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Original Article

Effects of Endotracheal Tube Size and Cuff Pressure on the Incidence of Postoperative Sore Throat: Comparison Between Three Facilities

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ABSTRACT

Objective: It is assumed that lower endotracheal tube (ETT) cuff pressure is associated with a lower incidence of postoperative sore throat. However, this is not confirmed in many studies. The relation between ETT size and cuff pressure and the incidence of postoperative sore throat were studied in three different facilities.

Methods: Three facilities at Hamad Medical Corporation, Qatar, Tertiary care hospital/ two secondary care hospitals (2ry (1) and 2ry (2)) were addressed in this study. ETT cuff pressure and size were measured by blinded observer after induction of general anesthesia and patients' intubation before the surgery. The sore throat was recorded after full recovery of the patients and before discharge from PACU by a blinded observer. Statistical analysis was performed using Chi-square for comparing between two categorical variables, Pearson Correlation for parametric variables were used to correlate tube size to cuff pressure. Spearman's for non-parametric variables was used to correlate throat pain to changes in cuff pressure and tube size (Sig. is $p<0.05$).

Results: The sore throat was not significantly correlated to either tube size or cuff pressure in the three facilities. Only at 2ry (1), the tube size was significantly correlated to cuff pressure, probably more standardized work.

Conclusion: A large number of trainees at tertiary care hospitals may explain the increased incidence of postoperative sore throat and not ETT size and/or cuff pressure.

INTRODUCTION

Postoperative sore throat (POST) following endotracheal intubation and general anesthesia is a common problem, reaching up to 90% of exposed patients at some centers.[1–3] POST has several risk factors that include demographic features (e.g. female and young age),[4,5] as well as clinical aspects (e.g. anesthetic management, airway suctioning and use of succinylcholine and nitrous oxide).[6,7]

Concerning anesthetic management, two aspects stand out, namely cuff pressure and cuff size. As for cuff pressure, when performing general anesthesia, appropriate endotracheal tube (ETT) cuff pressure is essential in endotracheal tube management, and guidelines recommend a cuff pressure of 20–30 cm H_2O.[1,8] Despite such guidelines, the research found that cuff pressure exceeded 40 cm H_2O in 40–90% of the tested patients.[9] When pressures exceed 50 cm H_2O, total obstruction of tracheal blood flow occurs.[10] A range of complications is associated with high cough pressure, including postoperative throat pain and discomfort, laryngeal nerve palsy, hoarseness and stridor.[11] Likewise, there is evidence[12] that higher cuff pres-

sure was associated with an increased incidence of POST (p=0.004), probably related to tracheal mucosal erosion. Others[13] similarly reported that high ETT cuff pressure was suspected as the cause of the tracheal infection in an unconscious patient. Hence, it is assumed that lower ETT cuff pressure is associated with a lower incidence of POST. However, this has not been confirmed in many studies.[2,14]

Concerning ETT size and POST, a systematic review and meta-analysis of three randomized controlled trials (with 509 patients) revealed that the ETT diameter of 6 mm significantly decreased the incidence of POST in the post-anesthesia care unit (PACU) compared to ETT size 7 mm.[2]

In connection with demographic variables, women are almost twice more likely to suffer from POST after endotracheal intubation than men.[15] POST was present in 29.5% of the female participants who were intubated with ETT size 6.5 mm and in 39.5% of those who were intubated with ETT size 7.0 mm.[15] Other researchers[5] also reported that, among women, endotracheal tube No. 7.0 was significant risk factors for postoperative sore throat (size 7 mm; p=0.02) (Jaensson et al. 2012a).

We observed a high incidence of POST at our tertiary care hospital (TH) compared to other secondary care hospitals (2ryH A and B) at the same institution. Hence, to identify areas for improvement, we undertook a quality improvement project (QIP) to explore the causes of such a high incidence of POST. The specific objectives of the QIP were to assess whether:

1. Is POST risk correlated to ETT size at three different facilities
2. Is POST correlated to ETT cuff pressure at three different facilities
3. Find out other factor/s that may be associated with POST.

MATERIALS AND METHODS

Ethics and settings

The Departmental Quality and Safety Committee (QPS) approved this quality improvement project (QIP) that was conducted at three facilities at Hamad Medical Corporation, Qatar. One tertiary care hospital (TH) and two secondary care hospitals (2ryH A&B) included in this QIP.

Sample and procedures

A purposive sample of 100 ASA 1&2, male and female patients with Mallampatti one, who were six hours fasting and aged 18–40 years, were recruited from each facility. A margin of error of 0.057 at 95% confidence was used. ETT cuff pressure and size were measured using a cuff manometer by an observer after induction of GA and patients' intubation using traditional Macintosh blade 3 or 4 for adult male and female patients. All participating patients received Propofol 2 mg/kg, Fentanyl 2 mg/kg and Rocuronium as one mg/kg to facilitate intubation. All intubations were carried out after three mins of intravenous injection of Rocuronium. All patients who did not fulfill the previous criteria and the patients who were asthmatic or doing laryngeal surgery were excluded from the audit. The level of training of anesthesiologist performing intubation was identified as Trainee (T) or Non-Trainee (NT). ETT size was left to the decision of the primary anesthesiologist (in the range of 6–8 mm). All primary anesthesiologists were blinded to the audit.

Outcomes

POST was recorded after full recovery of patients and before discharges from PACU by a second observer as yes or no regardless of the degree of POST. The minimal Stay in PACU is one hour; patients with rapid discharge of less than one hour were excluded.

Statistical analysis

Statistical analysis was carried out using SPSS v20, with a significance level set at p<0.05. Eighty-one patients from tertiary care hospital, 78 from 2ry (2) and 90 from 2ry (1) were analyzed for the POST.

Chi-square test was used for comparing two categorical variables, Pearson Correlation for parametric variables were used to correlate tube size to cuff pressure. Spearman's for non-parametric variables was used to correlate throat pain to changes in cuff pressure and tube size.

RESULTS

After excluding all patients who did not fulfil the inclusion criteria, a total of 81, 77 and 92 patients were included in the audit from TH, 2ryHA and 2ryHB hospitals, respectively. Mean surgery time was 122±80 mins. Trainees (T) comprised 30% of the anesthesia providers at TH compared to 0% T at 2ryHA and 2ryHB.

Figure 1 shows the incidence of POST at three Facilities. The TH exhibited the highest incidence of POST (27%), which was significantly higher compared to 7.5% at 2ryHA and 7.6% at 2ryHB (p<0.05).

Figure 2 shows that 35% of the sample had a cuff pressure ≥35 cm H_2O, where 13% had a pressure between 30–40 cm H_2O.

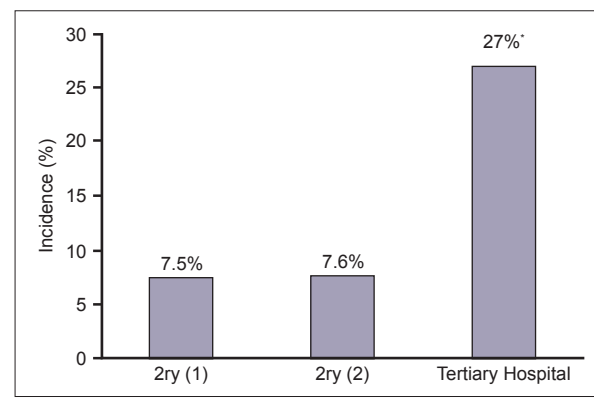

Figure 1. Incidence of POST at three facilities. *Significant (p<0.05).

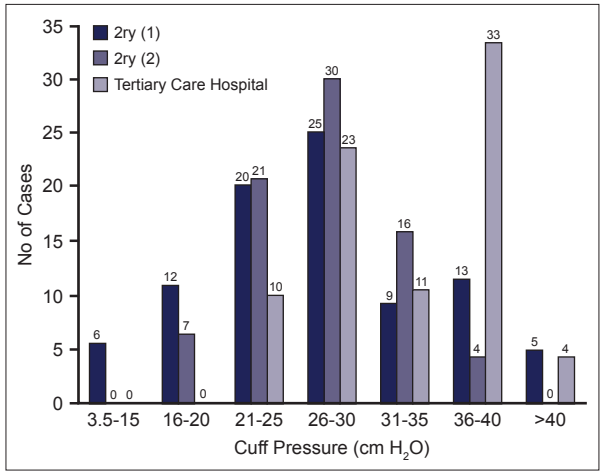

Figure 2. Comparison of ETT cuff pressure at the three facilities.

POST was significantly correlated to cuff pressure and ETT size at TH, while it was not significantly correlated to ETT size and cuff pressure at 2ryHA and two facilities.

Figures 1 & 2 represent the changes in ETT size and cuff pressure at the three facilities.

Table 1 shows that only at TH, the tube size was significantly correlated to cuff pressure, and that POST was not significantly correlated to either tube size or cuff pressure at any of the three facilities.

DISCUSSION

Sore throat is a common side effect of general anesthesia and is reported by 30% to 70% of patients after tracheal intubation.[16] Chang et al.[17] reported that minor sore throat after endotracheal intubation could adversely affect patient satisfaction and postoperative function. The ETT cuff performs a critical function of sealing the airway during positive pressure ventilation. Borhazowal et al.[18] stated that there is a narrow range of cuff pressure required to maintain a functionally safe seal without exceeding capillary blood pressure. The findings of the current audit do not correlate POST to either ETT size and/or ETT cuff pressure at any of the three facilities. The high incidence of Trainee at the TH (30%) and the failure to use cuff manometer may explain the high incidence of POST at this facility compared to others. The total incidence of POST is still the lowest recorded incidence compared to other published studies (35–90%).[1–3]

In agreement with our audit, Ozer et al.,[19] in their study on the influence of the experience of the person on the cuff inflation pressure, have concluded that experience alone is not sufficient and a manometer should be used in routine inflation of the cuff to reduce the postoperative complaints. They also found a correlation between cuff pressure and anesthesia duration with postoperative complaints; however, we did not do a correlation between surgery duration and POST in this study.

Trivedi et al.[20] found that routine ETT cuff pressure measurements reduced endotracheal intubation-related complications, and recommended the use of simple manometer to guide ETT cuff pressure rather than relying on subjective assessment. They found that anesthesiologists even with teaching experience over five years were unable to inflate the ETT cuff to the recommended range.[20] Cuff is more likely to be overinflated when conventional methods are followed. In Sweden, the main risk factor for developing sore throat in men was intubation by personnel with <3 months' work experience.[5] Sultan et al.,[21] in their review of the literature on endotracheal cuff pressure, suggested that complications related to endotracheal intubation were multifactorial, but elevated cuff pressure might be the major contributing factor and should be avoided. Cuff pressure adjustment at short time intervals would be helpful in reducing postoperative sore throat.[22] Studies have shown that cuff inflation by a manometer is the best means of achieving ideal cuff inflation pressures.[14]

We undertook actions taken, and the findings of the QIP were disseminated by email to all the Anesthesia Staff members. All faculty members are now encouraged to use a cuff manometer when inflating the ETT cuff and pass the education material to trainees and anesthesia technicians involved in the clinical service.

CONCLUSION

A large number of trainees at tertiary care hospital who are not using cuff manometer when inflating ETT cuff may explain the increased incidence of postoperative sore throat and not ETT size and/or cuff pressure alone at the tertiary care hospital, a risk factor of POST that was not

Table 1. Correlation between ETT size and cuff pressure and POST

Hospitals	(TH) POST (n=81)	2ry1 POST (n=77)	2ry2 POST (n=92)
ETT size	.071	.966	.444
ETT cuff pressure	.129	.784	.121
	TH	**2ry1**	**2ry2**
	(TH) ETT cuff pressure (n=81)	2ry1 ETT cuff pressure (n=77)	2ry2 ETT cuff pressure (n=92)
ETT size (p-value)	.002*	.366	.653

*Significant (p<0.05). ETT: Endotracheal tube; POST: Postoperative sore throat; TH: Tertiary hospital; 2ry1: Secondary hospital A; 2ry2: Secondary hospital B.

described before in the literature.

Ethics Committee Approval

Approved by the local ethics committee.

Informed Consent

Prospective study.

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: Y.H.; Design: Y.H.; Supervision: Y.H.; Fundings: Y.H.; Materials: A.F., Y.H., W.EL.; Data: A.F., W.E.; Analysis: Y.H., N.S.; Literature search: M.S., A.F., W.E.; Writing: Y.H., N.S.; Critical revision: Y.H., N.S., M.S.

Conflict of Interest

None declared.

REFERENCES

1. American Thoracic Society; Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med 2005;171:388–416.
2. Hu B, Bao R, Wang X, Liu S, Tao T, Xie Q, et al. The size of endotracheal tube and sore throat after surgery: a systematic review and meta-analysis. PLoS One 2013;8:e74467.
3. Sprague NB, Archer PL. Magill versus Mallinckrodt tracheal tubes. A comparative study of postoperative sore throat. Anasthesia 1987;42:306–11.
4. Higgins PP, Chung F, Mezei G. Postoperative sore throat after ambulatory surgery. Br J Anaesth 2002;88:582–4.
5. Jaensson M, Gupta A, Nilsson UG. Gender differences in risk factors for airway symptoms following tracheal intubation. Acta Anaesthesiol Scand 2012;56:1306–13.
6. Scuderi PE. Postoperative sore throat: more answers than questions. Anesth Analg 2010;111:831–2.
7. Gu AN, Yu M. The Effect of Intracuff Pressure Adjustment on Postoperative Sore Throat and Hoarseness after Nitrous Oxide and Air Anesthesia. J Korean Acad Nurs 2019;49:215–24.
8. Lorente L, Blot S, Rello J. Evidence on measures for the prevention of ventilator-associated pneumonia. Eur Respir J 2007;30:1193–207.
9. Braz JR, Navarro LH, Takata IH, Nascimento Júnior P. Endotracheal tube cuff pressure: need for precise measurement. Sao Paulo Med J 1999;117:243–7.
10. Seegobin R, Van Hasselt G. Endotracheal cuff pressure and tracheal mucosal blood flow: Endoscopic study of effects of four large volume cuffs. Br Med J (Clin Res Ed) 1984;288:965–8.
11. Robert J. Hoffman, Jefrey R. Dahlen, Daniela Lipovic, Kai M. Stürmann. Linear Correlation of Endotracheal Tube Cuff Pressure and Volume. West J Emerg Med 2009;10:137–9.
12. Lakhe G, Sharma SM. Evaluation of Endotracheal Tube Cuff Pressure in Laparoscopic Cholecystectomy and Postoperative Sore Throat. J Nepal Health Res Counc 2018;15:282–5.
13. Lee JM, Park IS, Lee CH, Lee KH, Chun DH, Kim JY, et al. Tracheal Infection Resulting from High Endotracheal Tube Cuff Pressure in an Unconscious Patient with Brain Trauma. Korean J Neurotrauma 2018;14:155–8.
14. Bao-Ji Hu, Jian Xu, Zhao XH, Pan MZ, Bo L, Zhang NN, et al. Impact of Endotracheal tube cuff pressure on postoperative sore throat: A systematic review ans meta analysis. Journal of Anesthesia and Perioperative Medicine 2016;3:171–6.
15. Gustavsson L, Vikman I, Nyström C, Engström Å. Sore throat in women after intubation with 6.5 or 7.0 mm endotracheal tube: a quantitative study. Intensive Crit Care Nurs 2014;30:318–24.
16. Tanaka Y, Nakayama T, Nishimori M, Sato Y, Furuya H. Lidocaine for preventing postoperative sore throat. Cochrane Database Syst Rev 2009;CD004081.
17. Chang JE, Kim H, Han SH, Lee JM, Ji S, Hwang JY. Effect of Endotracheal Tube Cuff Shape on Postoperative Sore Throat After Endotracheal Intubation. Anesth Analg 2017;125:1240–5.
18. Borhazowal R, Harde M, Bhadade R, Dave S, Aswar SG. Comparison between Two Endotracheal Tube Cuff Inflation Methods; Just-Seal Vs. Stethoscope-Guided. J Clin Diagn Res 2017;11:UC01–UC03.
19. Ozer AB, Demirel I, Gunduz G, Erhan OL. Effects of user experience and method in the inflation of endotracheal tube pilot balloon on cuff pressure. Niger J Clin Pract 2013;16:253–7.
20. Trivedi L, Jha P, Bajiya NR, Tripathi D. We should care more about intracuff pressure: The actual situation in government sector teaching hospital. Indian J Anaesth 2010;54:314–7.
21. Sultan P, Carvalho B, Rose BO, Cregg R. Endotracheal tube cuff pressure monitoring: A review of the evidence. J Perioper Pract. 2011;21:379–86.
22. Jaensson M, Gupta A, Nilsson UG. Risk factors for development of postoperative sore throat and hoarseness after endotracheal intubation in women: a secondary analysis. AANA J 2012;80:S67–73.

Endotrakeal Tüp Boyutu ve Manşet Basıncının Ameliyat Sonrası Boğaz Ağrısının İnsidansına Etkileri: Üç Sağlık Kurulu Arasındaki Karşılaştırma

Amaç: Düşük endotrakeal tüp (ETT) manşet basıncının, düşük ameliyat sonrası boğaz ağrısı sıklığı ile ilişkili olduğu varsayılmaktadır. Ancak, birçok çalışmada bu doğrulanmamıştır. ETT boyutu, manşet basıncı ve ameliyat sonrası boğaz ağrısı insidansı arasındaki ilişki üç farklı sağlık kuruluşunda incelendi.

Gereç ve Yöntem: Bu çalışmada Katar'da Hamad Tıp Kurumu (Hamad Medical Corporatio) bünyesindeki bir üçüncü ve iki ikinci basamak hastane (2ry [1] ve 2 ry [2]) incelendi. ETT manşet (kaf) basıncı ve boyutu genel anestezi indüksiyonu ve hastaların entübasyonundan sonra ve anestezi sonrası bakım ünitesinden (PACU) taburcu edilmeden önce çalışma hakkında bilgisi olmayan bir gözlemci tarafından ölçüldü. İki kategorik değişkeni karşılaştırmak için ki-kare testi kullanılarak istatistiksel analiz yapıldı. Tüp boyutunu manşet (kaf) basıncıyla korele etme amacıyla parametrik değişkenler içim Pearson korelasyonu kullanıldı. Boğaz ağrısını manşet basıncındaki ve tüp boyutundaki değişikliklerle ilişkilendirmede parametrik olmayan değişkenler için Spearman korelasyon testi kullanıldı ($p<0.05$).

Bulgular: Üçüncü basamak hastanede çok sayıda yeni stajyerin varlığı boğaz ağrısının görülme sıklığını açıklayabilir. Üç sağlık kurumunda da boğaz ağrısı, tüp boyutu veya manşet basıncı ile anlamlı şekilde korele değildi. Yalnızca ikinci basamak hastanede, tüp boyutu muhtemelen daha fazla standartlaştırılmış çalışma sonucu manşet basıncıyla önemli ölçüde korele idi.

Sonuç: Üçüncü basamak hastanelerde çok sayıda stajyerin bulunması ETT büyüklüğü ve/veya manşet basıncını değil, ancak ameliyat sonrası boğaz ağrısı sıklığının niçin arttığını açıklayabilir.

Anahtar Sözcükler: Ameliyat sonrası boğaz ağrısı; boğaz ağrısı; endotrakeal tüp boyutu; manşet basıncı.