

*Original Article*

## Assessment of difficult Airway management protocols used in selected Libyan hospitals and identify Major complications (Survey)

Kaothar S. Abuokraa<sup>1\*</sup>, Afaf J. Hamza<sup>1</sup> Sumia R Emhmed<sup>1</sup>  
Arwa M Al farnouk<sup>1</sup> Malak A Abooadn<sup>1</sup> Mariam M Al taloua<sup>1</sup>  
Department of Anesthesia, Faculty of Medical Technology, University of Zawia,  
Libya

\*Corresponding Email: [k.abuokraa@zu.edu.ly](mailto:k.abuokraa@zu.edu.ly)

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### ABSTRACT:

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Airway management is a medical process that used to control the ventilation in clear airway problems. Most of times obstructed airway occurs due to loss of consciousness which is common in patients with serious illness or patients who require resuscitation, which may lead to cardiorespiratory arrest. In which a rapid assessment of a patient's airway, ventilation and lung oxygenation is required to avoid hypoxia and its complications on the brain and other organs. Difficult airway management is being an alarming issue in anesthesia and in emergencies that the anesthesiologists faced with ventilation mask, tracheal incubation in some cases. The current study's goals are to evaluate and contrast the procedures and recommendations for difficult airway management that employed in selected Libyan hospitals. Using a questionnaire, the study was conducted in five hospitals in western Libya between December 2017 and June 2018. SPSS software and the F test used to analyze the collected data. The results of this study confirmed that there is no significant difference in techniques used in management patients with of difficult intubation among compared hospitals in the selected sample. To conclude, most of airway complications are unsuspected and can increase the mortality rate, particularly in the intensive care unit and emergency department, which must have well trained, prepared and educated staff in addition the most developed devices. These complications include; pulmonary aspiration, esophageal intubation, and failed airway management.

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**Keywords:** (Difficult airway, Techniques, management, Anaesthesia, Intubation, and complications)

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Citation.. Abuokra Kaothar S, **Assessment of difficult Airway management protocols used in selected Libyan hospitals and identify Major complications (Survey)**

2022;16(2):<https://doi.org/10.54361/ljmr.16209>

Received: 12/05/22accepted: 10/06/22; published: 31/12/22

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## Introduction:

complications related to difficulty airway management in emergency settings has been increased dramatically<sup>4</sup>. Despite tracheal intubation is the most widely used method for airway management, it considered difficult to apply for occasional user. Therefore, the requirement of different strategies and good alternative airway devices is emerged to minimize the risk of complications followed by difficulty of airway management<sup>5</sup>.

The purpose of this study was to create a survey and evaluate the difficulty in airway management strategies in order to identify the major complications associated with them and compare them across hospitals using different procedures.

For a long time, airway management has been one of the cornerstones of anaesthetic practice<sup>1</sup>. The main concern of anaesthetist during surgery taking care of the airway to ensure that the patient supplied with an adequate oxygenation and ventilation. However, the clinical importance of airway management was not fully understood until the 1990s, when results from the American Society of Anaesthesiologists (ASA) closed claims analysis proved that a diverse events associated with airway management were one of the leading causes of anaesthesia-related morbidity and mortality<sup>2</sup>.

Airway management is considered an essential element of both hospitalized and outpatient during cardiopulmonary resuscitation<sup>3</sup>. The percentage of

## Material and Methods

### Participant

A number of 143 participants from five hospitals in western Libya were involved in this study. This including an Anaesthesiologist and Anaesthetic technician and four doctors from emergency medicine, which covering anaesthesia and emergency room staffs. The chosen hospitals were Tripoli Central Hospital [TCH], Zawia Teaching Hospital [ZTH], Zuwara Maritime Hospital [ZMH], Sabratha Teaching Hospital [STH], and Tripoli medical Centre [TMC]. The participants were from both genders with experience years range from 4yrs to 20yrs.

#### Questionnaire:

A questionnaire was designed based on a review of protocols and strategies that used for difficult airway management. Including ASA guidelines, difficult intubation guidelines DAS (2015) and AIDAA Indian difficult airway association guidelines. Then a questionnaire distributed within the selected hospitals in the period between March and April 2018.

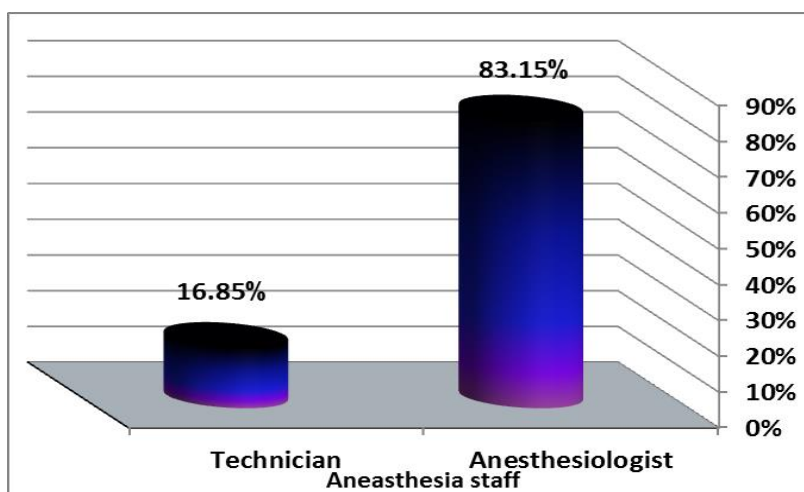
#### Data analysis

The collected data was analysed using IBM Statistical Package for Social Sciences (SPSS) Statistic software and F test.

## Results and Discussion

### Demographic features of result

The number of samples that enrolled in this study was 143 participants from both genders, where the number of male was 47 and the number of female was 93; the ratio of females was double of male. The most majority of contributors were anaesthesiologists with a percentage of approximately % 83.15, while the technicians were with percentage of %16.85 as it showed in figure1. They have different background and variety of experiences. Therefore, they play major role in difficult airway management



**Figure 1: Ratio of Anaesthesiologist to Technician**

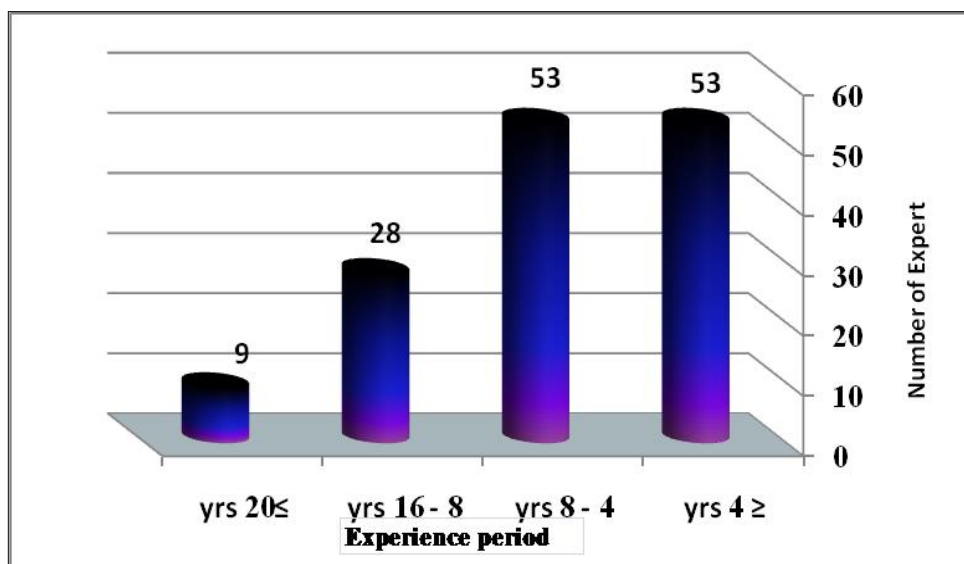
The study was conducted to assess the guidelines and protocols to identify the major complications among difficult intubation cases in different Libya hospitals. However, several studies have

documented the complications related to difficult airway management. 2,4,11 almost all participants who interned to this trial were from anaesthesia department.

**Distribution of Anaesthesia specialists**

It is a clear from graph (2) that the most of participants in this study (106) were with experience of less than eight years in the field of Anaesthesia, in which half of them (53) have less than four years experience. Only nine Participants have  $\geq 20$  years of experience were all from Tripoli medical centre TMC.

An important issue emerging from these findings in (Figure 2) is that the lack of experience may lead to major problems and multi attempted for the ETT in which increases the risk of complication during airway management. It was indicated that in DAS guidelines and another studies<sup>7</sup>.



**Figure2** Comparing the number of difficult airway intubation cases in the selected hospitals

In this study, we compared the number of cases that showed difficult intubation in five different hospitals. We observed that there was difference in the numbers among four sectors in the selected study. Liner graph in Figure 3 displays the number of difficult intubation cases according to hospitals unit. There was quite near in Anaesthesia department the highest number was 35 in TMC and followed by STH 30 cases. In the number of cases in ICU, Emergency department and other departments was relatively higher in TMC hospital. Due to some factors. Because TMC is a central hospital.

It is capacity is high and has advanced capabilities compared with others. Whereas, others figure 3 were represented other situations such as CT scan and MRI difficult intubation cases which had a very few repetitions in the selected sample. Conversely, the lowest numbers of cases found in ZMH that may be because of some reasons such as, over all the number of cases is very small in this hospital because it has a small capacity. In addition, it is location in the area with a few residents is not comparable to the capital.

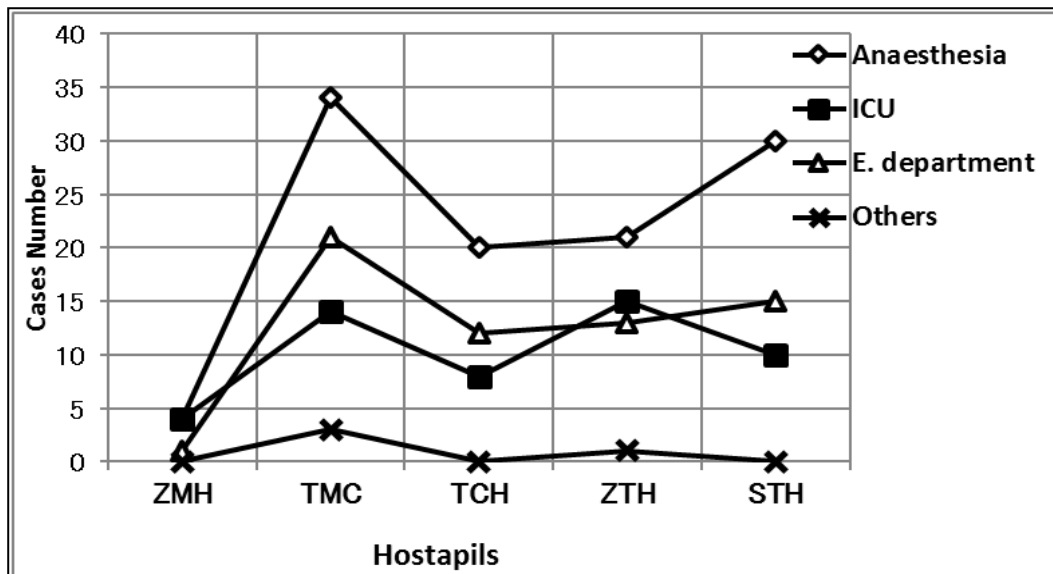
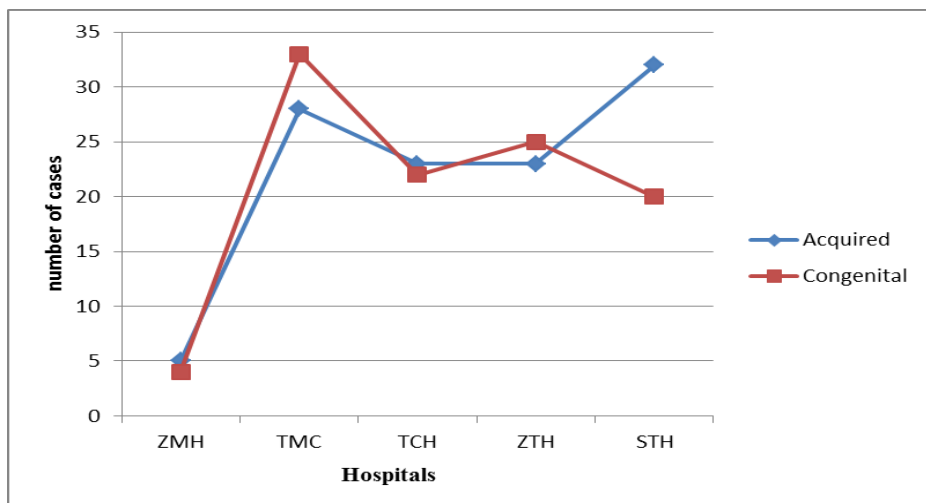


Figure 3: The number of critical cases that have difficulty in airway intubation process.

### Distribution of cases according the causes linked to patient

The graph in the Figure 4, displays the number of cases that encountered difficulty in the process of airway intubation with caused by congenital or acquired causes related to patient in the selected hospitals. In TMC, the difficult airway intubation (DA) was observed in

61 cases, where 33 have acquired problems and 28 have congenital anomalies. However, the lowest numbers of cases were found in the ZMH individually is acquired (N= 4) and congenital (N=5). ZTH and TCH had number of cases less than 30 in both categories.



**Figure 4:** the average number of cases had difficult airway with causes related to Patient (congenital or acquired)

### Distribution of difficult airway cases caused by Anaesthesia

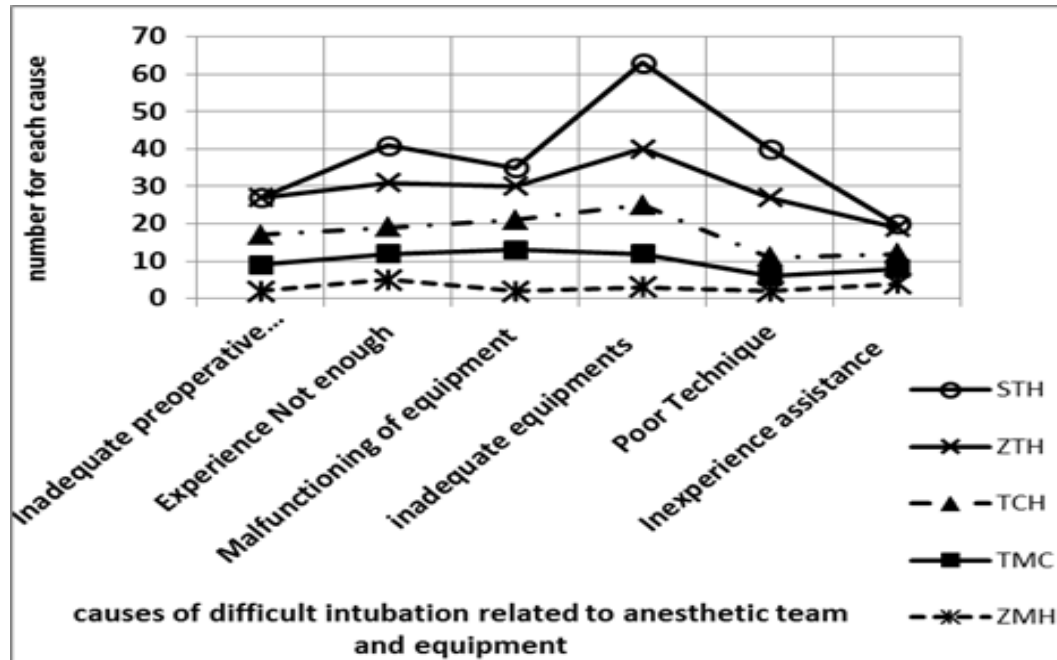
The figure (5) showed a comparison between the number of cases that had difficult airway management from difficulty in the airway management due to different causes that related to anaesthesia staff and equipment's in the selected hospitals. A less expert anaesthesiologist and poor preparation was observed among the selected hospitals in this study. The second most cause of difficult airway intubation there

was lack of experience with poor technique and malfunctioning of equipment's used during the procedure in the same hospitals.

An important issue emerging from these findings is inadequate equipment's and poor preparation leads to rise in risk factors that might contribute in increased incidence of complication during airway management<sup>8</sup>. However, a previous study

shows that preoperative assessment and good preparation using wide range of

equipment's are essential to reduce difficult airway complications<sup>9</sup>.



**Figure 5.** The Number of cases according to causes associated with Anaesthesia

### ANOVA: Two-Factor with Replication

**Table 1 ANOVA test for causes of DA related to Anaesthesia**

ANOVA						
Source of Variation	Sum of squares (SS)	Degree of freedom (DF)	Mean Square (MS)	F Ratio	P-value	F crit
Columns	227.1333	4	56.78333	2.676776	0.055125	2.75871

Figure (5) and table 1 for ANOVA shows the Comparison between numbers of cases that met difficulty airway management with causes related to anaesthesia. By measuring averages, and studying the average results for them. The statistical

Comparing between five hospitals in the number of difficult intubation cases related to anaesthesia (according to the six categories declared in figure 5).

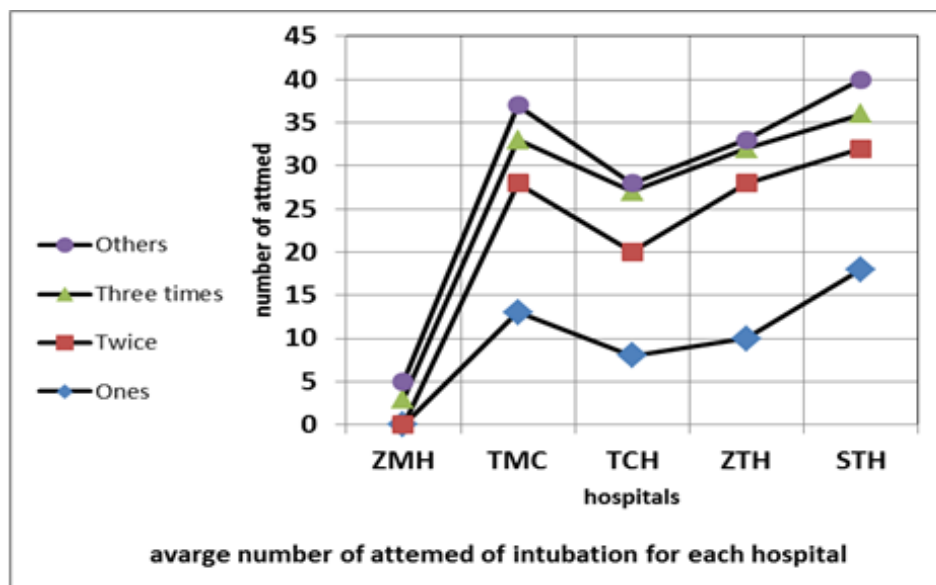
previous figure 5 that the conflation is close at Zawia teaching hospital, which led to a decrease in moral difference among them.

study shows that the  $SS= 227.13$ ,  $DF = 4$  the value of  $p = 0.055$  where the calculated  $F= (2.68)$  and the periodic  $F= (2.78)$ , the level of correlations between hospitals has no significant effect. We see from the

### Distribution average number of intubation attempted in the selected hospitals

The figure 6 exhibited the number of intubation attempt varied between once to four times. In contrast, the highest number of attempted was twice in above 25 cases in the ZTH followed by TMC. Others, which indicated more than three

attempted, had the largest number in STH with 40 cases. Increasing the number of attempt patients intubation increasing might contribute to have chance for occurring complications in the nominated hospitals.



**Figure 6:** the average number of intubation attempted in the selected hospitals



Findings in the present study are consistent with the findings of other studies in this subject. It is clear that 'greater than one attempt at ETI was associated with a 4-fold increase in severe and a 5-fold increase in total complications' 10. Although, previous publications found that greater than two attempts associated with increased complications. This new information has implications for both teaching and decision-making of ETI4 ,10. Furthermore, DAS suggests that in the guideline 2015 represents the default strategy for

intubation when this is not predicted to be difficult. The strategy deals with unexpected failed direct laryngoscopy. The patient is anaesthetised, paralysed (usually with non-depolarising relaxants) and intubation is attempted by direct laryngoscopy. A number of intubation attempts may be undertaken - to change the blade (long, straight McCoy etc.), to use the optimal external laryngeal manipulation. After 3-4 attempts at intubation, it is likely that the practitioner is repeating fruitless attempts and no further attempts should be made11, 12.

### **Repetition of strategies among selected hospitals**

The Figure 7 showed repetition of six categories of strategies for the five selected hospitals. The data indicated that there is diversity in the repetitions of different strategies among the compared hospitals. The STH had the highest repetition (29) in persistent nonsurgical attempts, followed by TMC with (27), ZTH with (19), respectively. Whereas, ZMH did not have any repetition (0).

In contrast, repetitions of case cancelled had varied in four hospitals (TCH, TMC, ZTH and STH) between (10-15). In the ZMH has low repetition with four times. However, surgical attempted had the lowest repetitions in the studied hospital which varied between (two-five) times.

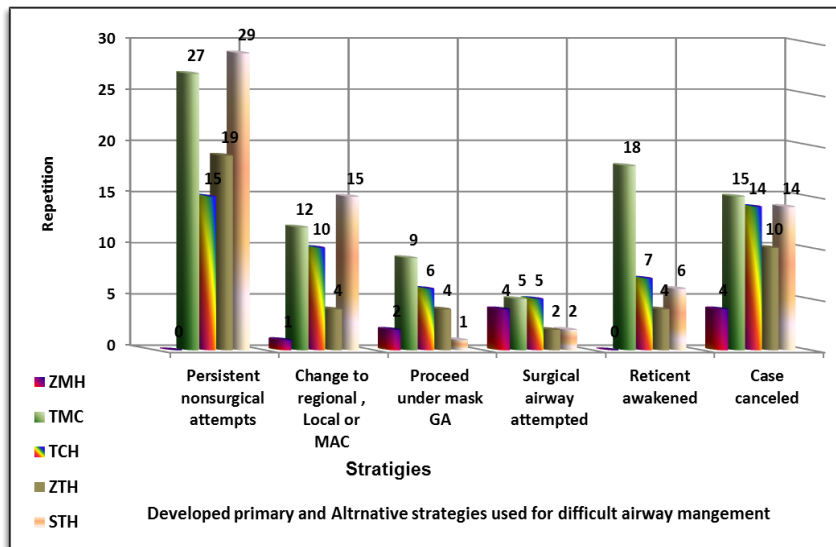


Figure 7.

Developed primary and Alternative strategies used for DA management

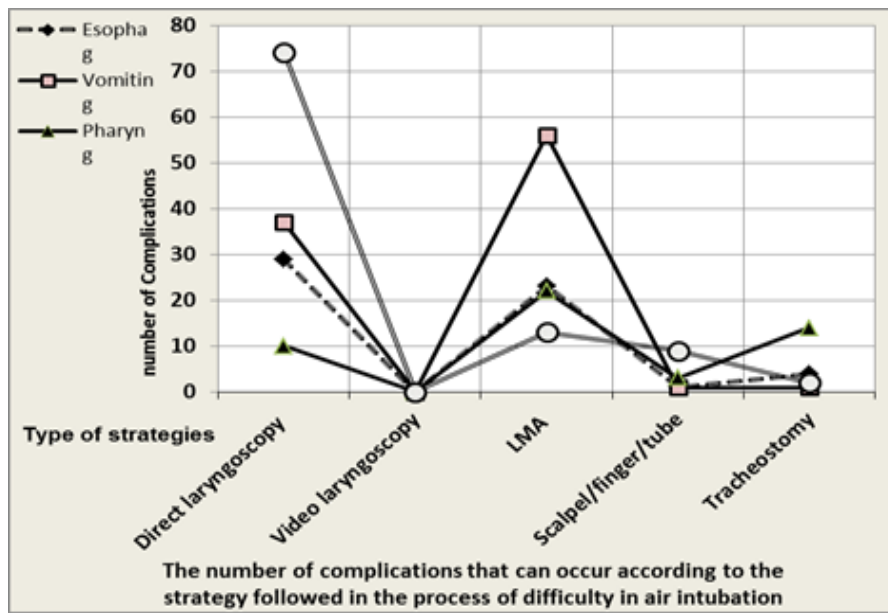
The Figure 7 showed developed primary and alternative strategies used for DA management. It is clear that the nonsurgical attempts had the highest repetition in the selected sample. There was variety in repetitions according number of cases in the hospitals. Surgical airway attempted had the lowest repetition following the DA protocols 2015

and plans by using simple techniques (ETT, LMA) as possible to minimize the risk of trauma and complications<sup>11, 13</sup>. There are different strategies have been used in the selected sample and each strategy has minor and major complications which would be explained in the next figure 8.

**Average number of Complications related to the previous strategies of airway intubation**

Figure (8) illustrated the number of complications that associated with different types of strategies; direct laryngoscopy was repeated in Trauma, with about 74 recurrences. The vomiting as complication of direct intubation with laryngoscopy appeared in (37) times, this

number is increased to 56 times during the use of LMA. While the Oesophageal, Pharynges trauma and vomiting have decreased frequency, which ranged from one to 14 times only at Scalpel / finger / tube and tracheostomy as surgical airway is rarely used.



**Figure 8.** The number of complications associated with different types of strategies

According to figure 8 the most common injury or trauma was related to direct laryngoscopy<sup>14</sup>. In addition, few complications at Scalpel / finger / tube and tracheostomy and that may be caused by surgical airway is rarely used. These results are consistent with previous studies<sup>4</sup>.

Pulmonary aspiration related to the vomiting remains a major concern and the leading cause of airway-related anaesthetic deaths. In most cases, risk factors exist and care is not optimal. A significant proportion of airway complications occur in the intensive care and emergency departments. These complications occur more frequently than

in operating theatres, are more likely to lead to patient harm/death<sup>4</sup>.

The most obvious finding to emerge from this study is that there is absence of using video laryngoscopy. A comparison of the two results reveals that video laryngoscopy is tool of choice in management of cases with difficult airway. According to the fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society published in 2011, strong evidence of using new techniques for DA management was found in the last studies<sup>14</sup>. The importance of Video laryngoscopes and Supraglottic airways were addressed to minimize the complication<sup>15</sup>.

In particular, in the intensive care unit and emergency room, where there must be well-trained, qualified, and educated staff in addition to the most cutting-edge equipment, the majority of airway issues

are undiagnosed and can raise the mortality rate. Pulmonary aspiration, oesophageal intubation, and unsuccessful airway management are some of these consequences<sup>4</sup>.

### ANOVA test for airway complications related strategies

Comparison between complication which emerge from 5 strategies in the five selected hospital as it clear in the Figure (8), and the results of ANOVA two way

test as it showed in table (2) below; The results exhibited that there is no statistically significant difference were found with  $P= 0.844$  which is  $> 0.005$ .

**Table 2 Anova test for airway complications related strategies**

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Columns	385.75	3	128.5833	0.272235	0.844509	3.238872

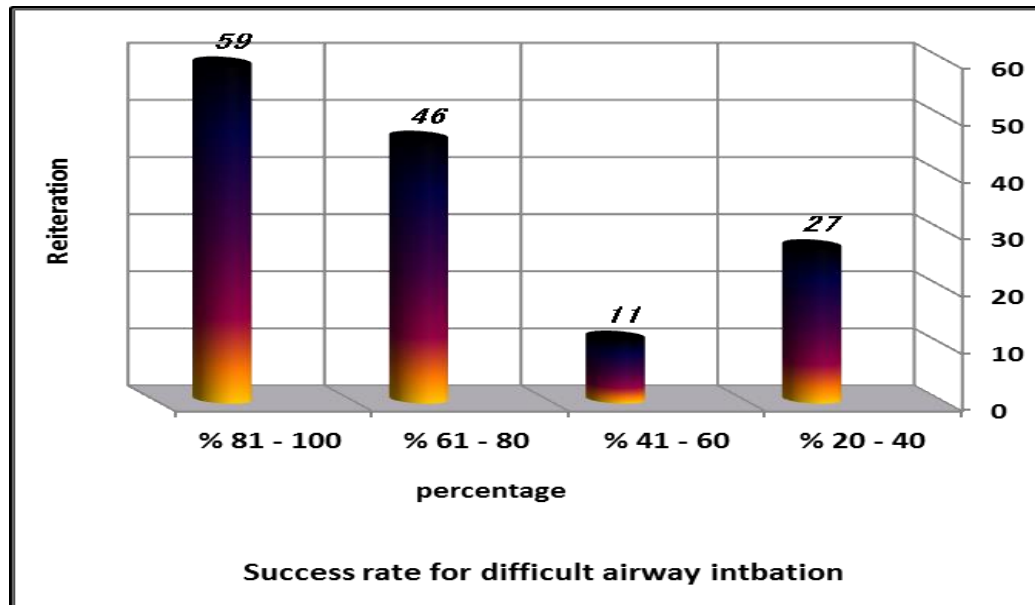
From the Figure 8 The statistical analysis also showed that the standard deviation of the laryngoscopy, tracheostomy, scalpel / finger / tube, LMA, video laryngoscopy at Oesophagus, Pharynx Trauma and Vomiting ; was  $19.6 \pm 27.6$ ,  $9.8 \pm 7.86$ ,  $19 \pm 23.25$ ,  $11.4 \pm 12.14$  respectively, where the standard deviation refers to the extent of the divergence of the values from the mean, meaning that the repetitive values have shown a wide range between them because of the different cases studied and

the different people. Whereas, the analysis of variance of these averages in ANOVA: two-factor with replication in the table 2 showed no significant differences between Oesophagus, Pharynx trauma and vomiting at a significant level ( $P 0.05$ ) to about 95%, given the value of the moral test, we find that the calculated F value is 0.2722345 while the value of the table F is 3.23887 and the values P-value 0.844509, which confirms the absence of significant differences.

### Comparison of success rate and failure in difficult airway management among the whole sample

Figure (9) represented the percentage of success to failure rates for difficult airway intubation in the selected hospitals. It demonstrated a success rate that was assessed at 41.25% and ranged from 81-100% up to (N = 59) times. In other words, it anticipated that 58.75% of attempts

repetitions with the lowest number of recurrences in the 41-60% success rate were found. The success rate repeated 27 times, according to 20–40% of the study's entire population, which is equivalent to an estimated 18.88% success rate. Indicating an 81.12% failure rate.



would fail in this situation. Only (N=11)

**Figure 9:** percentage of Success to failure rates for difficult airway intubation

### Recommendations indicated by participants

**Table (3) Recommendations to avoid the complications that may happen during tracheal intubations.**

Recommendation	Reiteration	Hospital	Percentages
Team work and team leader	3	TMC	8.1

Call for help	4	TMC	<b>10.8</b>
Don't panic and think for next step	4	TMC	<b>10.8</b>
<b>Good preoperative assessment, evaluation and examination</b>	<b>5</b>	<b>TMC</b>	<b>13.51</b>
Change plan B Regional Anaesthesia	3	TMC	<b>8.1</b>
Use fiberoptic bronchoscopy in cases of difficult airway	1	TMC	<b>2.7</b>
Use of video laryngoscopy	2	TMC	<b>5.4</b>
Don't try intubation more than 3 times	1	TMC	<b>2.7</b>
Follow DAS guideline	1	TMC	<b>2.7</b>
Don't be confident too much	1	TMC	<b>2.7</b>
Preoperative preparation of equipment's and drugs very useful	2	TMC	<b>5.4</b>

The table (3) is displayed the highest frequency has come in favour of the recommendation of Good preoperative, so you have exceeded the repetitive value of recommendations Call for help and Do not panic and think and the amount of Overflow to about 25%. An important issue emerging from these findings, which indicates the importance of preoperative evaluation and preparation patient and equipment is before air intubation is initiated [6].

The finding shown that, avoidance of airway management complications needs careful assessment, good planning and judgement, good communication and teamwork, knowledge and use of a range of techniques and devices, and a willingness to stop performing techniques when they are failing<sup>4</sup>. However, a number of limitations needed to be considered. It is obvious that limited sample size may affect the study and makes it difficult to find correlation between different variables. In addition, some Technicians refuse to fill in questionnaires and participate in this study. This finding has implications for,

technicians did not play a major role in airway management that indicate absence of teamwork, and they have poor information and lack practical experience.

## Conclusion

This study was undertaken to evaluate the difficulty in airway management strategies applied in certain hospitals to identify and compare the major complications associated with them. To conclude, most of airway complications are unsuspected and can increase the mortality rate, particularly in the intensive care unit and emergency department, which must have well trained, prepared and educated staff in addition the most developed devices. These complications include; pulmonary aspiration, oesophageal intubation, and failed airway management. It is clear that at least one in four major airway events in a hospital are likely to occur in intensive care and the emergency department. The outcome of these events is particularly adverse. Analysis of the cases has identified repeated gaps in care that include. May be due to poor identification of at-risk patients, poor or incomplete planning, inadequate provision of skilled staff and equipment to manage these events successfully, delayed recognition of events.

In addition, the finding of this study have indicated that there is no statistically significant different among compared hospitals in the selected sample. Therefore, management of the difficult airway requires technical and non-technical skills. Technical skills are defined as the specific medical knowledge and procedural ability required for managing the airway. Non-technical skills are generalizable skills required to manage dynamic high-risk/low-frequency crises. These non-technical skills include leadership, teamwork, situational awareness, task management, and decision-making.

To minimize the risk of complications; high- quality airway management training is needed. Other issues such as equipment availability and the logistics associated with rural versus urban critical care transport/EMS are required. Nevertheless, there are several factors that might contribute to reduce complications include good preparation, assessment, planning, communication, teamwork, skill with

multiple techniques, and situation awareness. In addition, Pre-oxygenation is highly recommended for all patients.

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