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FREQUENCY OF DIFFICULT AIRWAY AND ITS ASSOCIATED FACTOR IN PEDIATRIC PATIENT UNDERGOING GENERAL ANESTHESIA AT MARDAN MEDICAL COMPLEX (A CROSS-SECTIONAL STUDY)

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Abstract

Background: *When surgery is performed, it's crucial to anesthetize the patient, which depresses the respiratory center, so you must secure the airway by artificial means for ventilation or oxygenation. A critical component of anesthetic practice is managing difficult airways, especially in pediatric patients. The reason behind this difficulty is the anatomical and physiological differences in the airway of pediatrics compared to adults. This study identifies the frequency of difficult airway and associated factors in pediatric patients undergoing General anesthesia at Mardan Medical Complex, Pakistan.*

Objective: To determine the frequency and Associated factors of difficult pediatric airway patients undergoing general Anesthesia.

Method: *Analytical cross-sectional study design was used for this study. A simple chi-square test is applied to determine the association between categorical variables The total number of participants in the study was 244, of which 95(39.8%) were female and 149 (61.1%) were male.*

Result: *According to this cross-sectional study, which was carried out in MMC Mardan, KPK, Pakistan.The frequency of difficult airway and difficult laryngoscopy is 1.6%. Difficult face mask ventilation is faced only in 5 individuals, which is almost 2%. By using the Intubation Difficult Scale (IDS) determined that out of 244 individuals, Easy intubation took place in 205 participants, which is 84.0%. While slightly difficult intubation takes place in 11.9% which is almost 29 individuals. While severe difficult intubation is facing 4.1%. P values <0.05 are used to determine the statistical significance of the applied test.*

The association between two categorical variables is found out through a simple chi-square test, and P values are considered for statistically significant association. which determined that there is no association between gender and level of anesthetist with pediatric difficult airway, while Age, weight, and experience of anesthetist are strongly associated with pediatric difficult airway.

Conclusion: *Low weight or underweight, less experienced anesthetists, and small age pediatric patients are more prone to difficult airway, difficult MV, and difficult intubation. Because between these variables, there is a strong association present, determined by a P value <0.05. While gender and level of anesthetist are not statistically associated with pediatric difficult airway because their P value >0.05, which indicates that there is no association present between these variables.*

INTRODUCTION

According to ASA guidelines when skilled anesthetist has failed to intubated in the three attempts or failed to intubate within 10 minute or the inability to maintain an adequate oxygen saturation greater than 90% when 100% oxygen is provide, this is known as difficult airway(1). When an anesthesiologist works alone and is unable to avoid or resolve indicators of insufficient ventilation during positive-pressure mask ventilation, this is referred to as difficult mask ventilation(2). The systemic review of worldwide and Brazilian literature are conducted in 2009 to determine the cause of anesthesia-related mortality, this include the published data from 1954 To 2007.This study determined that the most common cause of anesthesia related death are associated with problem with airway management are simply difficult airway and cardiovascular problem associated with anesthesia and anesthetic drugs administration (3).tracheal intubations which was prospectively gathered from 13 pediatric hospitals between August 2012 and January 2015 in the USA, during which 1018 difficult pediatric tracheal intubation encounters. They discovered that cardiac arrest, which occurs in 2% of pediatric patients, is the most frequent serious event. The causes of this complication were more than two tracheal intubation attempts, three direct laryngoscopies, weight less than 10kg(4). Children's airways differ from adult airways in a two major category, Anatomically and physiologically .In anatomically its differ from adult in a variety of way children have relative large head and occipital compared to adult which make neck flex in supine position and partially obstruct the airway so need to be additionally extend the head or place the shoulder roll to clear the airway(5). Children are difficult to intubate and need special attention to seal the airway due to their wide tongues, broad heads, anterior larynx, small mouths, narrow airways(6).Due to small airway and anatomical differences it's difficult to performed direct laryngoscopy, intubation and mask ventilation (1). physiologically the oxygen consumption in pediatric patient is higher than compared to adult. Pediatric patient has small residual volume due which they do not tolerate, even for short time hypoxic may cause bradycardia and cardiac arrest (7).According to this study we found that patients with DMV had a considerably greater incidence of difficult intubations (30%) compared to patients without DMV (8%). Cormac and Lehane grades III and IV indicate that a person is difficult to intubate. The majority of these patients also have difficult-to-achieve face mask ventilation(2). Desaturation from 100% to 90% takes place in children and newborns (two days to 10 years old) in 96 - 214 seconds (1.36 - 3.6min) (8). When ventilation-oxygenation has been discontinued, the best period to secure the airway is 20 seconds for newborns and 30 seconds for all other children(9). A prospective multicentral observational study in Europe in 2015 uses a Secondary data of APRICOT (Anesthesia practiced in children observational trial) which contained data of 33 European country, 261 European hospital for analysis ,which determined that the incidence of difficult airway (more than three attempt) are 0.88% ,Out of that difficult tracheal intubation are reported in 0.28% patients , while the fail tracheal intubation are faced by 0.08% patients (10). The incidence of predicted difficult intubation ranges from 0.06% to 1.34%, while unknown difficulty by 0.24% of children under 1 year and 0.07% of children over 1 year. Unanticipated Face mask ventilation difficulties are relatively rare OR uncommon (11). to a prospective study conducted in 2020 at the Armed Forces Institute of Ophthalmology in Rawalpindi, Pakistan, with a sample size of 232 patients, of which 42 were children and 191 were adults, the prevalence of difficult airways was found to be (15.5%) overall, with children making up 7.3%. Approximately 17% of respiratory related issue stem from difficult intubation, and about 28% of anesthesia-related deaths are caused by difficult intubation or ventilation(12).

A study which is conducted in 2012 to determine the incidence of difficult laryngoscopy (DL) conclude that the factor which contribute to difficult laryngoscopy is age less than 1 year under-weight patient and ASA

class III and IV. He also determined that the incidence of difficult laryngoscopy is greater in old individual compare to pediatric population(13). A difficult airway is more probable to occur in children who are smaller(14). Regardless of resource availability, managing pediatric airways improperly can lead to higher morbidity and death(15). Given that the anesthesiologist's role was significant in our study's analysis of management of severe critical events, it is advised that a skilled pediatric anesthesiologist handle such cases(16). The incidence of difficult face mask ventilation was (0.08%-15%)(17)

While another study determined that the incidence of difficult laryngoscopy in child are 1.3%.which is less then adult 9% (18).

As adults, children have different anatomical and physiological requirements; hence, airway management becomes a crucial component of anesthetic care. Even, with advanced technology and training, difficult airway (DA) management remains a major contributor to morbidity and mortality in pediatric anesthesia. Therefore, to improve anesthesia-related problems, risk assessment in the preoperative stage, increased preparedness, and understanding the prevalence and causes of difficult airway cases in children are essential. Many underdeveloped countries, including Pakistan, lack vital national data on the prevalence of difficult pediatric airways. There are considerable disparities in healthcare training, demographics and populations, and airway management tools. Most clinical practices and guidelines on airway management do not contextualize the circumstances of low-resource countries because the majority of clinical research papers are based in high-income countries.

MATERIAL AND METHODS

This Analytical cross-sectional study was conducted in a tertiary care hospital in department of anesthesia in Mardan medical complex KPK Pakistan. The data are collected from the Anesthesia department (Operation theater) of Mardan Medical Complex.

According to the different surgical procedure performed the OT further divided into Eight operation theater namely Neuro I and II, Laparoscopic OT, Orthopedic I and II, General surgical OT, Eye OT and ENT OT. All pediatric patient age from birth to 18year with ASA physical status class-I and class-II undergoing general anesthesia with endotracheal intubation are the participant of the study. All the surgical procedure that are electively performed are included in the study. While indirect laryngoscopy, patients having congenital airway anomalies and emergency surgical procedures are excluded from this study.

The sample size of 244 was determined based on an anticipated prevalence with a 5% margin of error, 95% confidence interval. after ethical approval from research committee and department of anesthesia in mardan medical complex.

All patients meeting the inclusion criteria the purpose and benefits of the study is explained to the guardian of patients and a written informed consent will be obtained. Children scheduled for elective surgery under general anesthesia who needed endotracheal intubation were graded according to the Mallampati grade, in pre-operative The anesthesiologist who performed the laryngoscopy determined the patient's Cormack and Lehane's laryngoscopy grade. After that, each patient who had an endotracheal intubation was checked for difficult intubation and difficult laryngoscopy (DL) difficult MV in the operation room.

Data was analysis by using SPSS version 22.0. All data from questionere are enter into google form and excel spread sheet. And then All data from excel are export to SPSS for analysis. Chi sqauare test are applied to determine the association between two categorical variables. Consider Statistically Strongly association between variable when P-value < 0.05. Frequency and percentage of different variable are also determined by using SPSS.

RESULTS

The total number of participants in this study was 244 in which 95(39.8%) female and 149 (61.1%) males The frequency of difficult airway and difficult laryngoscopy are 1.6% which is almost 4 individuals. Difficult facemask mask ventilation is facing only in 5 individual which is almost 2%. By using Intubation difficult scale

(IDS) to determining the difficult intubation which find out that out of 244 individuals, the Easy intubation are take place in 205 individual which are 84.0%. while slightly difficult intubation is take place in 11.9% population which are almost 29 individuals. while difficult intubation is facing by 10 participants with percentage of 4.1%. In MMP grading, Grade I are 94.7%, grade II are 3.7%, Grade III are 1.6% while no one has found in Grade IV. In Han's scale Grade 0 and 1 are consider easy which are 1.2% and 96.7% respectively while Grade 2 and 4 are 1.6% and 0.4% respectively are the frequency of this study. Shown in table 1

Table 1 Different variables their frequency and percentage of the pediatric patient undergoing general anesthesia:

		FREQUENCY	PERCENTAGE
AGE	<2months	1	.4%
	1-6yr	69	28.3%
	12-18yr	91	37.3%
	6-12yr	77	31.6%
		TOTAL 244	TOTAL 100.0%
GENDER	FEMALE	95	39.9%
	MALE	149	61.1%
		TOTAL 244	TOTAL 100%
MALLAMPATI CLASSIFICATION	GRADE I	231	94.7%
	GRADE II	9	3.7%
	GRADE III	4	1.6%
		TOTAL 244	TOTAL 100%
CORMAC AND LEHAN	GRADE I	218	89.3%
	GRADE II	22	9.0%
	GRADE III	3	1.2%
	GRADE IV	1	0.4%
		TOTAL 244	TOTAL 100%
HAN's SCALE	GRADE 0	3	1.2%
	GRADE 1	236	96.7%
	GRADE 2	4	1.6%
	GRADE 4	1	0.4%
		TOTAL 244	TOTAL 100%
INTUBATION DIFFICULT SCALE SCORE	EASY INTUBATION	205	84.0%
	SLIGHTLY DIFFICULT INTUBATION	29	11.9%
	DIFFICULT INTUBATION	10	4.1%
		TOTAL 244	TOTAL 244

For the Association between age with Modified Mallampati Classification, Cormac and Lehan grading , HAN's scale and Intubation difficult scale. By applying statistical test which show that the P value <0.05 which determined that there is strongly statistically association are present between Age with Mallampati grading, Cormac and Lehan's grading and intubation difficult scale grading which are the scale for determining the difficult airway so mean that small age people are suffer more airway difficulty compare with higher age in pediatric population. while there is no association between Age with HAN's scale mean that there is no relation between age with difficult mask ventilation. shown in table 2

Table 2: Association between age with MMP, CL, HAN's scale and IDS

Age	MALLAMPATI CLASSIFICATION	INTUBATION DIFFICULT SCALE SCORE	P VALUE
<2months 1-6yr 12-18yr 6-12yr	GRADE I GRADE II GRADE III	GRADE I GRADE II GRADE III GRADE IV	<0.05
<2months 1-6yr 12-18yr 6-12yr	GRADE 0 GRADE 1 GRADE 2 GRADE 4		>0.05

Association between Gender with MMP, CL, HAN's scale and IDS. By applying statistical test which determined that p value >0.05 which clarify that there is no Any association present between gender with difficult airway. Its conclude that there is no any increase possibility of difficulty in Gender base both are equally probable for difficulty. Shown in table 3.

Table 3: Association between Gender with MMP, CL, HAN's scale and IDS

Gender	MALLAMPATI CLASSIFICATION	INTUBATION DIFFICULT SCALE SCORE	P VALUE
<2months 1-6yr 12-18yr 6-12yr	GRADE I GRADE II GRADE III	GRADE I GRADE II GRADE III GRADE IV	>0.05
<2months 1-6yr 12-18yr 6-12yr	GRADE 0 GRADE 1 GRADE 2 GRADE 4		>0.05

The association between experience of anesthetist and MMP, CL and HAN's determined that there is no any association present between these variables because the p value >0.05. But there is strongly association present between experience of anesthetist and intubation difficult scale (IDS scale for determining the difficult intubation). Less than 2 yr experience anesthetist intubate 56 patients while out of 56 he faced slightly difficulty 16

patient which is approximately 26.8%. 2-4year experience anesthetist intubate 23 patients out of that 3-patient faced slightly difficulty which is 13%. >4year experience anesthetist will follow 165 intubation out of that 11-patient face slightly difficult intubation which is approximately 6.7%. its conclude that more experience will face less difficulty during securing of pediatric airway because experience in inversely proportion to pediatric difficult intubation. shown in Table 4

Table 4.

Experience of anesthetist	MALLAMPATI CLASSIFICATION	HAN's	P VALUE
<2months	GRADE I	GRADE 0	>0.05
1-6yr	GRADE II	GRADE 1	
12-18yr	GRADE III	GRADE 2	
6-12yr		GRADE 4	
<2months	GRADE I		
1-6yr	GRADE II		<0.05
12-18yr	GRADE III		
6-12yr	GRADE IV		

The association between experience of anesthetist and MMP, CL and HAN's determined that there is no any association present between these variables because the p value >0.05. But there is strongly association present between experience of anesthetist and intubation difficult scale (IDS scale for determining the difficult intubation). Less than 2 yr experience anesthetist intubate 56 patients while out of 56 he faced slightly difficulty 16 patient which is approximately 26.8%. 2-4year experience anesthetist intubate 23 patients out of that 3-patient faced slightly difficulty which is 13%. >4year experience anesthetist will follow 165 intubation out of that 11-patient face slightly difficult intubation which is approximately 6.7%. its conclude that more experience will face less difficulty during securing of pediatric airway because experience in inversely proportion to pediatric difficult intubation See in figure 1

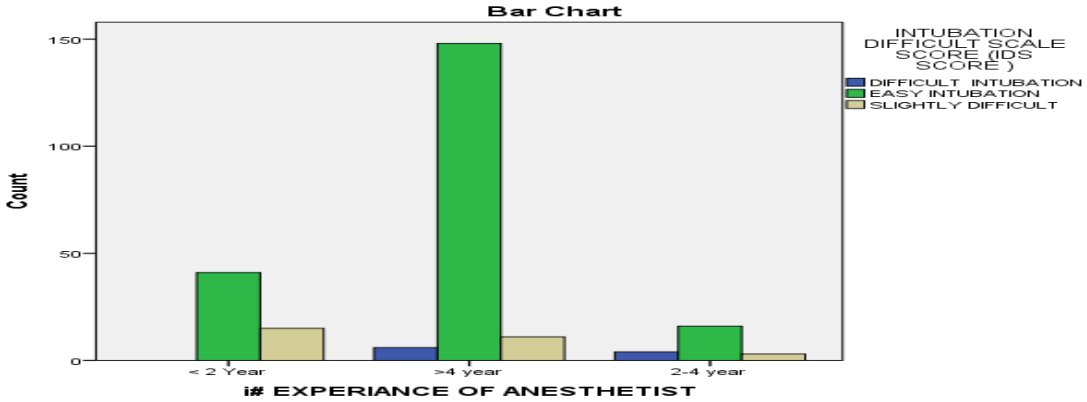

Figure 1.

DISCUSSION

This research is conducted in Mardan Medical Complex to determine the frequency of pediatric difficult airway and their associated factor which increase and decrease the frequency of difficult airway in pediatric

population. The total number of participants in the study was 244 in which 95(39.8%) female and 149 (61.1%) males. By applying different airway test for determining the airway difficulty of pediatric population. MMP test Grade I are 231 (94.7%), Grade II are 9 (3.7%), grade III is 4(1.6%) individuals. which determined that only 1.6 % pediatric face airway difficulty.

Previous study identified the difficult laryngoscopy in pediatric are 4.77%(17). While another study determined that the incidence of difficult laryngoscopy in child are 1.3%.which is less then adult 9% (18). While conclusion of our study determined that difficult laryngoscopy is facing only in 1.6%.

The incidence of difficult face mask ventilation was (0.08%-15%)(17).The study which are conducted in India determined that the percentage of difficult face mask ventilation of pediatric age 1-5 yr are 3% which are almost 3 individual(19). The finding of our study related to difficult face mask ventilation is 2% almost five participants. This study determined that the percentage of difficult intubation through IDS (intubation difficult scale) of pediatric patient age between 1-5year was 40% slightly difficult and 2% show severe intubation difficulty(19).Another retrospective study determined that the incidence of Difficult intubation in infant was 2.4%(17). while our study determined the difficult intubation by using IDS (intubation difficult scale) determined that slightly difficulty is faced in 29(11.9%) patients, while severe difficult intubation is faced only in 10(4.1%) individuals. Difficult intubation was substantially greater among neonates and children under one year old(10). factor which contribute to difficult laryngoscopy is age less than 1 year ,underweight patient and ASA class III and IV(10) .The anesthesiologists' experience reduced the chance for a critical respiratory event by 1% for every year of experience .which was also highlighted in the original report of the results of APRICOT(16). (10). There was no proof that the number of years of experience and the team's seniority had any impact on the frequency of difficult intubations(10). Our study determined that there is no any association between difficult airway in gender wise mean that pediatric male and female are equally probable of difficult airway.

There is Association present between Age, weight, experience of anesthetist with pediatric difficult airway mean that These factors deviate the frequency of pediatric difficult airway. we also determined that no association present between difficult airway with level of anesthetist.

CONCLUSION

Low weight or underweight, less experience anesthetists and small age pediatric are more prone to difficult airway, difficult MV and difficult intubation. Because between these variables there is a strongly association present determined by P value <0.05. while gender and level of anesthetist is not statistically associated with pediatric difficult airway because their P value >0.05 which show there is no association present between variable.

Recommendations

To minimize the risk of a difficult airway, give preference to experienced anesthetists when handling pediatric cases involving younger or underweight patients. Regularly train and simulate pediatric airway management techniques, particularly for anesthetists with less experience. Conduct comprehensive preoperative airway assessments on all pediatric patients to detect possible airway issues early.

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