

الطرق :تلخص هذه المراجعة النتائج المستخلصة من التجارب السريرية العشوائية، بما في ذلك تجربة استخدام البوجي في إدارة مجرى الهواء في حالات الطوارئ (BEAM) ودراسات أخرى تقارن بين ETI و SGAsوالتهوية بواسطة قناع - صمام (BVM) في بيئات OHCA. تقوم بتقييم معدلات النجاح في المحاولة الأولى، ونتائج بقاء المرضى، والمضاعفات.

النتائج :وجدت تجربة BEAM معدل نجاح أعلى في المحاولة الأولى لتأثير البوجي (98%) مقارنة بالطرق التقليدية (87%). أظهرت الدراسات الأخرى نتائج عصبية مشابهة بين BVM وETI، في حين أظهرت SGAs ميزة في البقاء على قيد الحياة مقارنةً بـ ETI في البيئات السابقة للمستشفى. ومع ذلك، لوحظت معدلات فشل التهوية أعلى مع BVM.

الاستنتاج :توفر أجهزة SGAs والبوجي بدائل واعدة لETI ، خاصة في البيئات التي تعاني من قيود الموارد أو البيئات السابقة للمستشفى. يظل BVMخيارًا قابلاً للتطبيق لكنه يسبب مضاعفات. هناك حاجة إلى مزيد من البحث لتأكيد النهج الأكثر فعالية عبر مختلف البيئات السريرية.

الكلمات المفتاحية :إدارة مجرى الهواء، أنبوب التنفس الرغامي، المجاري الهوائية فوق المزمار، التهوية بواسطة قناع - صمام، توقف القلب خارج المستشفى، البوجي.