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Advancements in Airway Management and Ventilation in a Prehospital Cardiac Arrest: A Narrative Review

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Abstract

Out-of-hospital cardiac arrest (OHCA) remains a leading cause of death worldwide, with survival rates heavily dependent on the quality of prehospital advanced life support (ALS). Among the critical components of ALS, optimal airway management and ventilation strategies are essential to ensuring adequate oxygenation and facilitating effective resuscitation. This narrative review examines the evolution and current best practices in airway management and ventilation during prehospital resuscitation for OHCA. A comprehensive overview of traditional and emerging techniques, including bag-valve mask (BVM) ventilation, supraglottic airway devices (SADs), and endotracheal intubation, is provided, with a particular focus on their respective advantages and limitations in prehospital settings. Additionally, the role of mechanical chest compression devices, ventilator use, and feedback mechanisms in improving the quality of resuscitation are explored. The review also addresses the critical role of training, experience, and team dynamics, emphasizing the importance of specialized care teams, including prehospital physicians and anesthesiologists, in optimizing outcomes. Despite ongoing challenges and variations in clinical practice, the evidence suggests that a systematic approach, informed by up-to-date guidelines, feedback, and continuous professional development, is vital for improving patient survival rates in OHCA. By integrating advanced airway management techniques with optimized ventilation strategies, prehospital care providers can significantly enhance the efficacy of resuscitation efforts, ultimately improving the chances of survival and neurological recovery for OHCA patients.

Keywords: Airway Management, Out-of-hospital cardiac arrest

Introduction

The administration of airway management and insufflations has been a fundamental part of resuscitation efforts since biblical times. In more recent history, the initial approach to resuscitation involved manipulating the victim's arms to induce a breathing-like pattern in the chest. Eventually, Peter Safar, MD, integrated artificial respiration with chest compressions, establishing the foundation for modern cardiopulmonary resuscitation (CPR). In addition to chest compressions, laypersons were trained in mouth-to-mouth resuscitation, while medical professionals were instructed in bag-mask ventilation, followed by endotracheal intubation. The initial approach to CPR, which emphasized the sequence of airway, breathing, and circulation (ABC), was revised to CAB, prioritizing chest compressions, as it was observed that in most cases, the circulatory system still contained sufficient oxygen during the early stages of arrest. Subsequent updates to CPR guidelines have further emphasized the importance of chest compressions, with the ratio of compressions to ventilations evolving from 5:1 to 15:2, and ultimately to the current 30:2. This compression-to-ventilation ratio has remained consistent in recent guideline revisions.

At present, there is a renewed focus on airway management, ventilation, and capnography in CPR. Endotracheal intubation is gradually being replaced as the gold standard in prehospital airway management during CPR, and various alternative ventilation strategies are being explored. Furthermore, there is growing recognition of the interplay between the different components of CPR, such as airway management and ventilation, and the critical role that human factors play in clinical performance. The dynamic interaction between chest compressions, airway management, and ventilation during out-of-hospital cardiac arrest continues to be an active area of research (Lurie et al., 2016).

Physiology

The primary objectives of CPR are twofold: A) to deliver oxygen to the tissues to alleviate hypoxic injury, and B) to restore the patient's circulatory function. In the initial minutes following cardiac arrest caused by a shockable rhythm, known as the electrical phase, the oxygen content in the blood and tissues (particularly in the heart) is typically adequate, making immediate defibrillation more critical than ventilation. However, within a few minutes, oxygen levels begin to decline, transitioning to the circulatory phase, where ventilation becomes progressively more important (Dorph et al., 2004). Optimizing CPR has been shown to enhance oxygen delivery and myocardial adenosine triphosphate (ATP) levels, which, in turn, increases the likelihood of successful defibrillation. In cases of hypoxic cardiac arrest, the provision of ventilations during CPR is particularly vital, as it addresses the underlying cause of the arrest.

Although the practice remains a topic of debate, international guidelines advocate for the administration of ventilations during cardiopulmonary resuscitation (CPR)(Perkins et al., 2015). Evidence suggests that CPR with ventilations is associated with improved survival outcomes when compared to compression-only CPR. In advanced life support settings, higher arterial oxygen partial pressures have been linked to an increased incidence of return of spontaneous circulation (ROSC) and enhanced survival rates. One additional benefit of ventilation during CPR is the removal of carbon dioxide, which aids in counteracting the metabolic acidosis that typically arises during cardiac arrest.

However, ventilation during CPR also presents potential physiological drawbacks. The normal physiological mechanisms that facilitate venous return to the heart, such as the relaxation of the right ventricle following contraction, the active muscle pump in the legs during walking, and the creation of negative intrathoracic pressure from breathing, are all disrupted during cardiac arrest. Consequently, venous return is solely dependent on moments of negative intrathoracic pressure generated by chest recoil during the decompression phase of chest compressions. Positive pressure ventilation, therefore, may result in elevated intrathoracic pressure, which can impede venous return and reduce the effectiveness of CPR. This issue is also relevant when considering the application of positive end-expiratory pressure (PEEP) during CPR.

Aim of this Review

This review examines airway management and ventilation techniques during prehospital resuscitation for adult out-of-hospital cardiac arrest, with the objective of enhancing prehospital care and guiding future research and innovation. Practical recommendations are provided for clinicians involved in prehospital emergency care, aimed at helping them to save lives.

Airway Management

A patent airway is essential for the effective transport of oxygen to the lungs. Even if airway obstruction is not the primary cause of cardiac arrest, a patient in arrest cannot maintain a clear airway due to the loss of muscle tone and protective reflexes. Regurgitation of gastric contents, leading to airway contamination and aspiration, is also common. Therefore, airway management is a critical intervention in every resuscitation effort.

The most employed airway strategy in clinical practice is a stepwise approach, tailored to the available resources and the stage of resuscitation. Laypersons and first responders are typically trained to perform mouth-to-mouth ventilation using the head-tilt-chin-lift technique and a facemask, when available. Basic Life Support (BLS) Emergency Medical Services (EMS) providers generally use basic airway maneuvers and self-inflating

bags (or bag-valve masks, BVM), while advanced airway management, including supraglottic airway devices (SADs) and endotracheal intubation, is typically carried out by advanced-level providers such as critical care paramedics, nurses, or physicians.

It is important to note that airway management impacts various other facets of resuscitation, including scene management, ventilation, the quality of chest compressions (including interruptions), defibrillation, and addressing the underlying cause of the arrest. Treating airway management in isolation, without considering these other factors, oversimplifies the complex environment in which prehospital care providers operate.

Bag-Valve Mask Ventilation

Bag-valve mask (BVM) ventilation is a practical initial technique in advanced life support, as it requires minimal preparation and is an efficient method for initiating oxygenation. Adequate ventilation with a BVM necessitates an open airway and a proper seal with the facemask, a challenge that is often underestimated, particularly during the stressful early phases of an out-of-hospital cardiac arrest, where many distracting factors are present (Saddawi-Konefka et al., 2015). There are concerns that suboptimal BVM ventilations in this context may lead to reduced oxygenation, which could negatively impact survival when compared to the use of advanced airway devices (Saddawi-Konefka et al., 2015). Therefore, optimizing the BVM technique is crucial to ensure an adequate tidal volume with the lowest possible pressure, minimizing the risk of gastric insufflation. To help maintain a patent airway, an oropharyngeal or nasopharyngeal airway may be employed. Using these devices with a low threshold is advisable as they facilitate effective BVM ventilation and oxygenation, with minimal risk of complications. BVM ventilations should be synchronized with chest compressions, following a compression-to-ventilation ratio of 30:2.

Traditionally, the rescuer performing BVM ventilations manages the airway and facemask using the one-handed "CE grip" technique, while squeezing the bag with the other hand. However, a modified two-rescuer CPR technique has been shown to yield superior ventilation while maintaining the quality of chest compressions. This technique includes the optimal BVM method: one rescuer holds the face mask with both hands, thumbs pointing downward, while providing a jaw thrust with the other fingers(Gerstein et al., 2013). The second rescuer administers two BVM ventilations after 30 chest compressions.

The modified two-rescuer CPR technique offers several advantages, including the prevention of unintentional simultaneous chest compressions and BVM ventilations, which can occur if rescuers become distracted without this technique. Additionally, this method eliminates the need for communication between the two rescuers to synchronize compressions and ventilations, thereby simplifying the process. Furthermore, the rescuer providing BVM ventilations typically assumes a leadership role in directing the resuscitation. This technique allows for more cognitive bandwidth to be devoted to organizing the scene effectively.

Aspiration is frequently cited as a reason for transitioning from BVM ventilations to an advanced airway device during CPR. While data on the incidence of aspiration in patients receiving only BVM ventilation compared to those with advanced airway devices is inconsistent, aspiration is a common occurrence in CPR, irrespective of the airway management technique used (Baekgaard et al., 2020).

Supraglottic Airway Devices (SADs)

Supraglottic airway devices (SADs), which are inserted into the oropharynx, have proven to play a critical role in emergency airway management. Various types of SADs are available, offering advantages over endotracheal intubation, including shorter preparation times, faster and easier insertion, a significant reduction in the need to pause compressions, and higher success rates of insertion, even by less experienced rescuers. The incidence of aspiration is comparable between SADs and endotracheal intubation, as regurgitation typically occurs soon after cardiac arrest, before prehospital providers arrive. Given that the insertion of SADs is less complex than endotracheal intubation, maintaining competency in their use is more feasible for prehospital care providers.

The main limitations of SADs include air leakage during ventilation and potential dislocation during transport. To prevent air leakage while ventilating with a SAD, CPR should be performed using the 30:2 compression-to-ventilation ratio rather than continuous compressions. Although large randomized controlled trials (RCTs) on SADs remain limited, some studies have shown no significant difference in outcomes, while others indicate that SADs, when used as the primary advanced airway device, result in better outcomes compared to endotracheal intubation. Recent trials suggest that patients who received SADs during cardiac arrest had a higher chance of neurological intact survival, while the incidence of complications remained comparable. As a result, recent recommendations for advanced airway management have favored the use of SADs in prehospital resuscitation, particularly when providers have limited experience with endotracheal intubation (Soar et al., 2020).

Endotracheal Intubation

Endotracheal intubation offers several advantages during CPR, such as providing airway protection from gastric contents, the ability to handle high airway pressures during ventilation, and freeing the provider's

hands to perform other interventions. Another argument for intubation is that it allows for continuous chest compressions with asynchronous ventilations, thereby increasing the number of chest compressions per minute.

However, many of these advantages have been questioned in recent years. Aspiration generally occurs before the arrival of emergency medical services (EMS) and is not prevented by endotracheal intubation. High airway pressures have a detrimental effect on cardiac output, and SADs can also free the provider's hands, often more quickly than endotracheal intubation. Furthermore, CPR with an endotracheal tube does not result in a higher rate of chest compressions compared to CPR with a BVM, and CPR using the 30:2 ratio has been shown to generate equivalent cardiac output to continuous chest compressions. Additionally, the majority of RCTs on endotracheal intubation fail to demonstrate a clear survival benefit over SADs (Soar et al., 2019).

Endotracheal intubation also has several disadvantages, including the challenge of maintaining competency for providers with limited experience, resulting in lower success rates for intubation, as well as undesirable interruptions in chest compressions during the intubation process. This often leads to distraction from performing high-quality chest compressions and treating the underlying cause of cardiac arrest, as the preparation and focus required for successful intubation can divert attention.

Endotracheal intubation remains an alternative for emergency airway management when BVM and SADs fail to provide adequate oxygenation during CPR. In such cases, it is essential to ensure the quality and safety of the intubation process. Key goals in this context include minimizing procedure time, maintaining continuous chest compressions during intubation, achieving a high first-pass success rate, using waveform capnography, and controlling ventilation after intubation.

There are several strategies to ensure high-quality intubation in an EMS setting. Achieving an optimal first-pass success rate requires experienced providers to perform the intubation. Providers need to perform more than 240 intubations to achieve a 90% success rate with high-quality performance during CPR. In many settings, this level of experience can only be attained by anesthesiologists, as evidenced by studies showing that experienced anesthesiologists achieve success rates above 99% in prehospital intubations. Current guidelines permit a 5-second pause in chest compressions for intubation. However, in practice, chest compressions are often paused for much longer than 5 seconds. Therefore, it is recommended to avoid interrupting chest compressions entirely during intubation. Using a stylet or bougie can improve the success rate of intubation in this challenging setting (Bączek & Zagańczyk-Bączek, 2020).

Videolaryngoscopy may be helpful in increasing the success of intubation, especially for less experienced providers who encounter patients in cardiac arrest requiring intubation, particularly when expert assistance is not immediately available. For experienced providers, videolaryngoscopy can help prevent interruptions in chest compressions and further enhance first-pass success (Arulkumaran et al., 2018). Additionally, videolaryngoscopy allows for the recording of the intubation process, which can be useful for monitoring quality and facilitating education.

Endotracheal intubation is also indicated for patients who achieve return of spontaneous circulation (ROSC) as part of post-resuscitation care. Maintaining high-quality and safety standards is crucial during this phase, as rapid sequence induction (RSI) can lead to serious complications in hemodynamically unstable patients. Therefore, endotracheal intubation should only be considered in the prehospital setting when performed by a team capable of meeting current quality guidelines, or alternatively, when the patient is transported to a cardiac arrest center with an appropriate pre-alert.

Front-of-Neck Airway (FONA)

When other airway management techniques fail to establish a patent airway, front-of-neck airway (FONA), also known as emergency cricothyroidotomy, serves as a rescue intervention. Although various techniques exist, the "scalpel-bougie-tube" approach is commonly recommended. In the prehospital setting, the use of simple, readily available, and familiar equipment for this procedure, along with sufficient practice, has been shown to improve the success rate of establishing a FONA. Some EMS systems train paramedics to perform surgical airways with satisfactory success rates, but ongoing education is crucial to maintaining the confidence of providers (Furin et al., 2016). For prehospital providers who may not be permitted or confident to perform a surgical technique, a non-scalpel method or device could serve as an alternative.

Endotracheal intubation has long been considered the "gold standard" for airway management during CPR. However, it has largely been supplanted using supraglottic airway devices (SADs) for prehospital airway management during CPR, as supported by multiple studies. SADs are easier to use, offer a higher first-pass success rate, and achieve oxygenation more quickly. Evidence suggests that the use of these devices results in comparable, if not superior, survival rates compared to intubation. A staged airway strategy, with a focus on oxygenation as the primary goal, is therefore recommended(Granfeldt et al., 2019).

Ventilation

Although ventilation has been a critical component of CPR for many years, it has received less attention in resuscitation science and practice compared to chest compressions, airway management, and the administration of drugs. Fundamental questions surrounding ventilation during CPR remain largely unresolved. Moreover, ventilation has often been overlooked as a potential confounder in many large studies within the field

of advanced life support. From the standpoint that cells require oxygen for survival, and CPR is designed to reverse the dying process, oxygenation and ventilation cannot be disregarded as essential elements of CPR. Furthermore, ventilation is closely linked to other crucial components of CPR, including chest compressions, airway management, and addressing the underlying cause of the arrest.

No Ventilation or Passive Oxygenation

A key research question in studies on ventilation during CPR is whether ventilation is necessary. It has been hypothesized that chest compressions might generate air movement sufficient for oxygenation, or conversely, that ventilations during CPR could be harmful due to the increase in intrathoracic pressure. CPR performed without ventilation has come to be known as "compression-only CPR." Most EMS systems that advocate for compression-only CPR use an oropharyngeal airway and a non-rebreathing oxygen mask to provide "passive oxygenation". However, the air movement generated by chest compressions does not surpass the anatomical dead space of the airway, making sufficient oxygenation unlikely (McDannold et al., 2014). Consequently, alternative techniques to insufflate oxygen with higher flow rates, such as the endotracheal Boussignac tube, have been proposed. While these techniques mitigate the potential negative effects of ventilation, they introduce disadvantages, such as increased atelectasis, the need for more complex actions and devices, and the fact that high-flow oxygen techniques using an endotracheal tube can only be initiated later, after intubation has occurred. Additionally, hypercapnia, which exacerbates acidosis, must be taken into consideration. Given the limited solid data on passive oxygenation (due to variations in methods, study methodologies, and small sample sizes), and the lack of clear evidence supporting a survival benefit, passive oxygenation during prehospital advanced life support is currently not recommended (Ordelman et al., 2015).

Synchronous (30:2) versus Asynchronous Ventilation during Continuous Compressions

Current guidelines advocate synchronizing chest compressions with ventilations at a 30:2 ratio prior to intubation and ventilating asynchronously during continuous compressions following intubation. The 30:2 ratio is believed to be the optimal balance for ensuring effective oxygen delivery. During continuous chest compressions, BVM ventilation is thought to generate high insufflation pressure, potentially leading to gastric insufflation. However, interrupting compressions for BVM ventilations can cause a rapid decline in cardiac output. A large cluster-randomized trial examining the effects of synchronous (30:2) versus asynchronous BVM ventilations on mortality found that synchronous (30:2) CPR resulted in higher survival rates (Nichol et al., 2015). This suggests that synchronous compressions and ventilations (30:2) might be superior because BVM ventilations without concurrent chest compressions provide better oxygen insufflation than during chest compressions. Additionally, experimental data from a porcine model indicated no difference in carotid blood flow when comparing 30:2 CPR with continuous compressions.

Influence of Mechanical Chest Compression Devices

Mechanical chest compression devices can influence ventilation during CPR, particularly in the 30:2 mode. Devices such as Autopulse® and LUCAS®, among the most used mechanical chest compression devices, pause compressions for 3 seconds after 30 compressions to allow for two ventilations. After this brief pause, compressions are automatically resumed. This duration may be insufficient, as prehospital care providers typically require a median of 5.5 seconds to administer two BVM ventilations during manual CPR. Consequently, it is anticipated that in a significant number of instances, providers may not be able to deliver two insufflations during the compression pause, or the tidal volumes delivered may be too small. This reduction in ventilation quality could potentially outweigh the improvements in chest compression quality, which may help explain the absence of a survival benefit for mechanical chest compression devices in large, randomized trials (Wik et al., 2014). However, these trials did not measure or report ventilation parameters when mechanical compression devices were used.

Ventilation Frequency

During asynchronous ventilation with continuous compressions, the ventilation frequency can be adjusted. An optimal frequency should be sufficient to ensure adequate oxygenation, while keeping the number of ventilations as low as possible to avoid generating high intrathoracic pressure that may reduce venous return. The currently recommended frequency of 10 ventilations per minute is based on animal studies. Subsequent observational clinical studies have shown that higher ventilation frequencies are not associated with worse outcomes and may sometimes even improve survival (Sanson et al., 2019). Evidence suggests that at ventilation frequencies between 15 and 20 per minute, the negative effect on cardiac output does not appear to outweigh the positive effect on oxygenation. It has been suggested that higher ventilation frequencies are especially beneficial in cases of prolonged cardiac arrest. A higher ventilation frequency also facilitates CO2 removal, which counteracts metabolic acidosis.

Tidal Volumes

Tidal volumes during CPR should be large enough to provide sufficient oxygenation but as small as possible to prevent excessive airway pressure and gastric insufflation in non-intubated patients. A tidal volume

of 1000 ml did not result in higher partial pressure of arterial oxygen (PaO2) than a tidal volume of 500 ml. Current guidelines recommend tidal volumes in the range of 500–600 ml. CPR training materials often suggest insufflating until visible chest rise occurs. However, recent data have indicated that this may lead to inadequate tidal volumes, as a volume of approximately 380 ml can already produce visible chest rise. In clinical practice, larger tidal volumes can be administered, as adult BVM devices typically have a volume capacity of around 1.5L. To prevent overinflation, alternative techniques such as using a different grip on the bag or smaller self-inflating bags (e.g., pediatric bags) have been proposed. Pediatric self-inflating bags provide tidal volumes of approximately 365 ml, compared to 779 ml for adult self-inflating bags. Both devices result in similar oxygen saturation but lower airway pressure and reduced gastric insufflation when the pediatric self-inflating bag is used. An insufflation time of 1 second is recommended to balance the disadvantages of both short and long insufflation times(Kroll et al., 2019).

Oxygen

During CPR, it is recommended that ventilations be provided with 100% oxygen to maximize oxygen delivery. Although no clinical trials directly compare various oxygen concentrations during CPR, preclinical studies have shown better outcomes with increasing oxygen concentrations. Additionally, two clinical observational studies found a positive correlation between partial pressure of oxygen (PaO2) and survival outcomes. After achieving return of spontaneous circulation (ROSC), oxygen levels should be adjusted to maintain an oxygen saturation of 94–98%, as hyperoxia has been suggested to negatively affect survival (Roberts et al., 2018).

Positive End-Expiratory Pressure (PEEP)

The application of PEEP during CPR has traditionally been considered undesirable, as positive intrathoracic pressure could impede venous return. However, recent findings have suggested that a small amount of PEEP may improve outcomes. One study indicated a positive correlation between airway pressure during CPR and survival. This effect may be explained by an improvement in oxygenation and a reduction in pulmonary vascular resistance, which subsequently enhances blood flow generated by chest compressions. Nonetheless, further randomized clinical trials are needed to better understand the precise effects of PEEP during CPR.

Impedance Threshold Device (ITD)

An impedance threshold device (ITD) creates negative intrathoracic pressure during CPR. It is integrated into the ventilation circuit between the airway and the self-inflating bag and features a valve that allows air to exit during chest compressions but blocks airflow back into the chest during decompression. This mechanism generates negative intrathoracic pressure, which aims to increase venous return. Several studies, particularly those involving active compression-decompression (ACD), have shown a positive effect on outcomes. A large randomized clinical trial, however, did not demonstrate a beneficial effect of the ITD, although a post-hoc analysis revealed that outcomes improved with ITD use when patients received high-quality CPR (Yannopoulos et al., 2015). While the ITD is not currently recommended due to insufficient quality of the available data, combining ITD with ACD and controlled sequential elevation of the head and thorax to reduce intracranial pressure has been shown to improve cerebral blood flow during CPR (Rojas-Salvador et al., 2020). In an observational study, this "bundle of care" was associated with increased survival, though further research is required to establish the role of the ITD in CPR and the impact of the "bundle of care" on survival.

Capnography

Waveform capnography plays an important role in various aspects of prehospital resuscitation. Primarily, it is the gold standard for confirming correct tube placement. Additionally, capnography can be used to assess the quality of chest compressions, detect ROSC, monitor ventilation frequency, and assist with prognostication. It can also be useful for differential diagnosis, as certain causes of cardiac arrest may lead to abnormal end-tidal CO2 values. However, artifacts in the waveform caused by chest compressions may affect the accuracy of end-tidal CO2 quantification on the monitor. Following ROSC, ventilation can be adjusted based on the end-tidal CO2 levels(Leturiondo et al., 2020).

Application in the Prehospital Practical Context

Implementing guidelines and achieving high-performance CPR in the prehospital setting is not an automatic process. Especially in cases where evidence is contradictory, such as for airway management and ventilation during advanced life support, clinical practice can vary significantly. The prehospital emergency environment is both demanding and diverse, and prehospital systems differ across regions worldwide. Even when up-to-date practice guidelines and clear implementation strategies are in place, successful implementation can be a complex and time-consuming challenge.

Several tools are available to facilitate the implementation of these guidelines and to help achieve high-quality standards in clinical care. First and foremost, training staff is essential to improve performance and positively impact outcomes in cases of cardiac arrest. Second, increasing the experience of prehospital providers by dispatching specific groups to out-of-hospital cardiac arrest incidents can enhance both prehospital treatment and decision-making. Deploying prehospital physicians further extends the range of available resuscitation

interventions, which can improve patient outcomes. Third, ergonomics play a significant role but are often underutilized. For instance, optimizing the design of a prehospital airway bag can reduce procedure times, minimize errors, and lessen the cognitive load on providers. Moreover, the use of easy-to-operate, automated devices can help ensure adherence to guidelines while simultaneously reducing stress levels for prehospital providers. The use of a ventilator during CPR, for example, can assist in achieving specific targets, such as the required ventilation frequency after intubation, although careful attention must be paid to ventilator settings. Lastly, providing feedback during and after prehospital resuscitation can improve performance. In addition to chest compression feedback devices, ventilation feedback devices have become available and demonstrated positive effects on performance, although their impact on outcomes is still under investigation. Structural feedback, audits, and implementation checks are also valuable tools for enhancing performance, fostering innovation, and creating a culture of excellence in prehospital care(Bleijenberg et al., 2017).

Role of the Anesthesiologist in Prehospital Resuscitation

Anesthesiologists can make significant contributions to various aspects of prehospital resuscitation, both operationally and strategically, although their presence in prehospital care varies by country and EMS system. Additional training to provide care in the prehospital setting is crucial for optimizing their impact. Including anesthesiologists in prehospital care as part of a critical care response tier within an EMS system has been shown to increase the success of intubation. Equally important, however, is their ability to determine when intubation should be avoided. Anesthesiologists possess expertise beyond airway management, as evidenced by a study in which the presence of a prehospital physician, the majority of whom were anesthesiologists, was viewed positively by ambulance staff, even when no additional interventions were performed on the scene. Whether through airway management, other interventions, or clinical decision-making, prehospital anesthesiologists have the potential to improve patient outcomes.

At the management level, anesthesiologists can serve as EMS medical directors or collaborate with EMS in areas such as education, guideline development, research, and innovation. Anesthesia societies also possess the expertise to develop guidelines for prehospital care (Rehn et al., 2016).

Conclusion

The implementation of high-performance CPR in the prehospital setting presents unique challenges, influenced by factors such as varied clinical practice, the complexity of the emergency environment, and the diversity of prehospital systems worldwide. Successful resuscitation depends not only on adherence to evidence-based guidelines but also on the integration of various tools and strategies to optimize patient outcomes. Training and experience, particularly the dispatching of specialized providers such as prehospital physicians, can significantly enhance the quality of care provided during out-of-hospital cardiac arrests. Ergonomics, automated devices, and feedback mechanisms further support the achievement of guideline-compliant performance, reducing errors and minimizing provider stress.

Anesthesiologists play a crucial role in prehospital resuscitation, not just through their expertise in airway management, but also in making critical decisions regarding the need for advanced interventions. Their involvement extends beyond clinical procedures, contributing to management and the development of prehospital care guidelines. By improving team performance through feedback and fostering a culture of continuous improvement, prehospital resuscitation teams can significantly impact survival outcomes.

In conclusion, achieving high-quality prehospital resuscitation requires a multifaceted approach, incorporating training, technological advancements, and expert decision-making. Ongoing research and innovation, along with systematic feedback and performance audits, will continue to refine prehospital care practices and ensure that out-of-hospital cardiac arrest patients receive the highest standard of care possible.

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