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RESEARCH ARTICLE

"DIFFICULT MASK VENTILATION IN OBESE PATIENTS: ANALYSIS OF PREDICTIVE FACTOR

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Abstract

American Society of Anesthesiologists (ASA), DMV is defined as the clinical situation. developing when it not possible for the anesthesiologist to provide adequate ventilation because of one or more of the following problems: inadequate mask seal, excessive gas lead or excessive resistance to the ingress or egress of gas.

Materials and Methods:-This is a prospective randomised observational study in patients with morbid obesity (n = 90;body mass index[BMI] >30 kg/m2. Patients were preoperatively assessed for age, height, weight, BMI,modified Mallampati test results,mouth opening [inter- incisor gap (cm)], thyromental distance (cm), sternomental distance (cm), mandibular protrusion,mandibular length (ML), neck circumference (NC) by anesthesiologist. Mask ventilation was graded according to four point Han scale.

Conclusion: In conclusion, male sex, snoring history, NC ≥43 cm, ML ≥9 cm and NC/TMD <5 cm were correlated with DMV in obese patients.According to the current investigation the three predictive factors are strongly associated.In the present study we demonstrated that (a)age >49 years, (B)Neck circumference >43cm,and (C) and short neck are strongly associated with DMV in obese patients.

Introduction:-

The degree of difficulty encountered is variable [1-4], with the incidence of Difficult Mask Ventilation (DMV) varying from 0.08–15% depending on the criteria used for the definition.

According to the American Society of Anesthesiologists (ASA), DMV is defined as a situation where it is not possible for the unassisted anesthesiologist to maintain the oxygen saturation > 90% using 100% oxygen and positive pressure ventilation, or to prevent or reverse signs of inadequate ventilation, because of one or more of the following problems: inadequate mask seal, excessive gas lead or excessive resistance to the ingress or egress of gas [5].

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Subsequently, any other definitions have evolved taking into account patient- independent factors that contribute to DMV, such as provider--and equipment- related factors [5].

Moreover, as an effort to overcome subjective definitions, several grading scales have been proposed, including Adnet's and Han's scales [1,6].

In the face of DMV, critical hypoxemia may rapidly ensue and emphasizes the need for proper identification of risk factors during the preoperative assessment.

Obesity reduces functional residual capacity, causing low oxygen reserves, disrupted gas exchange and shortened safe apnea time before desaturation. As a result, it is known that there is a limited duration to solve airway problems in "can't intubate, can't ventilate" situations (7).

Materials and Methods:-

Source of data

The present study will be conducted in department of anaesthesiology at Basaveshwara teaching and general hospital attached to Mahadevappa Rampure Medical College, Kalaburagi.

Inclusion criteria

1.Patients with BMI ≥ 35 kg/m2
2. Age 20–80 years,
3. American Society of Anaesthesiologists physical status classification of I–II

Exclusion Criteria

1. Patients with a history of difficult intubation, cervical spine defect
2. Patients with a history of previous head and neck surgery, or risk of pulmonary aspiration
3. American Society of Anaesthesiologists physical status classification of III–IV

This prospective and observational study included 90 obese ASA 1-3 patients aged 18-65 years with a body mass index (BMI) ≥30 who underwent elective surgery under general anesthesia.

The patients were preoperatively assessed for age, height, weight, BMI, dental structure, presence of beard, modified Mallampati test results, mouth opening [inter- incisor gap (cm)], thyromental distance (cm), sternomental distance (cm), mandibular protrusion, mandibular length (ML), neck circumference (NC), neck length, upper lip bite test, height to thyromental distance ratio (RHTMD), NC to TMD (NC/TMD), history of snoring, and Obstructive Sleep Apnea syndrome (OSAS) by an anesthesiologist blind to the study.

All patients received preoxygenation with 100% O2 for 5 minutes using appropriate masks. Anesthesia was induced with 2 mg/kg propofol and 1 μg/kg fentanyl according to total body weight, and rocuronium 0.6 mg/ kg according to ideal body weight.

During attempts at mask ventilation, all obese patients were placed in the head elevated laryngoscopy position and the operating room table was titled in the reverse Trendelenburg position. Vital signs were monitored accord- ing to ASA standard general anesthesia monitoring.

Mask ventilation was graded according to a four point scale described by Han et al. (8) (Table 1)

Table 1. Mask ventilation scale(12)

Grade	Grade description
1	Ventilated by mask
2	Ventilated by mask with oral airway/other adjuvant with or without muscle relaxant
3	Difficult mask ventilation (inadequate to maintain oxygenation, unstable or requiring two practitioners with or without muscle relaxant)
4	Unable to mask ventilate with or without muscle relaxant

Statistical analysis

Statistical Package for the Social Sciences (SPSS) v.19.0 (IBM Corp. in Armonk, NY) was used for statistical analysis. Descriptive statistics are given with frequency and percentage for categorical variables and mean, standard deviation, median and minimum-maximum values for continuous variables.

The Shapiro-Wilk test was used to evaluate the normality of the variables. The independent samples t-test and the Mann-Whitney U test were used for normally distributed and non-normally distributed variables, respectively. Yates' correction and Fisher's exact tests were used to test relationship between categorical variables.

All variables with a p value below 0.05 in univariate analysis were entered into a multivariate logistic regression model. For all statistical comparisons, a p value of less than 0.05 was considered statistically significant.

Results:-

A total of 90 patients (58 female and 32 male) with a mean age of 40.9±9.4 years and a BMI of 44.7±6.2 kg/m2 were included in the study. Of all the patients 38.9% were determined to have DMV. Surgeries were, in order, bariatric surgery (76.7%), lumbar disc hernia (6.7%), shoulder surgery (3.3%), percutaneous nephrolithotomy (3.3%), abdominal surgery (2.2%), and thyroidectomy (7.8%). The other patient characteristics are shown in (Table 2).In univariate analysis, risk factors for DMV were identified. There was a significant difference in the presence of history of snoring and OSAS, NC ≥43 cm, male gender,ML ≥9 cm and NC/TMD <5 cm were significantly different between patients with and without DMV (Table 3).

Age(year)±SD	41±9
F/M(%)	58/32 (64.4/35.6%)
Height(cm)±SD	163±9
Weight(kg)±SD	118±19
BMI(kg/m2)±SD	43.6±6.2
Mallampati:1/2/3(%)	10/58/22 (11.1/64.4/24.4%)
ASA:1/2/3(%)	4/66/20 (4.4/73.3/22.2%)
Beard(%)	17 (18.9%)
Historyofsnoring(%)	74 (82.2%)

OSASdiagnosis(%)	8 (8.9%)
Sternomentaldistance≥12.5cm (%)	81(90%)
TMD≥6cm(%)	88 (97.8%)
ML ≥9cm(%)	86 (95.6%)
Masknumbers:3/4/5(%)	5/46/39 (5.6/51.1/43.3%)
Upperlipbitetestgrade:1/2/3 (%)	59/31/0 (65.6/34.4/0%)
Neckcircumference±SD	44±4.4
NC/TMD±SD	4.8±1.09
RHTMD±SD	18.4±3.63
F/M: Female/male, BMI: Body mass index, ASA: American Society of Anesthesiologists, OSAS: Obstructive Sleep Apnea syndrome, TMD: Thyromental distance, ML: Mandible length, NC/TMD: Neck circumference/thyr omentaldistance, RHTMD: Height/thyromental distance ratio, SD: Standard deviation	

Table 2:- Patient demographics and preoperative variables

To estimate easy and DMV, the variables of history of snoring, sex and NC/TMD were taken into the model. Since only four patients had a ML below 9 cm, ML was removed from the model. The remaining three variables explained 35.7% of the variation in easy/DMV, with snoring and sex observed to be significant (p=0.020 and 0.011) for differentiation of easy/DMV. Snoring was assessed to increase the risk of DMV by 14.097 times while being a male increased the risk by 3.73 times (Table 4).

Table 3:- Univariate analysis of the variables associated difficult mask ventilation status (p<0.05).

Variables	Easy DMV; %	Dif cult DMV; %	p
F/M	46.7% 14.4%	17.8% 21.1%	p=0.006
Historyofsnoring NoYes	15 (27.3%) 40 (72.7%)	1 (2.9%) 34 (97.1%)	p=0.008
HistoryofOSAS NoYes	53 (65.4%) 2 (22.2%)	28 (34.6%) 7 (77.8%)	p=0.025
NC <43 cm ≥43 cm	46.7% 14.4%	17.8% 21.1%	p=0.013
NC/TMD <5 cm≥5 cm	43 (78.2%) 12 (21.8%)	19 (54.3%) 16 (45.7%)	p=0.021
ML <9 cm ≥9 cm	055 (61.1%)	4 (4.4%) 31 (34.4%)	p=0.02
DMV: Difficult mask ventilation, F/M: Female/male, OSAS: Obstructive Sleep Apnea syndrome, NC: Neck circu mference, NC/TMD: Neck circumference/ thyromental distance, ML: Mandible length			

Discussion:-

Difficulties in securing mask ventilation and airway in obese patients are common (9).

Difficult airway is defined as a situation where a conventionally-trained anesthesiologist encounters difficulty with face mask ventilation, intubation or both.

Table 4:- Independent predictors of difficult mask ventilation according to multivariate logistic regression model.

	B	SE	Wald	df	p	Exp (B)	95% CI of Exp (B)	
							Lower	Upper
Fixed	17.096	18808.6	0.000	1	0.999	-	-	-
Male sex	-1.317	0.516	6.520	1	0.011	0.268	0.097	0.736
Snoring	2.646	1.137	5.415	1	0.020	14.097	1.518	130.906
NC/TMD	0.398	0.246	2.625	1	0.105	1.489	0.920	2.409
NC/TMD: Neck circumference/thyromental distance, CI: Confidence interval, SE=stantard error								

The most dangerous situation in airway management is the situation where tracheal intubation is difficult or impossible and ventilation with a mask is insufficient or cannot be completed (patients who can't be intubated or ventilated).

The prediction of DMV is therefore of vital importance (11). The incidence of DMV in the general population and obese patient population has been reported to be 1.4-24% and 8.8-14%, respectively (9,10,15-18). In our study, the incidence of DMV was found to be 38.9%. Contrary to other studies, the male percentage in our study was higher which we believe may have caused the difference.

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Kheterpal et al. (12) indicated BMI of 30 kg/m2 or greater as the most important factor for grade 3 DMV.

Obesity is believed to predispose individuals to OSAS because of mass loading of the upper airway by adipose tissue in the neck (13). Approximately 5% of morbidly obese patients have OSAS (14).

Conclusion:-

In conclusion, male sex, snoring history, NC ≥43 cm, ML ≥9 cm and NC/TMD <5 cm were correlated with DMV in obese patients.

The sample size is small to conclusively state the results of our study if we compare with similar studies in adults. Further studies with larger sample size are needed for investigation of new indices, such as ML, NC/TMD in the obese population.

In case of difficulties in predicting DMV and placement of any airway apparatus, we suggest that airway equipment such as face mask, oral/nasal airway, laryngeal mask should be prepared or different airway methods should be planned.

References:-

1. Han R, Tremper KK, Kheterpal S, et al. Grading scale for mask ventilation. Anesthesiology. 2004;101(1):267.
2. Kheterpal S, Martin L, Shanks AM, Tremper KK. Prediction and outcomes of impossible mask ventilation: a review of 50,000 anesthetics. The Journal of the American Society of Anesthesiologists. 2009 Apr 1;110(4):891-7
3. Benumof JL: Management of the difficult adult airway. With special emphasis on awake tracheal intubation. Anesthesiology. 1991;75(6):1087–110.
4.Cattano D, Killoran PV, Cai C, et al. Difficult mask ventilation in general surgical population: observation of risk factors and predictors. F1000 Research. 2014;3:204
5. Practice guidelines for management of the difficult airway. A report by the American Society of Anesthesiologists Task Force on Management of the
difficult Airway Anesthesiology.Talware et al. International Journal of Pharmaceutical and Clinical Research194
6. Adnet F: Difficult mask ventilation: an underestimated aspect of the problem of the difficult airway? Anesthesiology. 2000;92(5):1217–8.
7. Juvin P, Lavaut E, Dupont H, et al. Difficult tracheal intubation is more common in obese than in lean patients. Anesth Analg 2003;97:595-600.
8. Han R, Tremper KK, Kheterpal S, et al. Grading scale for mask ventilation. Anesthesiology 2004;101:267.
9.Noble DW, Mccallum F. Anaesthesia for the obese patient. Anaesthesia & Intensive Care Medicine 2004;5:92-95.
10.Apfelbaum JL, Hagberg CA, Caplan RA, et al; American Society of Anesthesiologists Task Force on Management of the Difficult Airway. 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 2013;118:251-70.
obese patient. Anaesthesia & Intensive Care Medicine 2008;9:299-302.
12.Kheterpal S, Han R, Tremper KK, et al. Incidence and predictors of difficult and impossible mask ventilation. Anesthesiology 2006;105:885-91.
13.Shelton KE, Woodson H, Gay S, et al. Pharyngeal fat in obstructive sleep apnea. Am Rev Respir Dis 1993;148:462-6.
14.Adams JP, Murphy PG. Obesity in anaesthesia and intensive care. Br J Anaesth 2000;85:91-108.
15.Williamson JA, Webb RK, Szekely S, et al. Difficult intubation: an analysis of 2000 incident reports. Anaesth Intens Care 1993;21:602-7.
16.Leoni A, Arlati S, Ghisi D, et al. Difficult mask ventilation in obese patients: analysis of predictive factors. Minerva Anestesiol 2014;80:149-57.
17.Cattano D, Katsiampoura A, Corso RM, Killoran PV, Cai C, Hagberg CA. Predictive factors for difficult mask ventilation in the obese surgical population. F1000Res 2014;3:239.