POST EXTUBATION ASSESSMENT OF VOCAL CORD STATUS FOLLOWING THYROID SURGERY USING DIRECT LARYNGOSCOPY & VIDEO LARYNGOSCOPY

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Abstract

Amis and objectives: The study was to find out the post-extubation assessment of status of vocal cord following thyroid surgery using Direct Laryngoscopy and Video Laryngoscopy.

Material and methods: The Prospective, Interventional, Comparative, Randomized study was conducted in the Department of Anaesthesiology and Intensive care, Vardhaman Mahavir medical college and safdarjung Hospital, New Delhi. In the study, GROUP M: - Endotracheal extubation using Macintosh laryngoscopy (n=45) and GROUP V: - Endotracheal extubation using videolaryngoscopy (n=45)

Results: All the patients recruited in the present study 69% had benign lesions of the thyroid. Of the malignant lesions the commonest was papillary carcinoma thyroid (17%) followed by medullary carcinoma thyroid (10%). Patients in the direct laryngoscopy had higher proportion of patients with a patient discomfort score of 3 (97.8%) compared to video laryngoscopy group, where the proportion of patients with patient discomfort scores of 2 were maximum (88.9%). These differences were statistically significant

Conclusion: Therefore, it can be surmised from the study that in terms of hemodynamic parameters as well as outcome parameters, namely CL scores for glottic visualisation and Patient reactivity scores, C-MAC videolaryngoscopy utilised in the study performs better as the procedure of choice in assessment of patients post thyroid surgery as compared to its direct laryngoscopy counterpart.

Keywords: C-MAC videolaryngoscopy, thyroid surgery, vocal cord

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1. Introduction

Thyroid disease has high prevalance in the general population with female predominance. The anatomical structure for voice production lies in proximity to the thyroid gland and are vulnerable during operation on the thyroid gland. The recurrent laryngeal nerve must be identified and dissected completely in the thyroid region during surgery. Damage to the external branch of superior laryngeal nerve and the recurrent laryngeal nerve (RLN) is an important complication of thyroid surgery.[1,2] External Branch of Superior Laryngeal Nerve innervates the cricothyroid muscle and is primarily responsible for the pitch elevation, while RLN is responsible for vocal cord mobility. Laryngoscopic assessment of vocal cord mobility is required to rule out damage to RLN.[3]

The assessment of vocal cord mobility at the end of surgery becomes difficult as laryngoscopy needs to be performed after reversal of neuromuscular blockade and relatively awake patient. Therefore, it leads to discomfort for the patient and involves lot of haemodynamic changes. Also, there are chances of laryngospasm due to lighter plane of anaesthesia. Increasing the depth of anaesthesia especially in patient with diificult airway involves the risk of losing patients airway. Because of these problems, studies on postoperative fibre optic assessment of vocal cord by Flexible Fibreoptic Bronchoscope (FFB) with or without Bailey's technique have also been done and have been found to be useful. But the availability of FFB is a limiting factor at some places. With the advent of videolaryngoscope, which provides a bigger and better angle of view without much lifting of the epiglottis, the technique of laryngoscopy and intubation has revolutionised. Besides the view can also be seen even by the surgeons.

There are several possible reasons for the improved view with video monitor. The positioning of image fibre bundle tip close to the blade tip changes the view point from, straight line of sight, as required for conventional laryngoscopy. Also, because the view point is closer to the glottis, a wider view is transmitted to the monitor.[4]

Considering the advantages of videolaryngoscope over direct laryngoscope this study has been planned to compare of direct laryngoscope and videolaryngoscope for vocal cord assessment following thyroid surgery.

2. Material and methods:

The Prospective, Interventional, Comparative, Randomized study was conducted in the Department of Anaesthesiology and Intensive care, Vardhaman Mahavir Medical College and Safdarjung Hospital, New Delhi, after obtaining clearance from the Hospital Ethics Committee, written informed consent was obtained from patients.
GROUP M: - Endotracheal extubation using Macintosh laryngoscopy (n=45)
GROUP V: - Endotracheal extubation using videolaryngoscopy (n=45)

Inclusion criteria:

- Patients aged between 18 to 65 years
- ASA grade 1 and 2

Exclusion criteria:

- Difficult airway
- Patients on anticoagulant therapy
- Unstable haemodynamic responses
- Upper respiratory tract infection
- Cervical spine instability
- Modified C-L grading 4 during intubation

SAMPLE SIZE

The study of Lee et al observed that in Macintosh DL, 84% had Cormack–Lehane grade I+II, and in McGrath 100% had Cormack–Lehane grade I+II. Taking these values as reference, the minimum required sample size with 80% power of study and 5% level of significance is 42 patients in each study group.

Formula used is:-

$N =((pc*(1-pc)+pe*(1-pe))*(Z_\alpha + Z_\beta)^2)/(pc-pe)^2$

Withpc= Cormack–Lehane grade I+II in Macintosh

pe= Cormack–Lehane grade I+II in McGrath

Where Z_α is value of Z at two sided alpha error of 5% and Z_β is value of Z at power of 80% .**Calculations: -**

$N = ((.84*(1-.84) +1 *(1-1)) *(1.96+.84)^2)/ (1-.84)^2$

=41.16=42(approx.)

After rounding off, total sample size taken was calculated as 45 patients per group.

Methodology

Patient selection

After written and informed consent,90 patients (45 in each) of age 18 to 65 years of either sex and of ASA grades 1 and 2 with no obvious airway difficulty and BMI, schedule for various surgical procedure under general anaesthesia requiring tracheal intubation were taken up for study. They were divided in to two groups by Block randomization technique.

Anaesthesia technique

Patients were taken to the operation theatre, and standard monitors for non-invasive blood pressure, electrocardiography and pulse oximetry (SpO_2) were attached. Base line heart rate, B.P. and SpO_2 noted before induction of anaesthesia and an IV line with 18G cannula was secured.

Induction and maintenance-

Patients were premedicated with fentanyl 1-2 µ/kg body weight intravenously 2 minute before induction of anaesthesia, induced with propofol 2 - 2.5mg/kg body weight intravenously. After checking for adequate ventilation, vecuronium bromide 0.1mg/kg body weight given intravenously to achieve neuromuscular blockade. Face mask ventilation done with 50% oxygen and 50% N2O and isoflurane (0.6% - 0.8%). After 3 minutes, laryngoscopy performed using MacIntosh blade and modified C-L grade noted. If the C-L grading is >4 patient was excluded from the study. Endotrachealtube of appropriate size was inserted and fixed after checking bilateral air entry. Anaesthesia maintained with (N_2O 67%, O_2 33%) with 1 mac concentration of isoflurane (0.6-0.8%) and tidal volume of 10m/kg body weight ,respiratory rate 12-14/min using closed circle breathing system with sodalime, maintaining etco2 of 30-35mmHg and I:E ratio of 1:2 were maintained.

At the end of surgery isoflurane was switched off and patient reversed with intravenous neostigmine 0.05mg/kg and glycopyrrolate 0.01mg/kg.

Modified Cormack-Lehane grading scale.

- Grade I- Full view of vocal cords
- Grade IIa- Partial view of vocal cords
- Grade IIb- only arytenoids and epiglottis seen
- Grade III- Only epiglottis seen, none of glottis seen
- Grade IV- Neither glottis nor epiglottis seen.
- Patient's discomfort was rated on a 5 point patient reactivity score

SCORE	RAECTIVITY
1	No grimace
2	Grimacing facial expression
3	Discomforting head movement
4	Protective head and limb movement
5	Coughing and gagging

Laryngoscopy Technique

Direct Macintosh laryngoscopy: -

Once the patient was awake after surgery, the trachea was extubated under direct visualisation using Macintosh curve blade. The device was inserted from the right side of the mouth, Care was taken not to trap the lip between the laryngoscope blade and the teeth. The epiglottis was the first anatomical landmark to be visualized and the laryngoscope blade was then advanced into the vallecula, elevating the epiglottis by indirectly applying force on the handle of laryngoscope in an upward and outward direction. Vocal cord movement was assessed, CL grading, Patient discomfort score by patient reactivity were noted. Hemodynamic parameters (HR, SBP, DBP, MAP, SPO2) were also recorded at time 0 to 5minutes at interval of 1 minute.

- Videolaryngoscopy

  Patients head was placed in neutral position then videolaryngoscopy was inserted using midline insertion technique. In this technique, after opening the patient's mouth, Videolaryngoscope blade of appropriate size was introduced into the middle of the oral cavity without displacing the tongue. Further advancement of the blade over the tongue was done till it reached the vallecula by viewing this on the monitor. The tip of the blade was manipulated to get a good CL grade on the monitor. Vocal cord movement, CL grading, Patient discomfort score by patient reactivity were noted. Hemodynamic parameters (HR, SBP, DBP, MAP, SPO2) were also recorded at time 0 to 5minutes at interval of 1 minute

STATISTICAL ANALYSIS

Categorical variables were presented in number and percentage (%) and continuous variables was presented as mean ± SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality is rejected then non parametric test was used. Quantitative variables were compared using unpaired t-test/Mann-Whitney Test (when the data sets were not normally distributed.) between the two groups. Qualitative variable was compared using Chi-Square test /Fisher's exact test. The p value of <0.05 was considered statistically significant. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

Observation and results:

There is no statistically significant difference between the patients recruited in either the direct or video laryngoscopic groups in terms of their age, gender, BMI and ASA grade.

Table 1: Distribution of the study population according to their indication for thyroid surgery

Diagnoses of the patient	Group		Total	p value
	Video laryngoscopy (V)	**Direct laryngoscopy (M)**		
Benign lesions	36 (80.0%)	26 (57.8%)	62 (68.9%)	0.023
Malignant lesions	9 (20.0%)	19 (42.2%)	28 (31.1%)	
Total	**45 (100%)**	**45 (100%)**	**90 (100%)**	

All the patients recruited in the present study 69% had benign lesions of the thyroid. Of the malignant lesions the commonest was papillary carcinoma thyroid (17%) followed by medullary carcinoma thyroid (10%).

Table 2: Comparison of the Cormack–Lehane (CL) Grade of patients in the direct and video laryngoscopy groups

Cormack–Lehane (CL) Grade	Group		Total	p value
	Video laryngoscopy (V)	**Direct laryngoscopy (M)**		
1	42(93.3%)	29(64.4%)	71 (78.9%)	0.006
2a	3 (6.7%)	9 (20.0%)	12 (13.3%)	
2b	0 (0.0%)	5 (11.1%)	5 (5.6%)	
3	0 (0.0%)	2 (4.4%)	2 (2.2%)	
Total	45 (100%)	45 (100%)	90 (100%)	

Comparison of CL grade shows that none of the patients in the video laryngoscopic group had CL scores of 2b and above. The maximum proportion of patients in the both the group were CL grade 1. However, in the direct laryngoscopy group, 5 patients were in the CL grade 2b and 2 patients were in grade 3. The difference between the distribution of patients based on the CL grade was statistically significant.

Table 3: Comparison of the Vocal Cord Function Assessment Score of patients in the two groups

Vocal Cord Function Assessment Score	**Group**		**Total**	**p value**
	Video laryngoscopy (V)	**Direct laryngoscopy (M)**		
1	45(100%)	43(95.5%)	88 (97.7%)	0.694
2	0(0%)	2(4.5%)	2 (2.2%)	
Total	45 (100%)	45 (100%)	90 (100%)	

The table shows that, there is no statistically significant difference of vocal cord function assessment score between the two groups. However Vocal cord movement could not be assessed in two patients in M group because of CL grade 3.

Table 4: Comparison of the patient reactivity scores of patients in the direct and video laryngoscopy groups

	Group		Total	p value
	Video laryngoscopy (V)	Direct laryngoscopy (M)		
1	5 (11.1%)	1 (2.2%)	6 (6.7%)	0.000
2	40 (88.9%)	0 (0.0%)	40 (44.4%)	
3	0 (0.0%)	44 (97.8%)	44 (48.9%)	
Total	**45 (100%)**	**45 (100%)**	**90 (100%)**	

The above table shows the comparison of patient discomfort by patient reactivity scores. It reveals that patients in the direct laryngoscopy had higher proportion of patients with a patient discomfort score of 3 (97.8%) compared to video laryngoscopy group, where the proportion of patients with patient discomfort scores of 2 were maximum (88.9%). These differences were statistically significant.

Table 5: Comparison of Heart rate post extubation 0, 1, 2, 3, 4,5 minutes in the two groups

	Group		p value
	Video laryngoscopy (V)	Direct laryngoscopy (M)	
Pre op	84.16 ± 8.35	78.44 ± 9.92	0.054
T0	90.11 ± 1.23	85.76 ± 4.59	0.000
T1	94.67 ± 1.21	121.42 ± 6.80	0.000
T2	89.62 ± 0.83	116.69 ± 5.43	0.000
T3	88.60 ± 0.78	109.44 ± 4.68	0.000
T4	88.07 ± 0.69	106.69 ± 6.80	0.000
T5	87.49 ± 0.63	99.73 ± 3.47	0.000

The above table and figure compare heart rate between direct and video layngoscopic groups over time. Mean preop HR and at t0 were significantly higher in V group but the rise in HR was significantly higher in M group at various time intervals from T1-T5. While in V group the HR started more or less stable. The difference in HR at various time interval between two groups was stastically significant.

Table 6: Comparison of systolic blood pressures post extubation 0, 1, 2, 3, 4, 5 minutes

	Group		p value
	Video laryngoscopy(V)	**Direct laryngoscopy(M)**	
Pre op	127.53 ± 12.54	127.24 ± 13.10	0.92
T0	122.42 ± 3.53	121.60 ± 5.21	0.38
T1	119.60 ± 3.76	132.62 ± 5.16	0.00
T2	121.80 ± 3.31	132.58 ± 6.69	0.00
T3	123.18 ± 3.83	133.89 ± 6.81	0.00

T4	123.78 ± 4.33	129.42 ± 8.09	0.00
T5	123.82 ± 4.27	134.58 ± 9.31	0.00

The above table and figure show the comparison between the mean systolic blood pressure between direct and video layngoscopic groups over various time interval. The two groups showed no statistically significant differences in the mean systolic blood pressures at pre and time 0. SBP values over the next 5 minutes were statistically significantly at different time interval in M group as compare to V groups.

Table 7: Comparison of diastolic blood pressures post extubation 0, 1, 2, 3, 4, 5 minutes

	Group		p value
	Video laryngoscopy (V)	**Direct laryngoscopy (M)**	
Pre op	77.16 ± 9.12	77.04 ± 9.89	0.96
T0	76.36 ± 3.27	73.84 ± 3.70	0.00
T1	73.69 ± 3.27	79.18 ± 2.59	0.00
T2	76.29 ± 3.39	81.33 ± 3.77	0.00
T3	76.73 ± 3.20	83.49 ± 3.18	0.00
T4	77.47 ± 3.85	87.78 ± 3.64	0.00
T5	77.89 ± 4.01	87.18 ± 3.97	0.00

The above table and figure compare the mean diastolic blood pressure between direct and video layngoscopic groups over time. Preoperative DBP were comparable between the two groups, Mean DBP was significantly over at T0 in M groups but it increased significantly over next 5 minutes and was statistically significantly higher than in V groups.

Comparison of the mean arterial blood pressure between direct and video layngoscopic groups over time. There was a significant rise in MAP in the M group over next 5 minuts and was statistically highly significant. The difference in the mean Oxygen saturation between the two groups was not statistically significant at any point of time.

COMPLICATION- No complication like laryngospasm, Aspiration, Bleeding, and coughing were noted in study groups.

3. Discussion

Visualization of vocal cords following extubation after thyroid and major neck surgeries is highly desirable for the surgeon as well as the anesthesiologist to rule out vocal cord palsy or edema. The two major challenges faced by the anesthesiologist to achieve this are first to optimally visualize vocal cords as well as demonstrate it to the surgeon and second to ensure adequate patient comfort without producing any complication such as local trauma, coughing, desaturation, breath holding, laryngospasm, and aspiration. In this context, the present study was done to comparatively evaluate Video laryngoscope with the Macintosh Direct laryngoscope for post extubation assessment of vocal cords in patients undergoing thyroid surgery. Direct laryngoscopy using Macintosh laryngoscope has been used for laryngoscopy and intubation since 1940`s. Video laryngoscope has been introduced to provide better laryngoscopic view especially on a video monitor. It provides numerous technical advantages over Direct laryngoscope as the camera attached at the distal end of blade gives better field of view, even with minimal head and neck manipulations.[5]

Another advantades of videolaryngoscope is that because of separate screen, even surgeon can witness of movement of vocal cords. Most of the authors have studied the performance of Videolaryngoscope in difficult or potentially difficult airway and as a rescue device for failed intubations.

Patients were randomised into 2 groups: (M) Macintosh group Videolaryngoscope (V) with 45 patients in each group. Both groups were comparable with regards to age, gender, height, weight, ASA status, BMI and baseline parameters (Heart rate, Blood pressure (SBP and DBP), MAP and spo2.

In our study Videolaryngoscope was found to provide better laryngoscopic view as assessed by Cormack- lehane grading CL was found to be grade 1 and 2a in all the patients in Videolaryngoscope group while 11.1% and 5.4% of patients in Macintosh groups had CL grade 2b and 3. Vocal cord function assessment could not be done in 2 patients in direct laryngoscope group because of poor laryngoscpic view. Similar results were found in the study by Marshal B. Kaplan, where Video assisted visualization provided improved view of larynx compared to direct visualisation.[6]

In our study 93.3% of patients in group Videolaryngoscope had a Cormack lehane grade 1 view of glottis view compared to 64.4% in group M. While most of the patients in group M had Cormack lehane grade 2 view of glottis 20.0% and group V in 6.7% and 4.4% of group M had Cormack lehane grade 3and compared to 0% in group V. Thus, is suggested that video laryngoscope was highly significant in reducing Cormack –Lehane grade of glottis view ($p=0.006$). Similar observation was found in study done by Risse et al significant improved visualization of the glottis in videolaryngoscope than direct laryngoscope ($p=0.02$)[7]

Xue FS et al also concluded after a literature review on the use of CMAC Videolarygoscope that it provides a better laryngeal view in terms of Cormack lehane grade.[8]

Attempts of direct laryngoscopy specially to assess vocal cords after tracheal extubation leads to marked hemodynamic responses as it requires great force to lift the epiglottis and achieve a direct inline of glottis. Also, effects of the anaesthetic agents are wearing off leading to sympathetic stimululations. Videolaryngoscopy has an advantage has distally placed camera provide indirect view of vocal cords on monitor and the less force required to lift the epiglottis. In our study we observed a statically significant increase in HR in Direct laryngoscope compare to Videolaryngoscope.

The main finding of our study was that there was highly significant increase in HR in DL group, while mean heart was stable in VL groups, direct laryngoscopy is associated with sympathetic stimulation and altered hemodynamics and may result in a greater stress response. This study aims to compare the difference between hemodynamic changes during laryngoscopy in both groups, similar study by Upadhyaya S and Pathak L were concluded that statistically significant difference was found in Heart rate after laryngoscopy ($p<0.01$) and 1 min after laryngoscopy with attenuation seen in video laryngoscopy.[9]

In our study we observed a statically significant rise in SBP and DBP in DL group as compare to VL group at various time interval after laryngoscopy ($p<0.05$). Similarly, there was significant difference observed in DBP at 1, 2, 3 and 5 min after laryngoscopy. Nishikawa et al were also observed rise in SBP to be statistically significant in Macintosh laryngoscope compared to Videolaryngoscope ($p<0.05$) Video laryngoscope offers a reduce degree of hemodynamic stimulation compared with the Macintosh laryngoscope.[10]

In our study we observed a statistically significant rise in MAP in the DL group over next 5 minutes of laryngoscopy and was statistically highly significant. Similar results were found in study done by Kundra et al with significant difference ($p<0.05$) in MAP in group of direct laryngoscopes than videolaryngoscope.[11]

Our study suggested that there was no significant difference observed in Vocal Cord Function Assessment Score between M and V group ($p>0.05$). A study done by Kundra et al suggest video laryngoscope fiberoptic provide accurate assessment of vocal cord mobility with reasonable patient comfort in the post extubation period of laryngoscopy. Macintosh laryngoscope fails to give optimum visualization and predisposes the patient to significant discomfort and stress.[11]

On comparison of patients discomfort by patient reactivity score, we found direct laryngoscopy to be highly uncomfortable for post extubation assessment of vocal cords function, as 97.8% of patients had patient reactivity score of 3. This due to more force required during direct laryngoscopy as compared to Videolaryngoscope. Kundra et al had compared flexible fibeoptic bronchoscope with direct laryngoscope for post extubation assessment of Vocal cord and also reported very high reactivity score with direct laryngoscope.[11]

Limitations

Limitations of our study are–this study was conducted in a single centre in Indian population. Bias may have occurred because it was not possible to blind this anaesthesist to the device being used.

4. Conclusion

Therefore, it can be surmised from the study that in terms of hemodynamic parameters as well as outcome parameters, namely CL scores for glottic visualisation and Patient reactivity scores, C-MAC videolaryngoscopy utilised in the study performs better as the procedure of choice in assessment of patients post thyroid surgery as compared to its direct laryngoscopy counterpart.

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