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KEY WORDS: Cuff pressure, Peak pressure, Trendelenburg and reverse Trendelenburg positions, Tracheal Tube [TT].

A COMPARATIVE STUDY OF CHANGE IN CUFF PRESSSURE AND PEAK PRESSURE IN HEAD UP AND HEAD LOW POSITION IN LAPROSCOPIC SURGERY

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ABSTRACT

BACKGROUND: Endotracheal intubation using a Tracheal Tube (TT) is an essential step during general anaesthesia. Cuffs require proper sealing for positive ventilation, and are maintained using minimal pressure and volume to protect the perfusion of tracheal mucosa, minimizing airway complications such as oropharyngeal aspiration, sore throat and tracheal stenosis. Abdominal CO_2 gas insufflation, positional changes during laparoscopic surgery is required to provide a good surgical field during laparoscopic surgery. This all may contribute to endobronchial intubation or postoperative airway complications (due to changes in cuff pressure or in the position of the TT).

AIM AND OBJECTIVE: To know the variations in cuff pressure and peak pressure changes during laparoscopic surgery in head up and head low position and to compare the changes between them.

RESULT: It was noticed that peak pressure, cuff pressure increased significantly in head up and low position, changes are more in head low position compared to head up position.

CONCLUSION: There is significant change in cuff pressure, peak pressure and cuff pressure changes are more in head low position as compared to head up position during laparoscopic surgery under general anaesthesia.

INTRODUCTION

Endotracheal intubation using a Tracheal Tube (TT) is an essential step during general anaesthesia. The designs of TT cuffs have evolved since the mid-20th century. Cuffs require proper sealing for positive ventilation, and are maintained using minimal pressure and volume to protect the perfusion of tracheal mucosa, minimizing airway complications such as oropharyngeal aspiration, sore throat and tracheal stenosis [1-3]. This cuff has a variable cuff diameter (which is 120% of the tracheal diameter at its widest point) a taper angle of 14, and creates a 'sealing zone' where the cuff diameter corresponds to the tracheal diameter [4,5].

Laparoscopic surgery is popular because it is associated with the relief of postoperative pain; a rapid recovery and a shortened hospital stay [6]. Abdominal CO_2 gas insufflation, positional change is required to provide a good surgical field during laparoscopic surgery and N_2O use for anaesthesia may all contribute to endobronchial intubation or postoperative airway complications (due to changes in cuff pressure or in the position of the TT)[7,8].The intraperitoneal pressure increases due to pneumoperitoneum, and this causes the diaphragm to move cephalad, leading to increased intrathoracic pressure and mean airway pressure as a result. The intraatrial pressure increases as intrathoracic pressure increases, and the resulting decrease in venous return reduces cardiac output [5].

In this situation, a position change to head down or to the Trendelenburg during laparoscopic cholecystectomy, which further influences the location change of the intestines and diaphragm to significantly reduce the lung volume [6]. Therefore, it is important to examine the changes in respiratory mechanics according to the patient's position during laparoscopy and the change in intraperitoneal pressure.

The Endotracheal Tube cuff pressure must be in a range that ensures delivery of the prescribed tidal volume, thus reducing the risk for aspiration of secretions that accumulate above the cuff and will not compromise tracheal perfusion. Minimal pressure of 28cm H_2O is recommended to prevent aspiration and ventilator associated pneumonia. The amount of air needed to achieve a pressure of 28cm H20 is small, ranging from 2.6ml for 7.0mm Endotracheal Tube to 3.3ml for an 8.5mm tube. Endotracheal Tube cuff pressure associated with impaired tracheal capillary perfusion ranges between 35 and 50 cm H_2O. Sustained over inflation of the Endotracheal Tube cuff increases the risk for tracheal damage, subglottic stenosis or scarring, hoarseness, nerve damage, fistula and damage to tracheal wall [9,10].

Intermittent Positive pressure ventilation with volume mode was given. Mechanical ventilation was used throughout the surgery with tidal volume of 8 to 10 ml/kg and Respiratory rate between 12 to 14 breaths/min. Endotracheal tube cuff pressure should be adjusted between 20 and 30 cm H_2O by Pressure gauge without leakage.. In this study each measurement was made with same Pressure Gauge. This type of manometer is calibrated monthly. Endotracheal tube cuff pressure and airway pressure were measured immediately after inflation of cuff, post CO_2 insufflation, after change of patient's position and was recorded every 15 min till return to supine position. Intra-abdominal pressure (IAP) was kept between 10 to 15 mm Hg. After abdominal insufflation adjustments were made to patients in head up or head down position and cuff pressure and airway pressure changes were recorded

MATERIALS & METHODS:

SOURCE OF DATA: The study was conducted from September 2015 to September 2016. Hundred patients of physical status ASA-1, ASA 2 posted for elective surgeries under general anaesthesia were included in the study. Computer based blocks for randomization were used. Randomization was done under two groups 50 patients each, as under:

Group RT– Change in cuff pressure and peak pressure (Head Up position)

Group T – Change in Cuff pressure and peak pressure (Head Down position)

Study design: Hospital based prospective randomized study

ANAESTHESIA PROCEDURE:

Intravenous line was secured with 20G intracath and Patient was given general Anaesthesia. Premedication done with i/v inj glycopyrolate, i/v inj midazolam, i/v Inj Fentanyl.

Induction with Inj.Propofol Inj.scoline

Maintenance**:** Oxygen ,Air and Sevoflurane (MAC 2-2.5)

Inj vecuronium 0.1mg/kg iv as skeletal muscle relaxant

Additional analgesia was given with intravenous infusion of Diclofenac 75mg. Extubation was done after giving reversal with Inj Neostigmine 0.05mg/kg and Inj. glycopyrolate 0.08 mg/kg. i/v

Group RT (Head-Up Position by 30°):

50 patients undergoing laparoscopic cholecystectomy were randomly selected. Standard general Anaesthesia was given with endotracheal intubation.

The ETT cuff pressure was adjusted between 28 to 35 cm H_20 by the manometer right before skin incision without leakage by stethoscopic auscultation.

Endotracheal tube cuff pressure and Airway pressure was recorded immediately after cuff inflation, after CO_2 insufflation and after giving head up position by 30°.

Then ETT cuff pressure and Airway pressure changes were recorded after every 15 minutes till return to supine position. Intraabdominal pressure was kept between 10 to 15mm Hg. Data was recorded 2minutes after abdominal insufflation.Group T (Head-Down Position by 30°):

50 patients undergoing Total Laparoscopic Assisted Vaginal Hysterectomy and other procedures were randomly selected.

Standard general Anaesthesia was given with endotracheal intubation.

Endotracheal tube cuff pressure and peak pressure was recorded immediately after inflation of cuff and after CO_2 insufflation. ETT Cuff pressure and airway pressure were recorded after giving 30° gradual head down position. Then cuff pressure changes were recorded after every 15 min till return to supine.

Intraabdominal pressure was kept between 10 to 15 mmHg.

STATISTICAL ANALYSIS

Statistical procedures were carried out in two steps: data compilation, presentation & Statistical analysis.

Data compiled in Microsoft Excel sheet was analysed using the Statistical Package for Social Sciences (SPSS) version 19.0. Data obtained was compared by applying specific statistical tests to find out the statistical significance. Since the data was continuous, quantitative type and normally distributed, parametric tests were used for analysis.

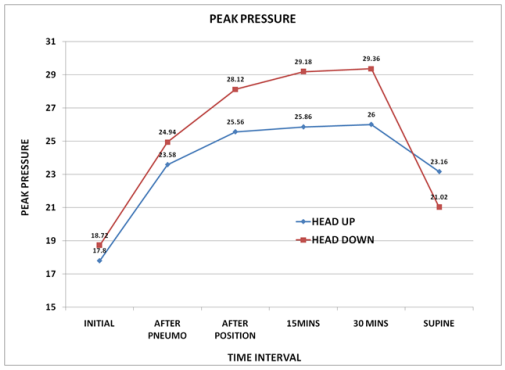
The mean and standard deviation of Peak Pressure and Cuff Pressure and at initial, after pneumo, after position, 15 minutes, 30 minutes and supine were calculated. The variation of Peak Pressure, Cuff Pressure and Tidal Volume scores between the two groups (head up and head down) at same time interval was analysed using "Unpaired T-Test".p value ≤ 0.05 was considered statistically significant.

Decoding was done after analysis of the data.

PEAK PRESSURE (mm of Hg)

TABLE 1

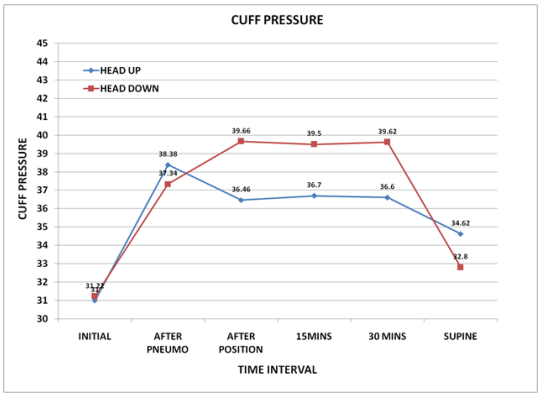
TIME INTERVAL	GROUPS (Mean ± SD)	T TEST		
	RT	T	T value	p value
INITIAL	17.80±.990	18.72±3.603	-9.311	.782
AFTER PNEUMO	23.58±1.416	24.94±3.689	-20.330	.144
AFTER POSITION	25.56±1.327	28.12±3.701	-26.183	.008*
15 MINS	25.86±1.738	29.18±3.515	-27.627	.001**
30 MINS	26.00±1.512	29.36±3.596	-27.845	.000**
SUPINE	23.16±2.909	21.02±2.615	3.869	.000**
p≤0.05= Significant*, p≤0.001= Highly Significant**				



GRAPH 01

TABLE 2

TIME INTERVAL	GROUPS (Mean ± SD)	T TEST		
	RT	T	T value	p value
INITIAL	31.00±1.471	31.22±4.092	.595	.553
AFTER PNEUMO	38.38±2.311	37.34±4.601	2.768	.007*
AFTER POSITION	36.46±2.764	39.66±2.353	-1.475	.014*
15MINS	36.70±2.978	39.50±4.537	-5.664	.000**
30 MINS	36.60±3.476	39.62±3.362	-3.835	.000**
SUPINE	34.62±3.362	32.80±3.574	2.623	.010*
p≤0.05= Significant*, p≤0.001= Highly Significant**				



GRAPH 02

DISCUSSION:

Laparoscopic surgery is becoming popular due to its benefits like reduction in postoperative pain, quicker return to normal activities decreased hospital stay and its advantages. Laparoscopic surgery are performed under general Anaesthesia with mechanical ventilation and High volume low pressure Endotracheal tube with a sealing cuff pressure about 30 to 35 cmH_2O used for a proper seal and avoidance of over inflation The main symptoms associated after tracheal intubation will be sore throat, hoarseness and dysphagia.

In present study we selected 100 patients of age 18 to 60 yrs posted for Laparoscopic cholecystectomy and laparoscopic Bariatric surgery 50 patients of 18 to 60 age, in LAVH and other gynecological procedures group all patients were female of age between 20 to 60 yrs. Anaesthesia providers use a number of methods to inflate and assess ETT cuff pressures. The commonly used method is to inflate the cuff just above the point where a seal is achieved by palpating for a leak in the suprasternal notch following intubation. In our study ETT cuff pressure was adjusted between 28 to 35 cm H2O by the manometer and confirmed by stethoscopic auscultation with no leak[2].

In this study each measurement was made with the same manometer and this manometer was caliberated monthly. Manometer was kept attached to pilot balloon throughout the

surgery to minimize the errors. Measurement was taken with each patient's head and neck in the neutral position and the occiput on a same type of pillow[2]. Data was recorded 2 minutes after abdominal insufflation.

In our study, after pneumoperitoneum with IAP 10 to15 mm of Hg there is rise in ETT cuff pressure and Airway pressure. In Group RT, the mean baseline cuff pressures (T1) were 31.00 ± 1.471, in Group T 31.22 ± 4.092. After CO2 insufflation T2 values were recorded as mean 38.38±2.311, 37.34±4.092 in 2 groups respectively. Baseline to pneumoperitoneum rise was statistically significant in both groups (t test).This rise was more in RT group than of T group. This was probably due to insertion of bougie in group RT patients who were undergoing bariatric surgery (50% of RT group had bariatric surgery) which was statistically significant. (Pair t- TEST).

The mean Airway pressures increased significantly from baseline values of 17.80±.990 in Group RT, 18.72±3.603 in Group T to 23.58±1.416 in Group RT, 24.94±3.689 in Group T after pneumoperitoneum. The rise was statistically significant in both groups (PAIRED T TEST) (T2-T1).

The rise was almost similar in both groups, which was statistically not significant. (Pair T- TEST).In Group T when the patient was positioned at 30° Trendelenburg ETT Cuff pressure and Airway pressure significantly increased.

Cuff pressures after position change was 39.66±2.353 in Group T While 36.46±2.764 There was significant difference in both groups. Values increased from baseline value in both the groups.

60This rise of cuff pressure in group T was persistent till patient was put back to supine position. Cuff pressure was significantly more in group RT as compared to group T. Airway pressure increased in both the groups after positioning the patient. The rise was more in T group as compared to RT group. There was significant difference in between both the groups (P value <.05). The values were 25.56±1.327 for RT group and 28.12±3.70 for T group respectively. The pattern was maintained till their respective position at 15 & 30 minutes; values were 25.86±1.738, 26.00±1.512 in RT and 29.18±3.515, 29.36±3.596 in T group respectively. The change was significant between both the groups. When patient was put back to supine position peak pressure decreased in both the groups. However the fall in peak pressure was significantly more in group T (21.02±2.615) as compared to group RT (23.16±2.909) (P value <.05)

Zeynep Baysal Yildirim et al concluded in their study that the cause of rise in Airway pressure might be due to pneumoperitoneum which causes increase in the IAP and intrathoracic pressure by approaching the diaphragm upward. Peak inspiratory pressure increases so it causes an increase in Airway pressures and in turn increase in endotracheal tube cuff pressure.[1,6]

Chun Yu Wu,Yu Chang Yeh et al found in their study that in patients undergoing laparoscopic surgery after CO2 insufflation mean cuff pressures increased from baseline values of 27±3 and 26±3 to 33±5 and 32±6cm H2O AND Mean airway pressures were also increased significantly from 18±4 to 25±4 cmH20 and 19±4 to 26±6cm H2O for patients undergoing laparoscopic colorectal tumor resection surgery (head down position) and laparoscopic cholecystectomy (head up position).After giving head down position in laparoscopic colorectal tumor resection led to increase in mean cuff pressure and mean airway pressure from 33±5 to 35±5 and from 25±4 to 26±5 cm H_2O respectively. Head up position in laparoscopic cholecystectomy causes no significant rise in cuff pressure and airway pressure[2]. These results were similar to our study.

CONCLUSION

Laparoscopic surgery is becoming popular due to its benefits like reduction in postoperative pain, quicker return to normal activities, decreased hospital stay.

Based on present study we concluded there was a significant rise in cuff pressure and airway pressure, after pneumoperitoneum in both the groups. There was significant rise observed in Group RT with change of position. But the changes were less as compare to T group.

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