



## Preoperative Airway Assessment for Anticipation of Difficult Bag and Mask Ventilation Using Standard Clinical Parameters and Ultrasound Parameters in Patients Having BMI >23KG/M2

Authors

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### Introduction

Successful airway management requires a range of knowledge and skills to predict difficulty and to formulate an airway management plan as well as to have the skills necessary to execute the plan using the wide array of airway devices available. Effective bag and mask ventilation is most important step in securing the air way. Various studies had shown that the incidence of difficult bag and mask ventilation in overweight patients is approximately 6% whereas in lean patients is approximately 1%.<sup>1</sup>

Clinical criteria's routinely used to assess patients prior to anesthesia have variations according to patient's height, weight and ethnicity.

Ultrasonography (USG) is well-known as a fast, safe and noninvasive technique. There were very limited studies which showed value of USG derived parameters in assessing airway for anticipation of difficult BMV in obese patients and its co-relation with proven clinical parameters. The clinical parameters i.e. MPS, TMD (thyromental distance), NC (neck circumference) were included in the present study. The USG derived parameters, preepiglottic space

depth (PES), epiglottis to vocal cord distance (EVC), skin to dorsum of tongue distance (S-DT) are the USG parameters taken and clinically assessed parameters and USG parameters were co-related with each other taking BMV grading as reference.

### Material and Methods

Prospective and observational study was carried out on 100 patients in the age group of 18-60 years of either gender after getting approval for institutional ethical committee coming for surgery and having BMI >23kg/m<sup>2</sup> (overweight and obese according to WHO BMI guidelines for Asian population) in the Department of Anesthesiology with sample size of 100.

### Exclusion Criteria

Patient's refusal to participate in the study, Rapid sequence induction of anesthesia.

Inability to open the mouth due to existing trauma or medical condition, Preexisting neck or facial disease,

Preexisting limitation or pain with cervical spine movement.

Clinical parameters (NC, TMD, MPS) were measured and USG parameters (PES, EVC, S-DT) were measured using a SonoSite® MicroMaxx® using linear and curvilinear probe.

All the patients were induced and bag and mask ventilation was done by a senior anaesthesiologist with more than 5 years of experience. BMV grade was noted. BMV was classified as easy (Grade 1 and 2) or difficult (Grade 3 and 4). Microsoft Excel spreadsheet, cleaned it for errors and analyzed the data using Stata IC software version 15. Quantitative data is presented as mean  $\pm$  SD. For comparison of means between two groups

Independent t-test or Wilcoxon rank sum was used. For categorical variables, number & percentages and their 95% Confidence interval is calculated. Chi-square test was applied to see association between different categorical variables. To calculate optimal cut-off values of different variables ROC curve was used. Area under curve was used to compare diagnostic accuracy of different variables. For all variables sensitivity, specificity, Positive and negative predictive values were calculated at cutoff value as per ROC Curve. A two sided *P* value of  $<0.05$  was considered as statistical significant.

## Result

Among 100 patients 83% were of BMV grade 1, 2 and 17% were of BMV grade 3,4.

### Mean Values of Parameters w.r.t BMV Grade

PARAMETER	EASY(G1+G2)	DIFFICULT(G3+G4)	p VALUE
NC (mean $\pm$ SD)	35.8 $\pm$ 2.3	38.8 $\pm$ 2.3	<0.001
TMD (mean $\pm$ SD)	6.5 $\pm$ 0.7	5.8 $\pm$ 0.5	<0.001
PES (mean $\pm$ SD)	1.0 $\pm$ 0.3	1.3 $\pm$ 0.4	<0.001
EVC (mean $\pm$ SD)	1.9 $\pm$ 0.5	1.9 $\pm$ 0.5	0.943
S-DT (mean $\pm$ SD)	5.5 $\pm$ 0.6	6.3 $\pm$ 0.5	0.001

### Diagnostic Accuracy with BMV Grade

	CLINICAL PARAMETERS			USG PARAMETERS		
	NC	TMD	MPS	P-ES	E-VC	S-DT
SENSITIVITY	100	94.1	29.4	94.1	52.9	94.1
SPECIFICITY	54.2	62.7	72.3	56.6	51.8	61.4
PPV	30.9	34.0	17.9	30.8	18.4	33.3
NPV	100.0	98.1	83.3	97.9	84.3	98.1
Area under curve (Total)	0.83	0.75	0.51	0.81	0.51	0.85
CUTOFF of ROC curve	$\geq 36.0$	$\leq 6.2$	$\geq 2.0$	$\geq 1.0$	$\geq 2.0$	$\geq 5.8$

## Discussion

There is a need of non-invasive methods which can predict BMV grade preoperatively with a higher predictive value. The advent of ultrasonography has brought a paradigm shift in the practice of airway management.

Bag and mask ventilation: Among all the patients, patients with easy BMV i.e. grade 1 or 2 were 83% and with difficult BMV i.e. GRADE 3 or 4 were 17%. Mean age and BMI for easy BMV grade (G1+G2) was 45.3  $\pm$  13.2yr and 25.8  $\pm$  1.5kg/m<sup>2</sup> and for difficult BMV grade (G3+G4) was 47.5  $\pm$  12.0yr and 27.7  $\pm$  3.8kg/m<sup>2</sup> respectively.

We concluded from our study that Neck circumference (NC) is the best parameter among the clinical parameters with highest diagnostic accuracy i.e. 0.83, skin to dorsum of tongue distance (S-DT) is the best parameter among USG parameters with diagnostic accuracy i.e. 0.85 for anticipating difficult BMV.

Lee and co-workers<sup>2</sup> did a study on 110 consecutive adult patients (66 men and 44 women). The age of the patients ranged from 21 to 96 years and incidence of difficult BMV was encountered in 51 patients (45.9%). Mean of TMD for difficult BMV was found 6.6 $\pm$ 1.2cm thus coinciding with our findings. Slight

difference value of TMD in predicting difficult BMV may be due to difference in criteria for estimating difficult BMV.

Kheterpal and co-workers<sup>3</sup> in 2006 defined difficult BMV as inadequate BMV or BMV requiring 2 operators. Total 53,041 patients for operations included an attempt at mask ventilation. Of these, 77 patients (0.15%) experienced the primary outcome of impossible mask ventilation, resulting in an incidence of approximately 1 in 690. 5 independent predictors of impossible mask ventilation predicted by their study was neck radiation changes, male sex, sleep apnea, Mallampati III or IV, and presence of beard.

Leoni and co-workers<sup>4</sup> studied 309 obese patients (BMI >30 kg/m<sup>2</sup>) undergoing general surgery. The modified Mallampati test, patient's Height/Thyromental distance ratio, Inter-incisor Distance, Protruding Mandible (PM), history of Obstructive Sleep Apnea and Neck Circumference (NC) were recorded preoperatively. Difficult BMV was defined as Grade 3 mask ventilation (BMV) by the Han's scale (BMV inadequate, unstable or requiring two practitioners). The multivariate analysis retained NC, limited PM and Mallampati test as risk predictors for difficult BMV. The model yielded a good discriminating capacity. MPS was one of the important predictor of difficult BMV whereas present study found less significance of MPS grading.

### Summary & Conclusion

Thus we summarise from our study that USG is a useful aid in airway assessment for predicting difficult BMV in perioperative settings.

Thus USG being noninvasive and easily available equipment we recommend its further use for anticipation of difficult BMV, though more studies are needed to clearly define its role and protocols for the same. In the present scenario it is at best suggested that USG is an additive aid to clinical tests for predicting difficult BMV of patients.

### References

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