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Endotracheal Tube Cuff Pressure Monitoring Using Conventional Technique Vs Ag Cuffill In Assessing Post Operative Sore Throat: A Comparative Randomized Observational Study

[1]Dr. Vijayanand S, Professor, Kempegowda Institute of Medical Sciences, Bangalore, India.

[2]Dr. Navyashree K M, Junior Resident, Department of Anaesthesia, Kempegowda Institute of Medical Sciences, India.

Corresponding Author: Dr. Vijayanand S, Professor, Kempegowda Institute of Medical Sciences, Bangalore, India.

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Type of Publication: Case Report

Conflicts of Interest: Nil

Abstract

Background: Postintubation sore throat [POST] is one of the most common side effects of general anaesthesia. This could be due to over-inflation of the endotracheal tube's [ETT] cuff, leading to ischemia of the oropharyngeal and tracheal mucosa. Traditionally, ETT cuff pressure is determined by palpating the cuff or by inflating it until there is no audible leak. The invention of modern-day manometers like the AG CUFFILL syringe allows us to inflate and maintain an optimal cuff pressure [20–30 cm of water], thereby minimizing the chances of over- or underinflation. The purpose of our study was to compare the incidence of postoperative sore throat [POST] in conventional vs. AG CUFFILL techniques.

Methods: 30 adult patients who met both inclusion and exclusion criteria were studied. General anaesthesia was given to all patients as per institutional protocol. Appropriate size ETT was put and cuff was inflated using 10 ml syringe. In first group, adequacy of inflation was assessed conventionally by palpation technique. In the second group, AG CUFFILL device was used to maintain inflation pressures between 20 and 30 cm of water. POST was assessed using a 4-point scale (0-3) at 0, 2, 4, 6, 12 and 24 hours postoperatively.

Results: Mean value of post operative sore throat score [POST SCORE] at 0 hour in Group C was 1.87±0.64 and Group A was 1.07±0.59 with a P value of 0.0001. Mean value of POST SCORE at 4 hours in Group C was 1.00±0.00 and Group A was 0.20±0.42 with a P value of 0.009 which was statistically significant.

Conclusion: The instrumental measurement resulted in a significantly lower incidence of POST. The conventional palpation method is unreliable. Instrumental cuff pressure monitoring is simple and inexpensive and suggested to be used as a routine.

Keywords: ET tubes, PPV, NIBP.

Introduction

ET tubes are used to facilitate positive pressure ventilation (PPV) and to protect a patient's airway from aspiration of gastric contents. To create an airtight seal, the cuff near the distal tip of the ET tube is inflated with air. Over inflation decreases tracheal capillary perfusion, and underinflation leads to pulmonary aspiration. [1,8] Therefore, a pressure of 20–30 cm of water is recommended. Postintubation sore throat is a commonest side effect of general anesthesia.[1] This may be as a result of ischemia of the oropharyngeal and tracheal mucosa due to over-inflation of cuff. Conventionally, ETT cuff pressure is assessed by palpation of cuff or by inflating the cuff just enough to stop an audible leak around the cuff. AG CUFFILL syringe has pressure sensor which displays cuff pressure during cuff inflation. The cuff inflation can be readjusted to maintain cuff pressures between 20-30cm of water. The objective of the study was to assess the efficacy and calculate the incidence of postoperative sore throat [POST] in conventional technique as compared to AG CUFFILL device.

Methodology

Patients were randomly allocated into 2 groups of 15 each using computer formulated randomization technique by an anaesthesiologist who did not take part in the study. Patients with ASA status I and II, between the age group of 18-70 years undergoing elective surgeries under GA with endotracheal intubation were included in the study while patients belonging ASA III and above, with a history of upper respiratory tract infection, Asthma, sore throat, anticipated difficult airway with Mallampatti grade >2, Weighing >80kgs, smokers, Pregnant and lactating women were excluded from the study. Patients posted for elective surgeries were pre-operatively evaluated, relevantly investigated and adequately premedicated and shifted to the OT on the day of surgery. All ASA standard monitors like HR, NIBP, SPO2 were attached. Baseline hemodynamic parameters were noted. Patients were induced using Propofol(2mg/kg) and relaxed with nondepolarizing muscle relaxant. Male patients were intubated with 8.0 or 8.5mm internal diameter ETT and female patients with 7.0 or 7.5mm internal diameter ETT. Plane of anaesthesia was maintained with sevoflurane, nitrous oxide and oxygen. A 10 ml syringe was used for ETT cuff inflation. The cuff pressure was measured by one of the investigators after intubation. In Group C patients, the adequacy of inflation was assessed conventionally by palpation of the pilot balloon or by readjusting and inflating the cuff just enough to silence an audible leak around the cuff. In Group A patients, AG CUFFILL was connected to the pilot balloon and pressure was adjusted based on the pressure sensor readings to maintain adequate cuff inflation between 20-30cm of water. Post extubation, incidence and severity of sore throat was assessed using a 4-point scale (0-3) [where 0= no sore throat, 1=Minimal, patient answered in the affirmative when asked about sore throat,2=Moderate, patient complained of sore throat on his/her own, 3=Severe - Patient is in obvious distress] at 0, 2, 4, 6, 12 and 24 hours postoperatively. Rescue analgesia was given for all patients with a sore throat score of ≥ 2 with Intravenous Diclofenac 75mg IV. Sample size calculation was based on the standard cuff pressure in ETTs (20–30 cm H2O) and was calculated using G POWER SOFTWARE [VERSION 3.1.9.7].

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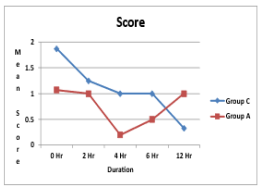
Fig 1: Ag Cuffill Syringe, Pressure Sensor Device (On Left), Ett Pressure Being Readjusted To Maintain A Cuff Pressure Between 20-30 Cm Of H2o

Results

ETT pressure was measured in 30 patients undergoing surgery under general anaesthesia. Group C (10 ml syringe, n=15) and Group A (AG CUFFILL syringe, n=15). There was no significant difference in age (P=0.668), duration of surgery (P=0.338), post intubation heart rate (P=0.146), SBP(P=0.703), DBP (P=0.591), MAP (P=0.639), SPO2 (P=0.455). ETT cuff pressure was measured and maintained between 20-30com of H2O. The descriptive statistics of cuff pressures in Group A showed a mean of 26.13, median of 26.00, SD of 1.96. There was no significant difference in the post extubation heart rate (P=0.039), SBP (P=0.094), DBP (P=0.289), MAP (P=0.349), SPO2 (P=0.186). Post operative sore throat was assessed using independent T test. There mean POST score at 0 hour in group C was 1.87±0.64 and group A was 1.07±0.59, the difference was statistically significant (P=0.0001). POST score at 4 hours in group C was 1.00±0.00 and group A was 0.20±0.42, which showed statistically significant difference (P=0.009). [Table 1]. There was no difference seen at 2,6,12 and 24 hours. There was significant association between rescue analgesia and groups (P=0.001). [Table 2]

Table:1

POST SCORE	GROUP		P VALUE
	GROUP C	GROUP A	
0 Hr	1.87±0.64	1.07±0.59	0.0001
2 Hr	1.25±0.50	1.00±0.00	0.391
4 Hr	1.00±0.00	0.20±0.42	0.009
6 Hr	1.00±0.00	0.50±0.71	0.272
12 Hr	0.33±0.58	1.00±0.00	0.423



Post operative sore throat score was statistically significant at 0 hour and 4 hours in group-C patients compared to group a patients

Table: 2

RESCUE ANALGESIA	GROUP C	GROUP A	P VALUE
GIVEN	12(80.0)	03(20.0)	0.001
NOT GIVEN	03(20.0)	12(80.0)	
TOTAL	15(100.0)	15(100.0)	

Association between rescue analgesia among both groups shows a significant p value.

Discussion

An endotracheal tube is used to protect the patient's airway from the risk of gastric aspiration and to provide positive pressure ventilation during surgeries under general anaesthesia and also to facilitate mechanical ventilation in Post anaesthesia care unit [PACU] or Intensive care unit [ICU]. ETT's made of polyvinyl chloride are high-volume low-pressure cuffs which are designed to take the shape of trachea when inflated and creates an airtight seal thereby reducing the risk of micro aspirations and ventilator associated pneumonia [VAP].[2] The cuff pressure depends on the compliance of the trachea and the cuff. The pressure measured at the pilot balloon gives an indirect estimate of the pressure exerted on the tracheal mucosa by the cuff. For the prevention of aspiration and ventilator-associated pneumonia, a cuff pressure of 20-30 cm of water is recommended. Under inflation [<20 cm of H2O] increases the risk of micro-aspirations and the passage gastric contents and contaminated secretions of the oral cavity into the trachea, potentially causing aspiration

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pneumonitis and pneumonia, bronchitis as well as accidental extubation and self extubation. Over-inflation is referred to as injection of a volume of air more than that needed to create an adequate seal between the cuff and the tracheal wall [2] According to Kao et al, hyper-inflation of the ETT cuff causes herniation of the cuff balloon in front of the tube's end, preventing gas exchange during tracheal stoma creation. A cuff pressure greater than 30 cm H2O impairs local tissue blood flow and damages the tracheal mucosal wall and surrounding anatomical structures. Blood flow to the antero-lateral part of the trachea is said to be compromised at pressures more than 30 cm of H20 and obstructed at pressures more than 50 cm of H20.[6][7] Postintubation sore throat is a common side effect of general anesthesia. This may happen due to ischemia of the oropharyngeal and tracheal mucosa due to over-inflation of the cuff. In general, ETT cuff pressure is assessed by palpation of cuff or cession of audible leak around the cuff is the end point for inflation.[4] The ETT cuff pressure of 20–30 cm of H2 O was considered as standard.[5] In our observational study we evaluated the efficacy of cuff inflation and incidence and severity of post operative sore throat [POST] using conventional method and AG CUFFILL. AG CUFFILL is an accurate cuff inflation syringe with a pressure sensor. It is a pocket sized, syringe like design allowing simple and easy solution for measuring cuff pressures and controlling the volume of airway cuffs in clinical practice. According to Mehta and Myat 1984, in order to prevent aspiration, the pressure exerted by the cuff against the tracheal wall should be greater than the sum of the hydrostatic pressure generated by the cuff and the negative pressure generated during inspiration. Crimlisk et al 1996 and Guyton et al 1997 described two approaches for creating an adequate seal using ETT cuff: the minimal leak technique (MLT) and the minimal occlusive volume (MOV). MLT refers to the smallest volume of air in the ET tube cuff, allowing for a small air leak of 50-100 ml tidal volume decrease on inspiration. The minimum amount of air required in the ET tube cuff to prevent an air leak during inspiration is referred to as MOV.Sengupta et al 2004 and Hoffman et al 2009 described a linear relationship between the measured cuff pressure and the volume of air inserted into the cuff. Hoffman et al (2009) described this relationship with a 97% linear correlation. Furthermore, they discovered no relationship between the measured cuff pressure and the patients' age, gender, or height. The measured cuff pressure did not differ as a function of ET tube size. The pressure inside the ET tube cuff is increased by a variety of factors including: patient position (Godoy et al 2008), head position (Brimacombe et al 1999) [3], temperature (Atlas 2005), cuff position (Bernhard et al 1985), cuff volume (Sengupta et al 2004), and nitrous oxide anaesthesia (Mitchell et al 1999). Harm et al found that tracheal tube cuff pressures in patients intubated prior to aeromedical transport were excessively high, and hence they promote the mandatory use of a cuff pressure manometer to avoid inappropriately high pressures. He has suggested the use of a 5 ml syringe alternative to the traditional bigger size syringe.[2] In our study, we observed a significant reduction in the incidence and severity of POST in the second group in whom the ETT cuff pressures were appropriately maintained as analysed by independent t test. The requirement of rescue analgesia was statistically lower in group A patients compared to group C as analysed by Chi square test. A limitation of our study is that cuff pressure was evaluated just once after induction of anaesthesia before

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handing over the case for surgical procedure. It was less likely that cuff pressures varied later as nitrous oxide was not used. Further studies are required to find out the incidence and severity of POST after repeated instrumental measurement in prolong duration surgeries and surgeries in different positions.

Conclusion

It is reported that high ETT cuff pressure for more than 15 minutes results in obstructed mucosal blood flow, damage to the columnar epithelium and basement membrane. Damage to the trachea during intubation is unavoidable due to contact between the ETT and the trachea. The conventional digital balloon palpation correlates poorly with the measured endotracheal cuff pressure. The use of an instrument to measure and adjust cuff pressure resulted in a significantly lower incidence of postprocedural sore throat, hoarseness, and blood-stained expectorant. The traditional method for ETT cuff inflation and balloon pressure measurement is unreliable. Instrumental cuff pressure monitoring is simple and inexpensive and suggested to be used as a routine.

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