Original Research Article

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Endotracheal Tube Cuff Pressure Monitoring Prospective Double Blind Randomised Control Study

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Abstract

Background: Endotracheal intubation by William McEwan in1878 remained the foundation stone of modern anesthesia. After successful use of laryngoscope and demonstration of laryngoscopy technique by Chevalier Jackson in 1913, endotracheal intubation achieved many milestones but it is not without complication. Following tracheal intubation, surgery, post-extubation there is an association of laryngotracheal morbidities such as a sore throat and hoarseness of voice [3,4] even in short duration of surgeries. *objectives*: To evaluate the efficacy of perioperative cuff pressure monitoring in decreasing the incidence of a postoperative sore throat and hoarseness of voice after oro-tracheal general anesthesia. *Materials and Methods*: We conducted this study as a double-blind randomized control trial in sixty patients who met the study criteria and underwent endotracheal general anesthesia in Karpaga Vinayga Institute of Medical Sciences and Research Institute. Totally sixty patients, each group has thirty patients. Group A - Study group (those who underwent cuff pressure monitoring) Group B - Control group. *Results*: The incidence of a sore throat and hoarseness of voice were present in both groups. The percentage of above two sequelae were found appreciably lower in Group A compared to Group B. *Conclusion*: Patients undergoing general anesthesia with endotracheal intubation show significantly reduced the relative risk of developing post-operative sore throat and hoarseness of voice when endotracheal tube cuff pressure monitoring is done.

Keywords: Endotracheal Intubation; Minimal Leak Test; Sore Throat; Hoarseness of Voice; Cuff Pressure.

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Introduction

Laryngotracheal morbidity is frequent after tracheal intubation [1]. Following tracheal intubation, sore throat and hoarseness of voice were the most common complaints which are sometimes more agonizing than post-operative pain [2]. These complications have an incidence ranging from 24% to 90% [3]. Mucosal damage occurring at the level of endotracheal tube cuff is thought to be causative factor [4], though the exact pathophysiology is not elucidated clearly. Tracheal perfusion pressure is 20-30 mm of Hg and an increase in mean mucosal perfusion pressure (22 mm of Hg) [5] causes the mucosal damage which disrupts the submucosal basement membrane and sloughing of epithelial lining which is spotty and completely heals in 2-3 days [6]. The high inflation pressure of endotracheal tube cuff initially and diffusion of nitrous oxide into the cuff intraoperatively were found to be main implicating causes of postoperative airway complications in patients undergoing general anesthesia with endotracheal tube intubation [4]. Though various

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methods were described to minimize the diffusion of nitrous oxide and reduction of postoperative airway complications the best method is continuous routine monitoring of cuff pressure [7]. This study was designed to evaluate the efficiency of reducing the incidence and severity of tracheal lesions postoperatively by monitoring the endotracheal tube cuff pressure perioperatively.

Materials and Methods

We conduct this study as a double-blind randomized control trial in sixty patients who met the study criteria and underwent endotracheal general anesthesia in Karpaga Vinayaga Institute of Medical Sciences and Research center. Group A-Study group (cuff pressure monitored group) Group B - Control group. Inclusion criteria of the patients undergoing this study were ASA grade I and II, 20-60 years of age, Elective surgery duration of surgery 1-4 hours. Exclusion criteria were ASA grade III and IV, Upper respiratory tract infections pre-operatively, anticipated difficult airway, surgeries involving head and neck, more than one intubation attempt, traumatic intubation, laryngoscopic Cormac Lehane grading 3 and 4, contraindications for nitrous oxide use and surgeries exceeding more than four hours. Portex cuff pressure monitor was used for minimal leak test and to measure the cuff pressure changes. One port of this monitor is attached to a syringe to deflate and inflate the cuff which is equipped with a one-way valve and a pressure gauge to adjust the desired pressure and the other port is attached to the pilot balloon. A minimal leak test was done by placing diaphragm of the stethoscope over the laryngeal area and endotracheal to be cuff is inflated until the air leak is gone. The patient was connected to ventilator and cuff pressure was decreased in small portions until a minimal air leak is heard. This air leak pressure is considered as the baseline mucosal perfusion pressure. Baseline mucosal perfusion pressure values were noted in both groups. In Group A cuff pressure monitoring was done every 10 minutes either by inflating or deflating and baseline cuff pressure was maintained till the end of surgery.

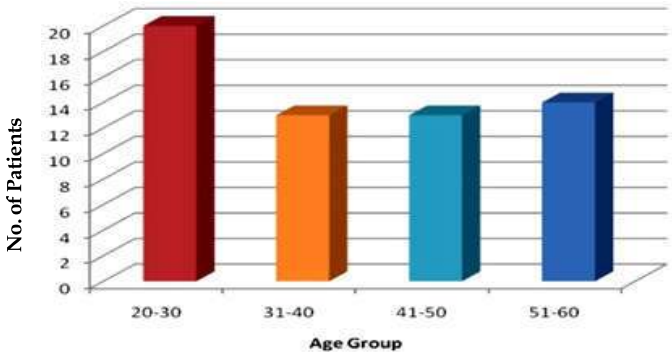
In Group B baseline mucosal pressure noted but no monitoring done in maintaining the baseline perfusion pressure and values were noted every 10 minutes. Anesthesia was given with Fi02 33%, N_2O, and sevoflurane. At the end of surgery patients were extubated following adequate reversal with Neostigmine 0.05mg/kg and Glycopyrrolate 0.01mg/kg. Anesthesia duration from the commencement to the cessation of N2the 0 was noted in both groups. After 24 hours both the group were interviewed by a blinded observer regarding the occurrence of a sore throat by the visual analog scale and hoarseness of voice by a change in the timbre of the voice. The results were rea corded separately.

Statistical Analysis

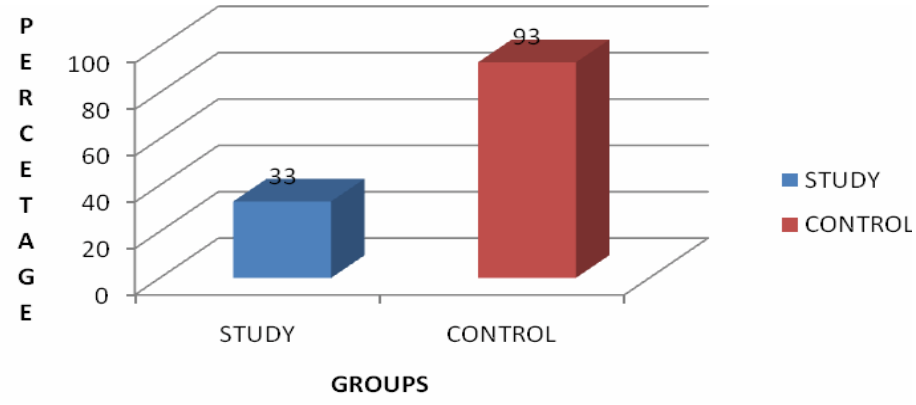
A t-test was used as a means to analyze the mean and standard deviation of age, sex, and duration of surgery. A signed ficant P value less than 0.05 was considered. Fisher's exact test was used to compare the occurrence of a sore throat and hoarseness of voice in both the groups and a P value less than 0.05 were considered significant. The relationship between surgical al duration, the incidence oan f a sore throat were compared with Fisher's exact test. Signifícthe ant association found if the P value is less than 0.05.

Results

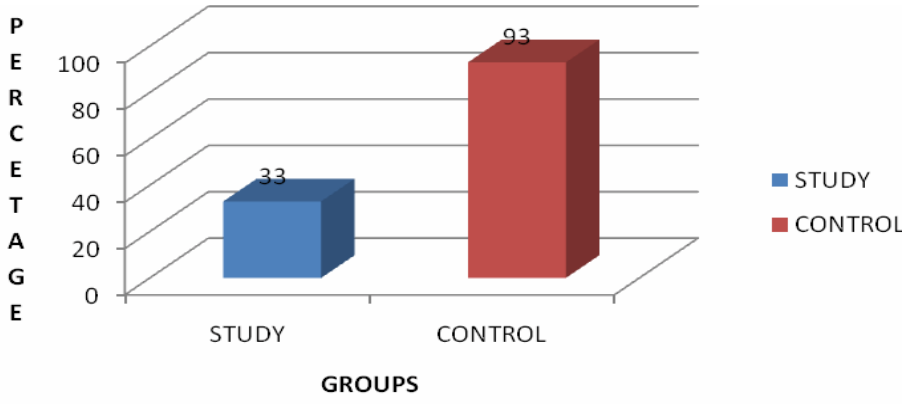
This prospective randomized double-blind study included sixty adults of age ranging from 20 - 60 yea ars and ASA grade I and II, who were randomly allocated to either group. Group A consisted of 30 patients who underwent cuff pressure monitoring and Group B consisted of 30 patients who didn't have cuff press they are monitoring (Graph 1-4).



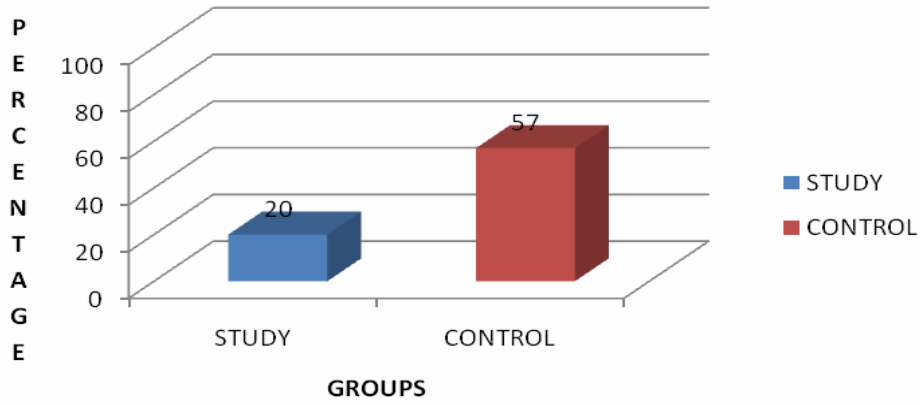
Graph 1: Demographic Data (P Value > 0.05)



Graph 2: The incident ce of a sore throat found to be 33% in the study group and 93% in control group (p Value < 0.05)



Graph 3: The incidence of hoarseness of voice found to be 20% in the study group and 57% in control group (p Value < 0.05)



Graph 4: The duration of surgery was compared with the severity of a sore throat which was found to increase in the severity of a sore throat with an increase in duration of surgery.

Discussion

After endotracheal lube extubation, postoperative sore throat and hoarseness of voice are of common occurrence. Anesthetic drugs, intubation time, number of intubation attempts, gastric tube insertion [8] are the variables implicated in this. By studying the effect these variables, Christenson et al. [8] concluded the incidences of postoperative sore throat and hoarseness of voice were higher in females. intubation with succinylcholine, surgeries involving the movement of head and neck and nasogastric tube insertion. Hence we removed these confounding variables. from our study. William Bernard et al. [9] study revealed initial high cuff pressure with large volume as well as diffusion of N_2O during the surgery were the causative factors for a sore throat and hoarseness of voice. Perbe - Hans Joachim et al[7] study revealed the mucosal injury and occurrence of a sore throat can be prevented by monitoring the endotracheal tube cuff pressure intraoperatively by maintaining the pressure below baseline mucosal perfusion pressure.

Hans Mondeo et al. [10] quoted cuff pressure more than 30 mm of Hg tracheal mucosa becomes ischemic and to keep the cuff pressure below 20 mm of Hg. Ayub Chakib et al. [11] cited the incidence of 21% in the study group and 65% in control group. Hence, we decided to find the baseline mucosal perfusion pressure by minimal leak test and monitoring was done every 10 minutes to maintain this baseline value in study Group A, which showered 33% incidence of postoperative sore throat. In Group B, baseline mucosal perfusion pressure is found by a minimal leak test were monitoring was not done showed 93% incidence of a sore throat. The probable reason for Ayub Chakib et al. [11] study was the difference in height to weight ratio between Indian population being comparatively smaller than the western population. Hence use of smaller size endotracheal tube 7.5 size for an adult female and 8 size for an adult male was followed in our study which also contributes for the incidence of a sore throat. H.N. Tu et al. [12] found that tracheal injury correlated with cuff pressure changes, which was done by bronchoscopic evaluation and grading of a sore throat. In our study, we believe that patients clinical symptoms would be more relevant and hence we evaluated and graded a sore throat by VAS scoring system and hoarseness by a change in the timbre of voice. In our study analysis of a sore throat by VAS system showed a lower incidence of postoperative sore throat and hoarseness of voice in the study group compared to the control group. Hence monitoring of cuff pressure not only decreases the incidence of a sore throat but also reduce its severity. Association of hoarseness of voice with the severe post-operative sore throat of higher VAS score had hoarseness of voice which was 20% in our study group and 57% in control group having a significant P value of 0.0073.

Conclusion

Monitoring of cuff pressure significantly reduces the incidence and security of a sore throat. It also reduces the hoarseness of voice. It reduces the relative risk of developing postoperative sore throat and hoarseness of voice. It reduces the relative risk of developing postoperative sore throat and hoarseness of voice in patients after general anesthesia with Endotracheal Intubation.

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