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ORIGINAL ARTICLE

Prehospital airway management by health workers in Riyadh city: a local survey

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ABSTRACT

Objective: This study sought to determine the perception of healthcare workers (HCWs) about pre-hospital airway management (AM) and their experiences.

Methods: This cross-sectional study was conducted among health workers at the emergency department of King Fahad Medical City in the capital of Saudi Arabia, Riyadh City. This study targeted physicians, nurses, paramedics, and respiratory therapists. Data were collected using an online questionnaire. The questionnaire included demographic characteristics, training, and experiences in AM and a five-item questionnaire to measure the perception of HCWs about AM.

Results: Of the 100 HCWs, 39% were doctors and 37% were nurses. Approximately 23% had a poor experience with intubation (ETI). Traumatic injuries were the major difficulties involving AM (44%). The overall perception of HCWs about prehospital AM was good (68%), 31% were moderate, and only 1% were considered poor perception levels. No significant differences were observed between perception scores in relation to the demographic characteristics and experiences of HCWs in AM (all $p > 0.05$).

Conclusion: Despite HCWs' good perception of prehospital AM, some gaps have been identified mainly through ETI skills and experiences. This study provided evidence that perception toward prehospital AM was not affected by profession, years of experience, regular practice of ETI, and AM. Regular training should be implemented, with equipment and resources should be available to improve AM and patient quality of care.

Keywords: Airway management, healthcare workers, perception, prehospital, Saudi Arabia.

Introduction

Airway management (AM) is the assessment, planning, and set of medical operations necessary to preserve or restore a person`s ventilation or breathing. Air can enter the lungs from the nose and mouth by keeping the airway open [1]. To provide unrestricted airflow to the distal endobronchial tree, the airway must be opened and cleared. There are descriptions of manual airway opening techniques. These tools enable medical professionals to confirm the location of the tube in the airway and to keep the efficacy of ventilation [2].

A study was conducted in Karachi, Pakistan, to assess the training and knowledge of ambulance staff and the availability of AM equipment in ambulances. It was reported that ambulance services in Pakistan need to increase ambulance to staff ratio to improve prehospital AM and patient survival [3].

Another study was conducted to assess prehospital AM for trauma patients by first responders in six Sub-Saharan African countries and five other low- and middle-income countries. It was found that AM interventions in low and middle-income countries were deficit; therefore, there is a need to prioritize basic life support (BLS) AM courses, especially in sub-Saharan Africa [4]. Furthermore, Timmermanna et al. [5] did a prospective study, which aimed to assess prehospital tracheal intubation (ETI) characteristics and AM difficulty in out-of-hospital

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patients treated by emergency medicine physicians with anesthesia training. This study determined an increased incidence of failed and difficult laryngoscopy.

According to a systematic review conducted in 2022 mainly in the United States and Canada, followed by Europe and Asia, among 630,397 cases, determined that there is a difference between bag-valve-mask ventilation, supraglottic airway and ETI in AM before hospital admission, specifically in emergencies [6].

According to a cohort study conducted in the United States, in all patients of different ages who attempted oral ETI in the pre-hospital setting for a period of 4 years, this study showed the difference between a difficult and a non-difficult airway and difficult airway before admission (more than four attempts are needed) [7]. Moreover, according to a prospective cohort study conducted in Seattle, United States, among 4,114 patients who attempted oral ETI in the pre-hospital setting. It was reported that early intervention combined with advanced caregiver skills is also an important factor in determining the success rate of oral ETI [8].

AM is the assessment, planning, and set of medical operations necessary to preserve or restore a person's ventilation or breathing. Lack of airway control in circumstances where it could be necessary might result in a person's blood oxygen levels being lowered, which is potentially fatal. Thus, this study aimed to determine the healthcare workers' (HCWs) experiences, qualifications, and perceptions of prehospital AM in Riyadh, Saudi Arabia.

Subjects and Methods

Study subject

- Inconclusion: Health workers included [Doctors, Nurses, Respiratory therapist (RT), and Paramedics] for both gender who are working in Riyadh, Saudi Arabia.
- Exclusion: For people who do not fulfill the requirements.

Study design

This was a cross-sectional study conducted at the emergency department of King Fahad Medical City in the capital of Saudi Arabia, Riyadh city. This study targeted physicians, nurses, paramedics, and RTs.

A sample size of a minimum of 100 participants was estimated by the OpenEpi web tool, with a 95% confidence level. The population used to calculate this sample size was around 100-200 which represented the number of health workers who work in the emergency department.

Data were collected using an online questionnaire/written form for all participants fulfilling the inclusion criteria. It was a multi-item questionnaire. The first section included general information such as jobs, specialties, and years of experience. The second part was designed to obtain information about the training and experience of the health workers about the type of training, whether there was formal AM training or not, experience regarding AM equipment, number of ETIs per month, and the difficulty that was involved during the AM. The last part of the questionnaire required an answer on a five-point analog scale (strongly disagree, disagree, natural, agree, and strongly agree). This part was about opinions regarding the importance of prehospital AM.

The perception toward hospital AM was assessed using a 5-item questionnaire, with 5-point Likert scale categories ranging from "strongly disagree" coded with 1 to "strongly agree" coded with 5 as the answer options. The total perception score was calculated by adding all 5 items. A score ranging from 5 to 25 points was generated; the higher the score, the higher the perception toward hospital AM. By using 50% and 75% as the cutoff points to determine the level of perception, HCWs were categorized as having poor perception if the score was below 50%, 50% to 75% scores were categorized as moderate, and above 75% score was categorized as good perception levels.

Categorical data were shown as counts and proportions (%). Continuous data were summarized as mean and SD. The differences in the score of perception among the socio-demographic characteristics and experiences of HCWs on AM were performed using the Mann-Whitney *Z*-test and Kruskal Wallis *H*-test. The normality test (e.g., Statistical collinearity) was carried out using the Shapiro-Wilk test and Kolmogorov-Smirnov test. The perception score follows a non-normal distribution. Therefore, non-parametric tests were applied. A *p*-value of 0.05 was taken as the cutoff point to determine statistical significance. All statistical data were analyzed using the IBM SPSS version 26 (Statistical Packages for Social Sciences, version 26, Armonk, NY: IBM Corp, USA).

Results

This study enrolled 100 HCWs. The majority were doctors (39%). Most of the doctors were general doctors (66.7%). HCWs with 1 to 5 years of experience constitute 45%. Among paramedics (n = 15), 80% had 6 or fewer emergency calls per shift (Table 1).

The most frequently difficult AM in practice was for traumatic injuries (44%), followed by the position of patients (37%), then secretions and aspiration (31%) (Figure 1).

The most attended training was BLS (44%). The proportion of HCWs who attended formal AM training was 83%. Approximately 38% had experience in performing Bag-Mask ventilation. One-fourth of the HCWs indicated poor experience regarding ETI skills (23%), and 51% expressed that they perform less than one ETI per month (Table 2).

Regarding HCWs' perception of the importance of AM, more than half strongly agreed that prehospital AM improves mortality/morbidity and had similar ratings (strongly agreed: 54%) that the paramedic staff should have formal training in ETI. Around 34% strongly agreed that the risks and benefits outweigh prehospital care, while 26% strongly agreed that the equipment provided in an ambulance setting is

sufficient for ETI. Also, 39% strongly agreed that the lack of access to advanced airway equipment and assistance is detrimental to acute patient care and long-term outcomes. Based on the above statement, the overall mean perception score was 20.7 (SD 2.77), with good, moderate, and poor perception accounting for 68%, 31%, and 1%, respectively (Table 3).

When measuring the differences in the score of perception in relation to the demographic characteristics and experiences of the HWCs in AM, it was found that there were no significant differences observed between the score of perception in all demographic and experiences variables including, occupation, years of experience, training, and experience, formal AM training frequency of ETI per months and the practices in accordance with difficulties involving AM (all p>0.05) (Table 4).

Table 1. *HCWs basic demographic data* [(n = 100)].

Study data	Frequency (Percentage) *N* (%)
What's your job?	
Doctor	39 (39.0)
RTs	04 (04.0)
Nurses	37 (37.0)
Paramedics	15 (15.0)
Technicians	03 (03.0)
Others	02 (02.0)
What's your specialty (if doctor)? [(n = 39)]	
Generalized doctor	26 (66.7)
Specialized	13 (33.3)
Years of experience	
<1 year	29 (29.0)
1-5 years	45 (45.0)
6-10 years	16 (16.0)
>10 years	10 (10.0)
Frequency of emergency calls per shift (if paramedic) [(n = 15)]	
≤6	12 (80.0)
>6	03 (20.0)

Discussion

This study evaluated the perception of HCWs regarding prehospital AM. Based on the current study criteria, the perception of HCWs was deemed reasonable. Approximately 68% of participants had good perception levels, 31% were moderate, and only 1% were poor (mean score: 20.7; SD 2.77, out of 25 points). These findings are almost consistent with the study of Abd Samat et al. [9]. According to the reports, 68.9% of the Emergency HCWs had high knowledge, and 53.3% possessed a high confidence level about AM. This was concurred by the paper of Duggal et al. [10].

Among 300 physicians, approximately two-thirds understood safety guidelines and recommendations, and many were well aware of the safety precautions during airway interventions. Contradicting these reports, Nigatu et al. [11] found that Emergency Department nurses' knowledge about airway and breathing management was found to be insufficient as only 45.1% had confidence in the process.

Emergency healthcare personnel should possess well-versed skills in AM. Hence, continuous education and training are crucial among HCWs to improve AM and optimize patient care. Data in the current study suggested that perception scores did not differ significantly by profession, years of experience, training, and experience, formal AM training, frequency of perform ETI per month, and the actual practice of AM (all $p > 0.05$). This is not following the report of Deng et al. [12]. Based on their accounts, the practice of AM of emergency room nurses was affected by demographic and job-related characteristics.

In Malaysia [9], the highest knowledge was seen in Emergency HCWs with a length of service (LOS) between 4 to 10 years, adding that the designations and LOS significantly impacted airway-related knowledge. In a qualitative study conducted in the UK [13], four themes related to AM were identified namely, pride, utility, inconsistent expectations, and professionalization. Among the four themes, inconsistent expectations have led to different views on AM, particularly among UK paramedics, and these were based on evidence and

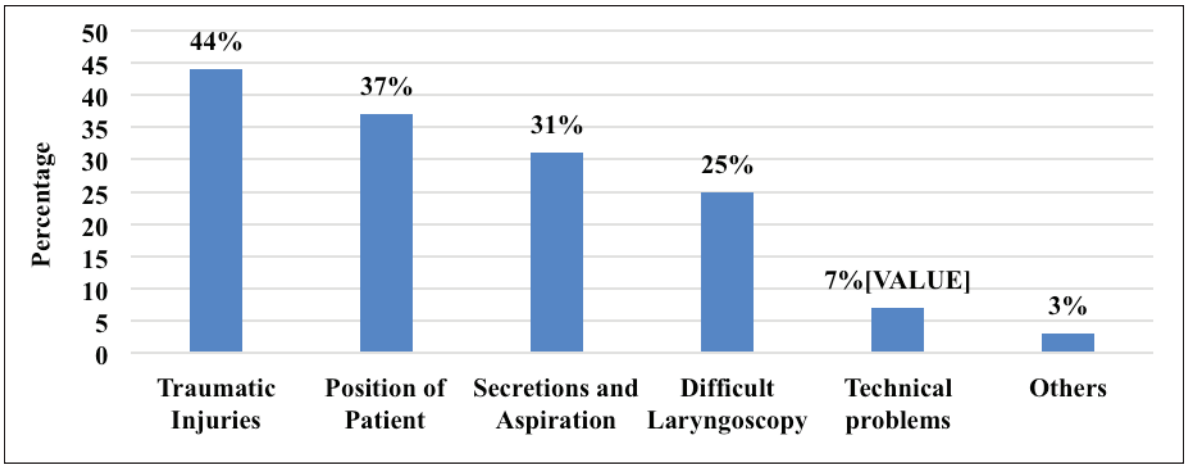

Figure 1. *Practice in accordance with the difficulties involving AM.*

Table 2. Training and experiences [n = 100].

Variables	Frequency (Percentage) *N* (%)
Training and experience	
BLS	44 (44.0)
ACLS	42 (42.0)
ATLS	09 (09.0)
Others	05 (05.0)
Formal AM training	
Yes	83 (83.0)
No	17 (17.0)
Experience regarding the use of	
Oropharyngeal/Nasopharyngeal airway	23 (23.0)
Perform bag-mask ventilation	38 (38.0)
Use of laryngeal mask airway	03 (03.0)
ETI	36 (36.0)
Rate your experience regarding your ETIs skills	
No experience	25 (25.0)
Poor	23 (23.0)
Fair	17 (17.0)
Good	16 (16.0)
Very good	07 (07.0)
Excellent	12 (12.0)
How often do you do ETI per month	
<1 ETI	51 (51.0)
1-5 ETIs	32 (32.0)
6-10 ETIs	09 (09.0)
>10 ETIs	08 (08.0)

Table 3. Perception regarding the importance of prehospital AM [n = 100].

Perception statement	Frequency (Percentage) *N* (%)
1. Does prehospital AM improve mortality/morbidity?	
Strongly disagree	0
Disagree	01 (01.0)
Neutral	08 (08.0)
Agree	37 (37.0)
Strongly agree	54 (54.0)
2. Should paramedics staff have formal training in ETI?	
Strongly disagree	01 (01.0)
Disagree	0
Neutral	10 (10.0)
Agree	35 (35.0)
Strongly agree	54 (54.0)
3. The risks and benefits outweigh prehospital	
Strongly disagree	01 (01.0)
Disagree	01 (01.0)
Neutral	20 (20.0)
Agree	44 (44.0)
Strongly agree	34 (34.0)
4. Equipment provided in an ambulance setting is sufficient for ETI	
Strongly disagree	03 (03.0)
Disagree	15 (15.0)
Neutral	29 (29.0)
Agree	27 (27.0)
Strongly agree	26 (26.0)
5. The lack of access to advanced airway equipment and assistance can be detrimental to acute patient care and long-term outcomes	
Strongly disagree	0
Disagree	01 (01.0)
Neutral	19 (19.0)
Agree	41 (41.0)
Strongly agree	39 (39.0)
Total perception score (mean ± SD)	20.7 ± 2.77
Level of perception	
Poor	01 (01.0)
Moderate	31 (31.0)
Good	68 (68.0)

experience rather than philosophy. Thereby, suggesting that AM might have contributed to paramedics' professional character, but it might not be contingent.

In the specific details of perception, HCWs' showed a good understanding that prehospital AM might improve mortality/morbidity (strongly agree: 54%) and that paramedics should have formal training in ETI (strongly agree: 54%). The majority of HCWs agreed (44%) or strongly agreed (34%) that the risks and benefits outweigh prehospital. However, a lack of perception was seen about the equipment needed for ETI, and most HCWs believed this gap could be detrimental to acute patient care and long-term outcomes.

In Pakistan [3], the study noted that all ambulance services are equipped with the basic equipment needed for AM; however, there was a lack of trained staff to utilize the equipment, and these ambulances were only used for the purpose of transportation. Training and attending courses for life-threatening situations are integral to confidence in AM.

In the current study, 83% of HCWs had attended AM training, but their attendance during life-threatening emergencies was unsatisfactory. Results of the current study showed that HCWs who attended BLS and advanced cardiovascular life support (ACLS) were 44% and 42%, respectively, while only 8% attended advanced trauma life support (ATLS). This is not consistent with the study conducted in Denmark [14]. Accordingly, it was found that 84.9% reported attending life support course(s), whereas 64.2% had attended an advanced AM course.

Interestingly, 24.5% fulfilled the curriculum suggested for Danish emergency medical services physicians. However, only 20.8% were fully aware of the availability of the equipment needed for AM. Only 36% were seen to have experience with ETI, and HCWs' perceived rating experience for ETI skills was poor (23%), followed

Table 4. *Differences in the score of perception in relation to the demographic characteristics and experiences of the HCWs in AM* $^{(n = 100)}$.

Factor	Perception Score (25) Mean ± SD	*H*/*Z*-test	*p*-value
What's your job? [a]			
Doctor	20.9 ± 2.98	4.716	0.194
Nurses	20.8 ± 2.28		
Paramedics	20.7 ± 3.19		
Others	19.1 ± 2.85		
Years of experience [a]			
<1 year	20.7 ± 3.47	0.011	0.994
1-5 years	20.8 ± 2.52		
>5 years	20.7 ± 2.38		
Training and experience [a]			
BLS	20.8 ± 2.53	3.792	0.285
ACLS	20.2 ± 3.18		
ATLS	22.1 ± 1.90		
Others	21.0 ± 1.87		
Formal AM training [b]			
Yes	20.8 ± 2.68	0.468	0.640
No	20.2 ± 3.23		
How often do you ETI per month [a]			
<1 ETI	20.9 ± 2.75	1.145	0.564
1-5 ETIs	20.3 ± 3.05		
>5 ETIs	20.6 ± 2.29		
Practice in accordance with the difficulties involving AM [†] [b]			
Position of patient	20.3 ± 3.19	0.800	0.424
Difficult laryngoscopy	20.9 ± 3.32	0.767	0.443
Secretions and aspiration	20.9 ± 2.87	0.613	0.540
Traumatic injuries	21.1 ± 2.17	1.163	0.245
Technical problems	20.3 ± 2.21	0.566	0.571

** Significant at $p < 0.05$ level.

[a] *p*-value has been calculated using Kruskal Wallis *H*-test.

[b] *p*-value has been calculated using Mann Whitney *Z*-test.

[†] Variable with multiple response answers.

by fair (17%) and good (16%), while very good (7%), and excellent (12%) rating were seen to be less. Other experiences being mentioned were Bag-mask ventilation (38%) and Oropharyngeal/Nasoopharngeal airway (23%). Furthermore, the most frequently encountered difficulty in AM includes traumatic injuries (44%) and patient position (37%).

In Germany [5], the study documented a higher incidence of the difficult-to-manage airway in trauma patients (18.6%) and during cardiopulmonary resuscitation (16.7%) than the rest of the patient group (9.8%). ETI failed miserably in trauma (3.9%) compared to the rest of the patient group (1.1%). However, in Turkey [15], most of the students (81.1%) expressed that they did not intubate at all in patients with maxillofacial trauma. In addition, 61.1% of students had performed orotracheal ETI, 30% for laryngeal mask airway, and 17.8% performed naso-endotracheal ETI. It was implied that these deficiencies were mainly related to methods and tools to provide airway patency.

Conclusion

HCWs demonstrated adequate perception toward prehospital AM. It is interesting to know that HCWs' perceptions were not affected by specialties, years of experience, formal AM training, and actual practice of AM. This study proved that HCWs who were working in the Emergency Department had a better perspective and understanding of prehospital AM. However, some gaps have been identified, particularly in ETI skills and experiences. A multicenter study approach is required, involving a bigger sample size to determine HCWs perceptions of prehospital AM.

List of Abbreviations

ACLS Advanced cardiovascular life support
AM Airway management
ATLS Advanced trauma life support ()
BLS Basic life support
ETI Intubation
HCWs Healthcare workers
LOS Length of service
SPSS Statistical Package for the Social Science

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent to participate

Written informed consent was obtained from all the participants.

Ethical approval

Ethical approval was obtained from the International Review Board of Imam Mohammad ibn Saud Islamic University, Riyadh, Saudi Arabia, via reference number-371/2022. date: 20\11\2022.

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