CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.2595990

Available online at: http://www.iajps.com ***Research Article***

THE PREDICTIVE VALUES OF ANATOMICAL PARAMETERS FOR TROUBLED MASK VENTILATION

[1]Dr Hafiz Ali Zain Ul Abdeen,[2]Dr Zunaira Pervaiz,[3]Dr Muhammad Shaheryar.

[1]MO,RHC Ahmed Nagar,Wazirabad., [2]WMO,BHU Jamalpur Syedan,Gujrat., [3]MO,RHC Chak 75SB Sargodha.

Article Received: December 2018 **Accepted:** February 2019 **Published:** March 2019

Abstract:

Mask ventilation is the primary technique of ventilation before insertion of any airway device. Difficulties in mask ventilation have been associated with serious complications, such as death or hypoxic brain damage. If the anesthetist can predict which patients are likely to prove difficult to ventilate, he/she may reduce the risks of anesthesia considerably.

The study was aimed to assess the incidence of and predictive values of anatomical parameters for difficult mask ventilation among patients who underwent elective surgeries.

Institutional based cross sectional study was conducted in two hospitals. The study was conducted on 278 patients of which 101 (36.3%) were males and 177 (63.7%) were females. Patient demographics, incidence and predictive values of anatomical parameters for difficult mask ventilation were studied among elective patients who took general anesthesia.

The incidence of difficult mask ventilation (grade III) was 2.2%; whereas, impossible mask ventilation (grade IV) was 0.4%. Highest percent of difficult mask ventilation (grade III) was occurred in patients with obstructive sleep apnea, BMI>26 kg/m^2 and Mandibular Protrusion Class C. Modified Mallampatti class III and IV and Mandibular protrusion class B and C are highly accurate parameters with high specificity, negative predictive value and positive predictive value to predict difficult mask ventilation.

Keywords: *Troubled mask ventilation; Anatomical parameters*

Corresponding author:

Dr. Hafiz Ali Zain Ul Abdeen,

QR code

Please cite this article in press Hafiz Ali Zain Ul Abdeen et al., ***The Predictive Values Of Anatomical Parameters For Troubled Mask Ventilation.,*** *Indo Am. J. P. Sci, 2019; 06(03).*

INTRODUCTION:

Mask ventilation is an integral skill for all anesthetists. It forms the starting point of the majority of general anesthetics and more importantly, it is an essential fall-back technique for maintaining oxygenation during a failed or difficult intubation. Despite its importance, less attention is devoted to mask ventilation in research papers and textbooks, with a larger focus on difficult or failed intubation.

Difficult mask ventilation is defined as a situation in which: It is not possible for the anesthesiologist to provide adequate ventilation because of one or more of the following problems: inadequate mask seal, excessive gas leak, or excessive resistance to the ingress or egress of gas.

Failure to anticipate difficult mask ventilation before anesthesia induction is in 57% of the patients who were ultimately difficult to ventilate. There is a wide variation in the reported incidence of difficult mask ventilation (DMV) in the literature. Whereas one study reported an incidence as low as 0.08%, another reported a 15% incidence. The highest incidence (15%) was reported from a retrospective study of subjects who had difficult intubation. The majority of prospective studies, on the other hand, reported a lower incidence. 0.9%, 5% and 7.8%.

The large prospective study of 22,660 MV attempts used a DMV grading scale and reported an incidence of 1.4%. Because this is the large and most recent study and because the reported incidence is in agreement with several other studies 1.4% may be considered the most likely estimate in the general population.

METHODS:

Study Design

An Institution based cross-sectional study was used.

Study population

Surgical patients admitted to hospitals and also scheduled for elective surgery under general anesthesia were selected.

Eligibility criteria

Patients who underwent elective surgery under general anaesthesia are included. However, critically ill patients in which airway assessment is difficult; Age less than 18 years; Psychiatric patients; and Patients scheduled for thyroid and maxillofacial surgeries were exclusive.

Sample size determination and Sampling technique

Sample size was determined using finite population correction formula by assuming the prevalence as 0.5 and 5% margin of error at 95% confidence interval. Accordingly, a total sample size of 286 elective surgical patients was planned to participate in this study.

Technique of Data Collection

Structured questionnaire prepared in Urdu was used. During data collection ten, BSc holders and one MSc holder was involved as data collector and supervisor respectively. Patients scheduled for elective surgery under GA was assessed at the waiting room immediately before their entry to the operation room. Then, after adequate preparation of necessary equipment's each patient was observed for difficult mask ventilation in the operation room while qualified anaesthetist applying mask ventilation and one anaesthetist grading mask ventilation.

Data quality assurance

One full day training was given for the data collectors and supervisor. During data collection, close supervision and follow up was made. The collected data was cross checked for its completeness, clarity and consistency.

Ethical considerations

Ethical clearance was obtained from concerned departments. Then, a letter of support and permission was given to the hospital administrators. Informed verbal consent was secured from every study participants. Confidentialities and anonymity was ensured.

Data analysis

Data with complete information was entered to SPSS version 20. The descriptive statistics and Receiver Operating Characteristics (ROC) curve was performed. The validity of parameters (screening tests) such as sensitivity, specificity, positive predictive values and negative predictive values was performed using crosstabs.

Class definition

ASA 1: Normal healthy patient

ASA 2: Patient with mild systemic disease (no functional limitations)

ASA 3: Patient with severe systemic disease (some functional limitations)

ASA 4: Patient with severe systemic disease that is a constant threat to life (functionality incapacitated)

ASA 5: Moribund patient who is not expected to survive without the operation

ASA 6: Brain-dead patient whose organs are being removed for donor purposes

Classification description:

Han's Mask Ventilation Classification and Description Scale

Grade 0 Ventilation by mask not attempted

Grade 1 Ventilated by mask

Grade 2 Ventilated by mask with oral airway or other adjunct

Grade 3 Difficult mask ventilation (Inadequate, unstable, or 2 person technique)

Grade 4 Unable to mask ventilate

Inter incisor distance (IID): It is the distance between the upper and lower incisors. A value of less than 3 patient's fingers or less than 3cm predicts difficult airway.

Mandibular protrusion (MP): the lower incisors can be brought in front of the upper incisors: inability to bring the lower incisors to the upper or Mandibular protrusion class B & C suggests difficulty.

Mallampatti class (MMC): The Mallampatti classification correlates tongue size to pharyngeal size. This test is performed with the patient in the sitting position, head in a neutral position, the mouth wide open and the tongue protruding to its maximum. Classification is assigned according to the extent the base of tongue is able to mask the visibility of pharyngeal structures into four classes, I-IV:

RESULTS:

Personal socio-demographic characteristics

The study was conducted on 278 patients of which 101(36.3%) were males and 177(63.7%) were females. The highest number of cases 57.6% (n=160) were belonged to the age group of 18-40. The mean age of study population was 36.21 ± 10.9 (minimum 18 and maximum 76). Out of 278 Patients 163(58.6%), 108 (38.8), 7 (2.5%) were ASA physical status class I, II, and III respectively. There were no cases with ASA physical status class IV or V. Majority of cases was within ASA physical status class I and age group 18-40. The numbers of female patients were higher than males with the ratio of (1.7:1)

Variable	Category	Frequency	Percentage
Sex	M	101	36.3
	F	177	63.7
Age group	18-40	160	57.6
	41-60	111	39.9
	≥ 60	7	2.5
ASA physical status	I	163	58.6
	II	108	38.8
	III	7	2.5

The incidence of difficult mask ventilation (grade III) is higher in males, ASA physical status class II and within age group 41-60. Impossible mask ventilation (grade IV) was occurred within age group 41-60 and the patient was female with ASA physical status class II. Highest precent of mask ventilation grade II was occurred in male patients, within age ≥ 60 years and by ASA physical status class III.

Variable	Category	Frequency	Mask ventilation n (%)			
			Grade			
			I	II	III	IV
Sex	M	101	89 (88.1)	9 (8.9)	3 (13)	-
	F	177	164 (92.7)	9 (5.1)	3 (1.7)	1 (0.6)
Age group	18-40	160	153 (95.6)	4 (2.5)	3 (1.9)	-
	41-60	111	97 (87.4)	10 (9)	3 (2.7)	1 (0.9)
	≥ 60	7	3 (42.9)	4 (57.1)	-	-
ASA physical status	I	163	152 (93.3)	10 (6.1)	1 (0.6)	-
	II	108	97 (89.6)	5 (4.6)	5 (4.6)	1 (0.9)
	III	7	4 (57.1)	3 (42.9)	-	-

All of the anatomical parameters showed highest specificity and negative predictive value for difficult mask ventilation. MMC class III &IV and Mandibular protrusion class B and C followed by OSA, neck circumference>40 cm, history of snoring and BMI ≥ 26 kg/m^2 showed highest accuracy, sensitivity and positive predictive value to predict difficult mask ventilation grade (III). Anatomical parameters (IID<3 cm, TMD<6 cm, SMD<12 cm, lost dentition, limited neck mobility and old age>55years) showed 0 sensitivity and PPV to predict DMV (grade III), as mentioned in Table 3 below:

Parameter	Sn %	Sp%	PPV%	NPV%	Area	Accuracy%
Inter incisor distance	0	99.6	0	97.8	0.498	49.8
TMD	0	98.9	0	97.8	0.494	49.4
SMD	0	98.5	0	97.8	0.493	49.3
BMI	33.3	99.6	66.7	98.5	0.665	66.5
History of Snoring	33.3	98.9	40	98.5	0.661	66.1
Dentition	0	99.6	0	97.8	0.498	49.8
Neck circumference	33.3	99.3	50	98.5	0.663	66.3
OSA	33.3	99.6	66.7	98.5	0.665	66.5
Neck mobility	0	99.6	0	97.8	0.498	49.8
Kyphoscoliosis	-	100	-	97.5	0.5	50
Old Age	0	96.3	0	97.8	0.482	48.2
MMC III & IV	50	98.5	42.9	98.9	0.743	74.3
Mandibular protrusion B &C	50	98.2	37.5	98.9	0.741	74.1

*Sn: Sensitivity; Sp: Specificity; PPV: Positive Predictive Value; NPV: Negative Predictive Value

DISCUSSION:

The airway risk assessment tools in widespread use were mostly focused on one specific aspect of a difficult airway (i.e. difficult laryngoscopy, difficult intubation). In More recent years, this paradigm has shifted to a more functional approach with greater emphasis placed on the overall importance of the airway patency. Indeed, due to early data demonstrating the significant risk of respiratory depression associated with sedation, The Joint Commission and Centers for Medicare and Medicaid Services has implemented policies to ensure

evaluation of the risk for a difficult airway prior to procedures. Moreover, the 2013 American Society of Anesthesiology Practice Guidelines for Management of the Difficult Airway caution about the risks of a difficult mask ventilation due to upper airway obstruction and recommend an airway risk assessment before every anesthesia procedure is performed.

In our study, we found the incidence of difficult mask ventilation (grade III) as 2.2 % (6/278). There is a wide variation in the reported incidence of DMV in the literature. Whereas one study reported an incidence as low as 0.08%, another reported a 15% incidence. The highest incidence (15%) was reported from a retrospective study of subjects who had difficult intubation. The majority of prospective studies, on the other hand, reported a lower incidence. 0.9%, 5% and 7.8%. The large prospective study of 22,660 MV attempts used a DMV grading scale and reported an incidence of 1.4%. Because this is the large and most recent study and because the reported incidence is in agreement with several other studies 1.4% may be considered the most likely estimate in the general population.

In our study highest percent of DMV was occurred in patients with OSA, BMI >26 kg/m^2, Mandibular protrusion class C followed by Neck circumference> 40 cm, history of snoring, MMC III and Mandibular protrusion class B. We found IID<3 cm, old age>55years, Kyphoscoliosis, limited neck mobility and lost dentition have no relation with DMV.

Similarly In a prospective study of 1502 patients performed a multivariate assessment and found five anatomical risk factors to be significantly associated with DMV and thus may be used as predictors. These were: age older than 55 year, (BMI) more than 26 kg/m^2, lack of teeth, history of snoring, and presence of a beard. The presence of at least two of these factors indicated a high likelihood of DMV. Similarly, an analysis through age weight, history of snoring, male gender, and Mallampatti Class IV found to be significantly associated with DMV.

In our study a total of 278 patients were investigated and only one case with impossible mask ventilation (grade IV) was encountered. A study by on 22,660 patients found the rate of grade IV as 0.16% (n=37), while another study by the same researcher identified the rate of grade IV as 0.15% (n=77) in 53,041 patients given mask ventilation. In a study of 576 patients by they stated they did not encounter grade IV MV. When the literature is examined, these studies were completed on very broad patient series and we see the rate of grade IV MV is very low.

In our study, impossible mask ventilation (Grade IV) was occurred in patients with Neck cercumfrence>40 cm, history of snoring, BMI >26 kg/m^2, TMD<6 cm, SMD<12 cm. We found IID<3 cm, old age>55 years, Kyphoscoliosis, limited neck mobility and lost dentition have no relation with IMV.

Regarding predictive values of anatomical parameters, our study showed that poor sensitivities and positive predictive values but good specificity and negative predictive values for DMV. In this study MMC III & IV, MP class B and C followed by OSA, BMI>26 kg/m^2, NC>40 cm showed higher accuracy, positive predictive value and sensitivity for difficult mask ventilation grade (III). Anatomical parameters (IID<3 cm, TMD<6 cm, SMD<12 cm, lost dentition, limited neck mobility and old age>55years) showed 0 sensitivity and PPV for DMV (grade III).

CONCLUSION:

Modified Mallampatti class III &IV and Mandibular protrusion class B and C are highly accurate parameters with high specificity, negative predictive value, and positive predictive value to predicted difficult mask ventilation (grade III). Anatomical parameters (IID<4 cm, TMD<6 cm, SMD<12 cm, lost dentition, limited neck mobility and old age>55years) are not related with DMV (grade III).

REFERENCES:

1. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, et al. (2013) Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 118: 251-270.
2. Asai T, Koga k, Vaughan RS (1998) Respiratory complications associated with tracheal intubation and extubation. Br J Anaesth 80: 767-775.
3. Benumof JL (1991) Management of the difficult adult airway. Anesthesiology 75: 1087-110.
4. Kheterpal S, Martin L, Shanks AM, Tremper KK (2009) Prediction and outcomes of impossible mask ventilation: a review of 50,000 anaesthetics. Anesthesiology 110: 891-897.
5. Soleimanpour H, Sarahrudi K, Hadju S, Samad EJ Golzari (2012) How to overcome difficult-bag-mask-ventilation: Recents approaches. Emerg Med 2: e116.
6. Prakash S, Kumar A, Bhandari S, Mullick P, Singh R, et al. (2013) Difficult laryngoscopy and intubation in the Indian population: An

assessment of anatomical and clinical risk factors. Indian J Anaesth 57: 569-575.

7. Peterson GN, Domino KB, Caplan RA, Posner KL, Lee LA (2005) Management of the difficult airway: a closed claims analysis. Anesthesiology 103: 33-39.
8. Rose DK, Cohen MM (1994) The airway: problems and predictions in 18,500 patients. Can J Anaesth 41: 372-383.
9. Rudra A (2005) Airway management in obstetrics Indian J Anaesth 49: 328-335.
10. Shah P, Sundaram V (2012) Incidence and predictors of difficult mask ventilation and intubation. J Anaesthesiol Clin Pharmacol 28: 451-455.
11. Soleimanpour H, Sarahrudi K, Hadju S, Samad EJ Golzari (2012) How to overcome difficult-bag-mask-ventilation: Recents approaches. Emerg Med 2: e116.
12. Sunanda G, Rajesh Sh, Dimpel J, Airway Assessment: Predictors of Difficult Airway. Indian J Anesth 49: 257-262.
13. Yildiz T, Solak M, Toker K (2005) The incidence and risk factors of difficult mask ventilation. J Anaesth 19: 7-11.
14. Yuan W, Barber Foss KD, Thomas S, DiCesare CA, Dudley JA, et al. (2017) White matter alterations over the course of two consecutive high-school football seasons and the effect of a jugular compression collar: A preliminary longitudinal diffusion tensor imaging study. Hum Brain Mapp 39: 491-508.