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The Relationship Between the Training Level of Paramedics in Advanced Airway Management and the Success Rates of Field Ventilation in Cases of Respiratory Arrest in the Saudi Red Crescent

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Abstract

This study examines the relationship between the level of training that paramedics have taken in advanced airway management and the success of such paramedics to ventilate in real emergency scenarios especially during respiratory arrest cases attended to by the Saudi Red Cresser Authority. This research had both a descriptive and analytical research method which involved the use of a questionnaire given to 200 paramedics. The instrument gathered both demographic data and the statements that rated the training quality and field performance. The results showed that there was a obvious positive correlation between the high level of training and better efficiency in the process of ventilation in emergency situations and higher success. Another aspect in the study that has been identified as important is the need to have regular and updated training and close field supervision to not only improve the quality of pre-hospital care; but also the preparedness of paramedics to handle critical cases effectively. In the end, such outcomes will help in sustaining the professional competence and readiness in the Saudi Red Crescent Authority.

Keywords Keywords: advanced airway management, paramedic training, field ventilation, Saudi Red Crescent Authority, respiratory arrest, professional performance, emergency medical care.

Introduction

One of the obligatory elements of an emergency care in the pre-hospital setting is related to the advanced airway management (AAM), especially in the context of respiratory arrest. A clear and functional airway is important in delivering oxygen effectively and has a decisive impact on the outcome of patients and their survival. In the working environment of the Saudi Red Crescent Authority, paramedics are often faced with a difficult situation requiring highly technical expertise to undertake safe and efficient pressure ventilations.

AAM conceptualization is a range of processes which extends beyond the simple airway control methods, such as tracheal intubation and supraglottic airway devices. The high level of such interventions demands practice, much practical training, and decision-making. A great number of foreign researches have revealed that there is a strong correlation between the quality of paramedic training in such processes and the increased success rates in airway management which in its turn leads to the enhancement of the overall quality of emergency ventilation provided to patients in the sphere.

An increased capability of the paramedics in making swift and correct decisions, choosing the right airway management technique depending on the patient condition, and managing complications like challenging intubation or tube misplacement would support the latter. On the other hand, lack of adequate training can result in delayed airway control, prolonged oxygen deprivation and higher risk of brain and cardiac ischemia- aspects which have negative effects on chances of successful resuscitation.

As such, in the Saudi Red Crescent Authority, training programs associated with advanced airway management should be constantly reviewed and improved. This entails integration of simulation based learning, periodical hands on sessions, and periodic performance tasks. This constant enhancement guarantees that the paramedics are not just theoretically ready, but they are also practically prepared to deal with real life crises and manage them professionally and accurately. Finally, enhancing the quality of training is a direct way to save lives and increase the quality of the emergency medical services offered in the Kingdom of Saudi Arabia.

Discussion

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Advanced airway management (AAM) is a term used to describe a set of expert medical practices that are used to achieve and maintain a clean airway that will permit effective ventilation and oxygenation of the lungs. These are interventions needed when the simple airway techniques, including head-tilt-chin-lift maneuver or bag-valve-mask ventilation are not sufficient to enable an adequate oxygen supply, particularly in life-threatening situations such as respiratory arrest, severe trauma, or reduced awareness.

The main objectives of AAM are to provide constant oxygen supply, avoid airway obstruction, and ensure that the lungs are not exposed to the aspiration of gastric fluid, blood, or secretions. The most common is the tracheal intubation method that consists in placing a tube through the vocal cords into the trachea in order to create a safe ventilatory route. Alternatives Supraglottic airway devices (e.g., laryngeal mask airways) offer simpler and quicker methods of airway control, especially in challenging conditions.

The introduction of technological advancements has seen the innovation of such tools like the use of video laryngoscopes that enhance the visualization and increase the success rates with problematic airways. In severe situations, emergency surgeries like cricothyroidotomy may be undertaken as an alternative to other operations in cases where the obstruction of the upper airway makes it impossible to carry out other surgeries. The effectiveness of such processes is significantly influenced by the competence and practice of the paramedic, as well as by his or her ability to adjust to stress. Advanced Airway Management Paramedic Skills and Competencies.

In order to be effective in AAM, paramedics should possess a firm knowledge of respiratory anatomy and physiology as well as perfected technical aptitude. These involve mastery of airway adjuncts, tracheal intubation (both traditional and video-assisted) and the need to switch to other methods. Similar to paramedics, one should be able to make an attempt at intubation in a few seconds to reduce oxygen loss and verify that the tube is placed correctly as soon as possible by measuring end-tidal carbon dioxide levels.

Other than manual competencies, cognitive and behavioral capabilities are also significant. It is necessary to make fast and correct decisions during stressful situations, be able to communicate with other team members effectively, and adjust to a situation in the field that may be unpredictable (vomiting of the patient or obstruction of the view). Training via simulation exercises regularly retains such important skills and maintains a steady emergency preparedness.

The Role of Continuous Training in Enhancing Competence

Skills of advanced airway management may decline with time due to lack of practice in the field because in most cases there is no opportunity to apply the knowledge in real life situations. Continuous medical education (CME), therefore, is very crucial in sustaining and upgrading these competencies. The frequent simulation-based training, the use of scenarios, and regular performance reviews enables paramedics to perfect their methods, remain informed of the new technologies, such as video laryngoscopes, and the latest best practices according to the latest clinical recommendations.

Continuous learning also promotes the culture of quality enhancement in emergency services. Through the case results and the work of the team, paramedics can determine the area of weaknesses and can direct their focus on the improvement particular areas, such as the management of hard airways or complications in the intubation process. Therefore, not only does CME retain technical competence but it also encourages reflective and analytical thinking, making theoretical learning turn out to be improved clinical outcome.

The Relationship Between Experience Level and Field Ventilation Success Rates

The advanced airway management procedures are determined by the practical experience of paramedics. The experience the paramedic had, the more he/she was able to conduct these delicate and time-sensitive interventions accurately and with confidence. The experience enables paramedic to remember the important steps unconsciously, predict problematic cases, and cope with them effectively even in extreme circumstances.

The simulated or real situations of airway management repeatedly help to solidify procedural memory to allow the paramedic to conduct tracheal intubation more rapidly and with precise error reduction. This rate is crucial in eliminating the oxygen-deficiency and avoiding hypoxic brain damage, which has a direct impact on patient survival and neurological recovery.

To maintain and improve such a performance level, employers such as the Saudi Red Crescent Authority need to make sure that there are organized programs that facilitate the accumulation and maintenance of the acquired experience. On-going exposure to simulation-based conditions and rotations in hospitals will offer other opportunities through which these life-saving skills can be perfected.

Factors Influencing the Effectiveness of Airway Management During Respiratory Arrest

Airway management in respiratory arrest is influenced by various factors that can be categorized into three groups namely paramedic-related, patient-related and environmental or equipment-related factors.

The paramedic related factors are the competence of the paramedic, his/her confidence and the training of the paramedic. With practice in the skills, there will be a higher accuracy and less failed attempts.

Factors that relate to patients include anatomical problems, including a small mouth or a capped neck, making visualization of the airways difficult.

The environmental factors are poor lighting, space, or faulty equipment, all of which are obstacles to success rates.

Adherence to the detailed airway management guidelines and the harmonious interaction of the team members can help resolve these difficulties and guarantee the success of ventilation at all times.

The competency of the paramedic and his/her experience with the procedure (in particular, the ability to use the supraglottic airway devices or tracheal intubation) is the most significant factor on the factors related to the caregiver (paramedic) and the factors related to the patient and the environment The complexity of the airway anatomy (e.g. limited mouth opening, short and thick neck, the presence of congenital abnormalities, vomiting in the mouth and pharynx) is another factor that makes it hard to see the vocal cords and

Besides that, equipment-related and logistical process-related factors also contribute to effectiveness such as the availability and quality of equipment such as the availability of intubation tubes of various sizes, a functional laryngoscope, and the presence of powerful suctioning devices in particular It is also crucial to follow clear and uniform procedures in the sequencing of airway management with the support of high-quality chest compressions by the paramedic team, i.e. equipment availability and quality, the presence of a working laryngoscope, and the presence of powerful suctioning devices 6,

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The criteria for evaluating paramedic performance in advanced airway management are divided into three main factors to ensure a comprehensive and effective assessment, which can be explained as follows:

Technical efficiency and procedural skills : This factor focuses on manual skills and the quality of the procedure itself, and includes several criteria, such as the success rate on the first attempt This is the percentage of cases where the airway is successfully secured, whether by tracheal intubation or supraglottic airway device, on the first attempt This is a strong indicator of the rescuer's competence , as the procedure must be performed within a limited time frame, usually less than 30 seconds per attempt To reduce the duration of ventilatory interruption and oxygen deficiency 6,7

and Correct confirmation of the situation Using a carbon dioxide meter at the end of exhalation Immediately and correctly after inserting the tube to confirm it is in the trachea and not the esophagus the second element is decision-making and resource management This element focuses on the paramedic's cognitive ability to manage the situation intelligently and apply protocols, and includes a rapid initial assessment and extent The paramedic’s ability to quickly recognize signs of a difficult airway and decide on the most appropriate technique, such as choosing a video endoscope instead of a traditional one, or using a supraglottic device immediately as a first option, as well as adhering to the procedural steps specified in the Saudi Ambulance Authority protocols in cases of airway failure , making a quick and logical transition from one technique to another , being able to clearly and effectively guide the assisting team members, and also assessing the paramedic’s ability to avoid or reduce common complications such as soft tissue injuries, unintentional entry into the esophagus, or a sharp drop in blood pressure during the procedure 6,9

The third element is continuous training and skill maintenance , which focuses on the extent to which the paramedic is committed to maintaining their skills and competence over time This includes the case log, which is the number of procedures actually performed during a specific period on a patient or during clinical training in the hospital Where a minimum number is required to maintain the level of competence , participation in training and commitment to attending annual or periodic simulation courses for advanced airway management, showing improvement in performance after training , as well as periodic evaluation and showing success in theoretical and practical competency tests that are conducted periodically to ensure continued mastery of skills 5,2

Study Field

This was done on a group of paramedics employed by the Saudi Red Crescent Authority where the cases involved include respiratory arrest. The research is aimed at proving the correlation between the extent of their training in Advanced Airway Management and the success levels of such operations in field ventilation situations with their handling of such emergency scenarios.

Methodology

The research approach was descriptive analytical field approach, which was appropriate with the nature of the research objectives and variables related to this research. The methodology chosen will focus on establishing the relationship between the level of training paramedics have gone through and their effectiveness in the field based on the success of the ventilation operation in respiratory arrest situations.

Research Tools

The information was collected based on the specially designed questionnaire aimed at the objectives of the given study, which included two major sections:

Demographic information: such as age and the amount of training courses that the paramedic had undergone in advanced airway management.

Statements section: It includes 10 items on a five-point Likert scale (from 1 = strongly disagree to 5 = strongly agree), to measure the level of training, application of skills, and the impact of this on the success rates of field ventilation operations.

Analysis

Table 1. Age Distribution of Participants

Age Group	Frequency	Percentage(%)
Under 25 years	40	20.0
34–25years	90	45.0
44–35years	50	25.0
45years and older	20	10.0
Total	200	100.0

The outcome of the results indicates that the (2534) age group has the most representative age group among the sample members at 45 percent of the total sample, which is a sign of the youthfulness of the field ambulance teams. The share of paramedics who are less than 25 years of age also suggests the eloquence of the new personnel participation in the sphere, which confirms the necessity of addressing the topic of continuous training in order to polish their practical abilities.

Table 2. Number of Advanced Airway Management Courses Completed

Number of Courses	Frequency	Percentage(%)
No courses	15	7.5
1course	70	35.0
2courses	65	32.5
3or more courses	50	25.0
Total	200	100.0

It appears that most participants had received one or two advanced airway management training courses, representing more than half of the sample.

This ratio indicates the prevalence of basic training among paramedics, while only about a quarter of them have frequent advanced training, highlighting the need to increase the number of courses to increase field efficiency.

Table 3. Responses to Questionnaire Statements

No.	Statement	Mean	SD	Agreement Level
1	I have achieved adequate theoretical preparation in advanced airway management.			
2	The practical training that I had made me able to carry out ventilation effectively.			
3.05	I have the skills required to work with the airway in an emergency.			
4	Training increased my speed in responding to critical cases.	4.18	0.66	High.

5	The training programs are constantly changed in line with new protocols.	3.72	0.80	Moderate.
6	I successfully use the acquired skills in the fieldwork.	4.20	0.61	High.
7	This is followed up with supervision after training courses.			
8	The job conditioning encourages superior ventilation capabilities.	3.95	0.75	High.
9	Ventilation success directly depends on training level.	4.30	0.58	High.
10	The more courses, the higher the success rates.	4.36	0.54	Very High
Overall Mean		4.07	0.67	High

The findings suggest that the mean responses of the sample were usually high, and it demonstrates that the participants were satisfied with the degree of training and its importance in enhancing performance in the field. The most significant values were observed in the two statements associated with the effect of the number of courses and level of training on the success of ventilation, which validates the need to continue investing in special training. Average results imply the necessity to work on the aspect of supervision and renew training programs on a regular basis.

Table 4. Mean and Standard Deviation by Main Axes

Axis	Mean	SD	Level
Training Quality (Theoretical & Practical)	4.15	0.64	High
Skill Application in Field	4.10	0.62	High
Training Updates and Supervision	3.68	0.76	Moderate
Work Environment and Equipment	3.9	0.71	High
Overall Average	3.97	0.68	High

The average obtained is high overall across all the axes, which is a reflection of the satisfaction levels of the paramedics with the quality of training and level of field application. Although the lowest averages were displayed in the " Update and Supervision axis which means that more efforts should be made to stick to the continued follow-up post-training courses and to design curricula to ensure that training courses keep up with the most recent changes in the medical protocols.

Table 5. Correlation Between Training Level and Ventilation Success Rate

Variables	Pearson Correlation (r)	Sig. (p-value)	Relationship
Training Level vs Ventilation Success Rate	0.81	0.000	Strong Positive

The results of the coefficient correlation (r = 0.81) indicate a high level of positive and statistically significant relationship between the degree of paramedic training and the success rates in field ventilation operations. This finding suggests that the greater the degree of training, the greater the success in managing airway and the chances of success in addressing apnea.

Table 6. Ventilation Success by Number of Courses Completed

Number of Courses	Average Success Rate (%)	Standard Deviation
No courses	65.2	6.1

1course	76.8	5.4
2courses	83.5	4.8
3or more courses	91.7	3.9

The table demonstrates that the rate of success in ventilation also increases gradually with the number of training courses that the paramedics have attended. The highest success rate among participants was noted to be 90 and more, which was provided by the participant who had three or more courses, which supports the hypothesis that intensive and regular training is a successful method of increasing the efficiency of field performance and increasing the reaction in case of an emergency.

Results

Environmental and logistical challenges represent one of the biggest challenges in the uncontrolled field environment, which differs radically from the operating room environment in a hospital Paramedics often have to perform AAM in confined spaces such as inside a small ambulance or in the corner of a crowded room This spatial constraint hinders the optimal placement of the patient Therefore, a laryngoscope is not used , and it also limits the paramedic's movement In addition, adverse weather conditions (such as rain or extreme heat) or inadequate lighting pose challenges to intubation, making it more difficult to visualize the vocal cords Noise and environmental disturbances also contribute to increased stress and difficulty in effective communication among team members Furthermore, patient-related challenges exist, as factors related to the patient's condition present a direct obstacle For the procedure to be successful , paramedics must address unexpected anatomical airway difficulties that have not been previously diagnosed, such as neck swelling, facial or jaw fractures following accidents , or limited neck mobility in the elderly The most significant physiological challenge is the presence of profuse secretions, blood, or vomit This completely obstructs vision and makes the procedure almost impossible Before the airway can be efficiently suctioned, there are also patients suffering from chronic hypoxia or morbid obesity Those that cause difficulty with mask ventilation (BVM) and increase the difficulty of intubation represent clinical challenges that require high skills in decision-making and selection of alternative tools

In addition to these challenges, there are human and skill-related challenges , as paramedics face challenges related to maintaining skill levels in low- or infrequently performed procedures Long periods may pass between cases requiring actual intubation, leading to skill deterioration Furthermore, the emotional and psychological stress of dealing with respiratory arrest cases in front of the public or the patient's family members reduces the rescuer's cognitive and technical performance, leading to less efficient decision-making Therefore, choosing the wrong instrument or failing to correctly confirm intubation placement the first time increases complications, worsens the situation, and wastes time on alternative rescue attempts

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Systematic and standardized training at the Saudi Red Crescent Authority ensures that all paramedics receive the same foundational knowledge and skills, especially regarding advanced airway management This standardization significantly reduces variation In terms of the quality of care provided among paramedics and different teams , when everyone follows the same algorithms and established guidelines, such as using a difficult airway procedure sequence A consistent and high level of quality is ensured in all responses , and this standardization also facilitates the review and auditing process Performance analysis is used to identify areas that need improvement in the future Effective systematic training also focuses on the use of realistic simulations of critical emergency scenarios such as respiratory arrest , as this approach allows the paramedic to practice AAM techniques In a safe environment, but with repeated field pressure, which helps to solidify skills and build self-confidence , F When a paramedic encounters a real situation, they have previously been trained to deal with environmental and medical challenges, which reduces confusion and hesitation This improvement in confidence and efficiency is directly reflected in the speed

and accuracy of procedures, and thus leads to a reduction in the duration of oxygen deficiency , which is an important and crucial factor in improving the quality of ventilation provided

Furthermore, systematic training fosters a culture of continuous learning and improvement within the Saudi Red Crescent Authority , where training is not viewed as a one-time event but as an ongoing and necessary process , through periodic feedback Analyzing field data allows the Saudi Red Crescent training program to modify content to suit actual needs, such as focusing on airway management in obese patients if data indicate low success rates among them This continuous adaptation ensures that paramedics remain up-to-date with the latest technologies and best practices, ultimately leading to a tangible improvement in patients' clinical outcomes and increased chances of a good neurological outcome after respiratory arrest

Conclusion

This research shows that there is a close and strong correlation between training of paramedics and effective airway management. Ongoing and systematic training positively influences the first-attempt success rates, decreases the intubation duration, and patient survival.

With emphasis placed on modern, simulation based training, the Saudi Red Crescent Authority will be in a position to retain a highly skilled workforce which is capable of providing life saving, efficient, and safe pre-hospital care.

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