Complications of Endotracheal Intubation in Open Heart Surgery Patients

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Open-heart surgery is associated with prolonged intubation and hypothermia. This prospective study was performed at intensive care unit „ 100 adult patients were intubated with BAXTER endotracheal tubes. Body temperature was decreased to 28.5 °C during cardiopulmonary bypass. Patients were electively ventilated for a mean period of 15.2 hours. All patients were extubated successfully. They were followed on first postoperative day for any intubation related complication.53 out of 100 patients reported one or more complications. Hoarseness was the major problem . Sore throat and dysphagia were other complaints.
Key words: Endotracheal intubation; complication ; open heart surgery; hypothermia .

Endotracheal intubation is helpful in maintaining leak proof ventilation during anaesthesia. Modern cuff on ETT is designed to produce low pressure so as to reduce the incidence of ischemic damage to the tracheal mucosa. Endotracheal tube cuff pressure may change from safe to unsafe limits during anaesthesia[1,2].Type of ETT cuff , size of ETT as compared to the internal diameter of trachea, muscle tone of trachea, airway pressure , nitrous oxide, body temperature, opioids, and duration of intubation are some of the factors affecting endotracheal tube cuff pressure once the cuff has been inflated[3]. During cardiac surgery patients are put on cardiopulmonary bypass[CPB]. The CPB is associated with hypothermia [upto 28°C].CPB is associated with periods of relative hypotension[4] and even within the acceptable pressure range, tracheal blood flow may be reduced followed by significant ischemia[5].The purpose of this study is to find the incidence of postoperative intubation complications during open heart surgery at moderate hypothermia [28°C] .

Material and Methods

One hundred patients scheduled for various open heart surgical procedures were included in the study. They were intubated with a disposable endotracheal tubes[BAXTER] with high volume , low pressure cuff. No lubricants were used. Sizes used were 8.0[female patients] and 8.5 mm internal diameter[male patients]. Standard anaesthesia was given. During CPB core temperature was dropped to 28.5°C[mean].Cooling time was 70.minutes [mean]. Patients were rewarmed to 37°C and CPB was switched off. All patients were electively ventilated for an average period of 15 hours [during surgery and ICU]. These patients were followed up for 24 hours postoperatively.

Results

Values are described as mean ± standard deviation One hundred adult patients were included in this study. There were 73 male and 27 female patients. Average age was 43.71±18.26 years. During CPB patients were cooled to 28.5±1.67°C. Mean cooling time was 70.23±21.65 minutes. Patients were ventilated for an average period of 15.02±6.34 hours during surgery and ICU. These patients were followed on first postoperative day.53 patients developed complications [Table 1]. 20 patients had one problem while. 33 patients reported more than one complication. Hoarseness was the major problem [Table 2,5]

Discussion

Cardiac surgery is unique in that whole body is cooled below 30°C. It is usually associated with periods of hypotension during cardiopulmonary bypass[4]. Patients are electively ventilated few hours postoperatively , thus leading to prolonged intubation. Factors leading to postoperative complications during open heart surgery are presented in Table 4. The incidence of early postoperative complications due to endotracheal intubation after general surgery in literature varies from 4-90%[10,11,12,13,14]. Sore throat [6-90%] , hoarseness [4-67%] and dysphagia [7-23%] are some of the common problems after general anaesthesia. Hypothermia of whole body is common during open heart surgery. The aim is to decrease the metabolic requirement of the body. Usually core temperature is kept between 25-30°C. There is cold induced vasoconstriction of tracheal mucosa and postoperative complications[15]. On the other hand, hypothermia also has a protective effect by decreasing endotracheal tube cuff pressure during cardiac surgery [6]. It is difficult to label all the complications during cardiac surgery mainly to hypothermia.

The other risk factor during cardiac surgery is hypotension. There are periods of hypotension due to low cardiac output during and after surgery. The major problem arises when the patient is put on cardiopulmonary bypass[CPB]. The CPB is associated with periods of relative hypotension[4] Sometimes the cardiac output from the heart lung machine has to reduced for short intervals. This may further lead to decrease in capillary perfusion pressure. Even within the acceptable pressure range, tracheal blood flow may be decreased followed by significant tracheal mucosal ischemia[5].

There are certain specific factors related with CPB. It has been shown that catecholamines, renin and prostaglandins are released during CPB[9]. It is not clear

how they affect the microvasculature of trachea. Additional work is required to ascertain their exact role.

Postoperative complications are also related to endotracheal tube . Type of ETT[1], size of ETT, volume of air in ETT cuff[16], type of injectate in ETT cuff[1], endotracheal tube cuff pressure[17], duration of inflation of cuff[13], nitrous oxide[18], opioids[1], anatomy of trachea[12], use of PEEP[6] , movement of tube in the trachea[21] and hypothermia[6] are some of the factors related with postoperative intubation complications. In this study most of these factors were kept constant.

All patients were intubated with BAXTER high volume, low pressure tubes. Sizes used were 8.0- 8.5 internal diameter. Air was used to inflate the cuff. Nitrous oxide was not used in this study. All patients were ventilated with air\oxygen mixtures. No PEEP was used during ventilation. The two ETT related factors, which could not be kept constant, were duration of intubation and endotracheal tube cuff pressure [ETCP]. The range of ventilation time was 12-24 hours. Patients were ventilated for a mean period of 15 hours.

The other ETT related variable was ETCP. The ETCP is related to the type of ETT cuff, volume of air injected and anatomy of trachea. All patients were intubated with same type of ETT. The amount of air could not be controlled as these patients were intubated by different anaesthetists. With a high number of patients complaining of intubation related problems it seems likely that our ETCP were higher than the safe limit of 25 cm of H_2O[20]. In two other studies done at PIC and Services hospital, Lahore, ETCP were found to be higher in nearly half of patients[17,3] Sore throat was observed in 2O% of patients when they were directly asked about it. It is well established that method of questioning is an important determinant of the incidence of sore throat[22]. Patients tend to forget about the throat complaints in the presence of wound pain. The low incidence in our study may be due to high doses of opioids used during cardiac surgery.

Hoarseness has been reported by 38 % of patients [Table 2]. The incidence has been reported to be 4 – 67 % during general surgery[1O]. There are certain factors which lead to vocal cord ischemia during cardiac surgery [Table 5]. Hypothermia and hypotension cause a decrease in tracheal mucosal blood supply. Hoarseness can be due to high ETCP[23]. ETCP should be routinely measured in all open heart surgery patients who need prolonged intubation. ETCP should be kept below 25 cm of H_2O. Its routine assessment in cardiac surgery becomes more important if the ischemic effects of hypothermia and systemic hypotension are taken into account.

Hoarseness can be produced due to thermal effects on recurrent laryngeal nerve. During cardiac surgery ice cold packs are kept around the heart as a protective measure. This brings the local temperature to 15°C . Moreover diathermy can be other source of thermal injury to the recurrent laryngeal nerve. Both these factors have been associated with postoperative hoarseness. Another factor leading to hoarseness can be damage to the vocal cords during intubation. Airway trauma has been reported to be between 6-60% during endotracheal intubation[24-28]. This is unlikely to affect our results as most of our intubations were performed by experienced anaesthetists.

Dysphagia observed in some of our patients may be due to maintenance of nasogastric tubes during ventilation period . Nasogastric tubes were removed at the time of extubation.

One patient developed aphonia. It was relieved after several hours. On second postoperative day only mild hoarseness was observed in this patient. Sore throat was common in female patients [Table 3].

Table 1.Complications observed

Sore Throat	20%
Hoarseness	38%
Aphonia	1%
Dysphagia	11%

Table 2. Degrees of hoarseness\ dysphonia (n=38)

Grade 1	Mild	27
Grade 2	Moderate	8
Grade 3	Severe	3
Grade 4	Aphonia	1

Table 3 Gender wise comparison of complications

	Male (n=73)	Female (n=27)
Sore throat	18 %	25%
Hoarseness	37%	38.8%
Dysphagia	13%	O.O3%

Table 4. Factors increasing the complications of intubation in open heart surgery patients

Hypothermia[6]
Cold induced vasoconstriction[6]
Systemic hypotension[5]
Decreased blood flow[7]
Prolonged intubation[1]
High ETT cuff pressure [8]
Cardiopulmonary bypass[6]
Renin, prostaglandin, and catecholamines[9]

Table 5. Factors increasing the incidence of hoarseness in open heart surgery patients [23,28]

Damage to vocal cords during intubation
High ETT cuff pressure
Damage to recurrent laryngeal nerve during surgery
Cooling during CPB
Systemic hypotension during CPB

Conclusion

The incidence of postoperative complications after open heart surgery in this study seems to be high. It is suggested that :Perfusion pressures should be kept at higher levels during cooling [above 5O mm Hg during CPB] ETCP should be monitored \ assessed in all patients undergoing

cardiopulmonary bypass.

References

1. Dorsch A, Dorsch SE . Tracheal tubes . In. DORSCH A [ed] .Understanding Anasthesia Equipment Williams and Wilkins. Baltimore.1994.3rd edition .p439-546.
2. Guyton D, Banner MJ, Kirby PR. High volume Low pressure cuffs. Are they always low pressure? Chest 1991.100;1076-1081.
3. MOHSIN A ,QURESHI SM. Endotracheal tube cuff pressures after intubation Journal of Anaesthesiology.PSA,1997: XV;38-46.
4. Nordin U. The trachea and cuff induced tracheal injury. Acta Oto Laryngologica. [Stockholm] 1977.Suppl.345.
5. Benguin L, Albin MS, Smith RB.Canine tracheal blood flow after endotracheal intubation during normotension and hypotension.Anaesthesia and Analgesia.1993;76:1083-1090
6. Inada T, Kawachi S , Kuroda M. Tracheal tube cuff pressure during cardiac surgery using cardiopulmonary bypass.British JAnaes.1995;74:283-286.
7. Hug CC jr.,Shanewise JS.Anaesthesia for adult cardiac surgery. In . Miller RD [ed] Anaesthesia 4th ed. New York. Churchil Livingstone. 1994;1757-1809.
8. Messahel BF .Total tracheal obliteration after intubation with a low pressure cuffed tube .British J Anaes.1994;13:697-699.
9. Hindmen BI, Lillehug Sl Tiker JH. Cardiopulmonary bypass and the anaesthesiologists. In .Kaplan JA .Ed. Cardiac Anaesthesia. Philadelphia; WB Saunders. 1993:919-950.
10. Jones MW, Catling S , EVANS E , et al . Hoarseness after tracheal intubation. Anaesth and Analgesia 1992, 47: 213-216
11. Mandoe H ,Nikolajson L. Sore throat after endotracheal intubation . Anaest and Analg .1992; 74: 8-7 –OO.
12. Messhael FM. Post intubation tracheal damage a four year prospective study. Middle Eastern Journal Of Anaesthesioliogy .1992; 11 :431 453
13. Jensenn Pj, Homalgaard P et al, Sore throat after operation .Influence of tracheal intubation, intracuff pressure and type of cuff. Br Jour Of Anaesth.1-82;54:453-457
14. Jaffery S, Kazmi A . Tracheal stenosis. Case report . Journal of Pakistan Society Of Anaesthesiologists .XIII 1995;7O-75.
15. Guyton AC .Textbook of Medical Physiology . W.B Saunders. Philadelphia. Eighth edition1—1. Pages 171-175.
16. Messhael BF .Total tracheal obliteration after intubation with a low pressure cuffed tracheal tube . British J Anaesth.1994;13: 697-699.
17. Qureshi SM , Gillani STI . Low pressure cuff tracheal tubes. Annals of KEMC. 1998 ;4[3]:27-3O
18. O' DonneL JM. Orotracheal tube intracuff pressure initially and during anaesthesia using nitrous oxide. CRNA .1995 ;6[2] : 79-85.
19. Yasuda I ,Hirano T, Yusa T .Tracheal constriction by morphine and fentanyl in man .Anaesthesiology.1978; 4-: 117-119..
20. Joh S, Matsura A, Kotani Y , et al . Changes in tracheal blood flow during endotracheal intubation. Acta Anaesthesiol Scandinivacia 1978;31: 3OO –3O4.
21. Christensen Am, Willemos Larson H, Lundby L, et al. Postoperative throat complaints after tracheal intubation. British J Anaes. 1994; 73: 786-787.
22. HARDING CJ, Mevery FK. Interview method affects incidence of postoperative sore throat. Anaethesia .1987; 42: 11O4-11O7.
23. Patel RI OH TH, Chandra R et al. Tracheal tube cuff pressure. Anaesthesia .1984, 39: 862-864.
24. Hilding AC. Laryngotracheal damage during intratracheal anaesthesia. Annals of Otology. 1971;8O:565-581.
25. Donelly WH. Histopathology of endotracheal intubation. Archives of pathology. 1996; 88: 511-2O.
26. Donelly Wh, Grossman Aa, Grem Fm. Local sequelae of endotracheal anaesthesia as observed by examination of one hundred patients. Anaesthesiology. 1948, 94: 90-97..
27. Peppard SB, Dickens JH. Laryngeal injury following short intubation. Annals of Otology: Rhinology and Laryngology. 1983; 92:: 327-3O.
28. Steele Holley H, Gildea JE. Vocal cord paralysis after intubation. JAMA. 1971; 19: :281-284.