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A CLINICAL COMPARATIVE STUDY OF MICROCUFF PAEDIATRIC TRACHEAL TUBES VS CUFFED TRACHEAL TUBES IN PAEDIATRIC LAPROSCOPIC SURGERIES

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ABSTRACT **Background and Aims:** In paediatric airway management, Cuffed ETT (CETT) were found to cause airway edema. Microcuff Paediatric Tracheal Tubes (MPTT) with improved tracheal sealing characteristics has led to tremendous change. The aim of this study was to compare MPTT Vs CETT in paediatric laparoscopic surgeries. **Methodology:** After obtaining Institutional Ethical Committee clearance, 60 children in age group of 6-18 years belonging to ASA I and II, posted for elective laparoscopic surgery under general anaesthesia were allocated into Group MPTT or Group CETT based on computer generated randomization table. Oral Intubation was done using direct laryngoscopy with either MPTT or CETT and the cuff was inflated using the cuff pressure manometer till no audible leak was heard. The airway sealing pressure was noted immediately after intubation. Cuff pressure was monitored and limited to 20 cmH2O with a pressure release valve. Cuff pressure, SpO2, EtCO2 were noted every 15 minutes. **Results:** We found that, sealing pressure was lower in MPTT group. Intraoperative cuff pressure at different intervals of time were lower in the MPTT group compared to CETT group. There was lesser incidence of sore throat, hoarseness with MPTT whereas tube exchange rate was comparable in both the groups. **Conclusion:** We concluded from our study that MPTT can be safely used in children if cuff pressure is compulsorily monitored as they have lower sealing pressures, minimal intra cuff pressure variations and fewer incidence of postoperative complications namely sore throat and hoarseness.

KEYWORDS : Cuffed Endotracheal Tubes, Microcuff Paediatric Tracheal Tubes, Cuff Pressure

INTRODUCTION

One of the fundamental skills of an anaesthesiologist is management of the airway. Endotracheal intubation is a routinely preferred technique of securing the airway in the conduct of anaesthesia.

In Paediatric airway management, Uncuffed Endotracheal Tubes (UETT) were always thought to be a safe practice. But with the use of UETT, anaesthesiologists face the difficulty to regulate tracheal seal with change in pulmonary compliance. Cuffed Endotracheal Tubes (CETT) were not routinely used due to concerns of airway edema in the post-extubation period.

Microcuff Paediatric Tracheal Tubes (MPTT) are newly designed cuffed tubes with improved tracheal sealing characteristics that have been used in paediatric airway management[1]. The design and construction of MPTT fulfills various criteria's like:

1) Clear insertion depth mark.
2) Short distally placed cuff in order to obtain a subglottic cuff free zone.
3) Short tip omitting the Murphy's eye.
4) Sufficient margin of safety against accidental endotracheal intubation/ extubation during head flexion or extension respectively.
5) High volume, low pressure cuff able to seal the airway at a cuff pressure below 20 cmH_2O. [2]

The cuff of MPTT is made up of ultrathin (10 micrometer) polyurethane foil instead of the much thicker (50-70 micrometer) polyvinyl chloride or polyethylene foils. Polyurethane cuff adds very little to outer diameter of the tube, is gentle to the tissue, drapes to the respiratory mucosa and to itself without folds and fissures thus preventing micro-aspiration. [2]

Paediatric Laparoscopic surgeries are associated with reduced pulmonary compliance due to pneumoperitoneum and various positions. Ineffective ventilation, excessive air leak with uncuffed tubes, caudal displacement of tracheal tubes resulting in endobronchial tube migration is very common. There is potential risk for aspiration. All these complications can be effectively addressed with the use of Microcuff paediatric tracheal tubes (MPTT) which gives the advantage of constant minute ventilation, precise respiratory monitoring and capnography, low fresh gas flow and decreased risk of pulmonary aspiration.[3]

OBJECTIVES

Primary Outcomes –

1) Sealing pressure
2) Intracuff pressure changes
3) Adequacy of ventilation in terms of capnography & SpO_2.

Secondary Outcomes-

1) Intra-operative complications like Tube Migration, desaturation
2) Postextubation stridor
3) Side effects like sore throat, hoarseness of voice, airway Obstruction.

METHODOLOGY

After obtaining institutional ethical committee clearance, 60 children in age group of 6-18 years posted for elective laparoscopic surgery under general anaesthesia were included in this study. Children were allocated into Group MPTT or Group CETT based on computer generated randomization table. Written and verbal informed consent was obtained from parent/guardian. A detailed medical history, physical examination, and necessary preoperative investigations were done. All children were kept NPO as per institutional NPO guidelines. All children were premedicated with oral Midazolam 0.5 mg/kg 30 minutes prior to surgery. An IV line was secured and IV fluids started based on Holliday Segar formula. Upon shifting the children to OT, monitors like SpO_2, ECG and NIBP were connected and the baseline recordings noted. All children were premedicated with Injection Glycopyrrolate 0.01mg/kg, Injection Ondansetron 0.1mg/kg. Children were induced with Injection Propofol 2mg/kg and analgesia with injection fentanyl 2mcg/kg, relaxed with Scoline 1.5mg/kg. Direct laryngoscopy was performed and oral Intubation done with either MPTT or CETT depending on the group allocation and the cuff was inflated using the cuff pressure manometer till no audible leak was heard.

Air leak pressure after intubation was tested with the child in supine position and head in a neutral position. The cuff was inflated using the cuff pressure manometer. Cuff pressure was monitored and limited to 20 cmH_2O with a pressure release valve. Minimal sealing pressure was assessed under steady state ventilation conditions and was maintained during the procedure. This was done by reducing the cuff pressure until an audible air leak appeared at the patient's mouth and then pressure was increased until leak disappeared.

- Proper positioning of the tube was confirmed.
- The initial cuff pressure was noted down as CPi.
- The airway sealing pressure was noted down as SP immediately after intubation.
- Cuff pressure, SpO_2, $EtCO_2$ were checked every 15 minutes.
- Maintanence of anaesthesia was done with O_2 + air + isoflurane + fentanyl + non-depolarising muscle relaxant.
- Towards the end of surgery all children were reversed with Inj. Neostigmine + glyco-p. All children were extubated after adequate respiratory efforts were noted.

DISCUSSION

Maintaining a patent airway is always a major concern for

anaesthesiologists during general anaesthesia. High-volume low-pressure cuffs like PVC Endotracheal tubes provide adequate seal of upper airway, while pressurising the mucosal blood supply of trachea resulting in the development of tracheal and subglottic complications.

However, leakages occurring down the longitudinal folds on the cuff membrane when inflated, resulting in micro-aspiration[5]. Sore throat, hoarseness of voice, tracheal necrosis, stenosis, laryngeal nerve palsy and trachea-esophageal fistula are all potential risks when intraoperative ETT cuff pressure is excessively high[6] and paediatric patients are at higher risk of developing these complications due to anatomic variations and hyperreactive airway reflexes.[7]

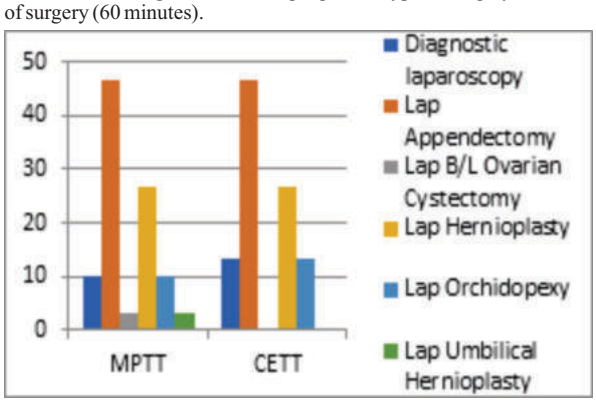
The Microcuff Paediatric Endotracheal tube is specifically designed for paediatric airway with correct anatomical design. The cuff is made from ultrathin polyurethane foil and is short and when inflated, it expands below the sub-glottis providing a seal with cuff pressures <15 cmH_2O. Thus, the problem that the cuff will cause airway mucosal injury, leading to sub glottic stenosis is circumvented.

The cuff pressure measurement is a top order procedure to prevent and minimize the complications associated with the use of cuffed endotracheal tubes. Various devices are available to measure and regulate cuff pressures from simple pop off valves and manometers to expensive automated pressure.[2,4]

The size selections were based on Khine's formula with clear insertion depth marks with good margin of safety to prevent accidental endobronchial intubation and extubation against movement of head.

The present prospective randomized study was undertaken to compare two groups, Group MPTT and Group CETT in the paediatric patients undergoing elective laparoscopic surgeries under General anaesthesia (30 patients in Group MPTT and 30 patients in Group CETT).

Both groups were comparable and there was no statistically significant difference with regards to mean age, gender, type of surgery, duration of surgery (60 minutes).



Graph-1:Type of Surgery (% of Cases)

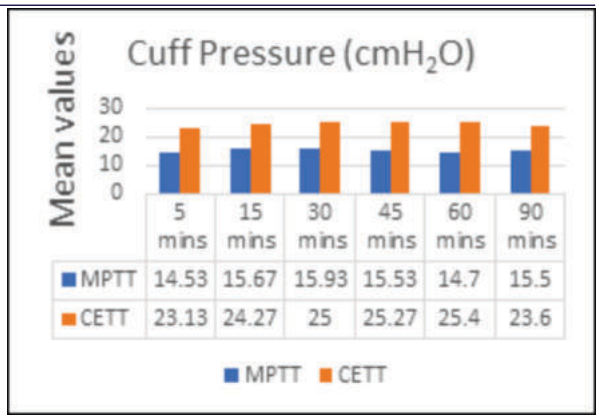
Haemodynamic parameters like Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure, Mean arterial pressure, SpO_2, $EtCO_2$ measured at baseline, 5 min, 15 min, 30 min, 45 min, 60 min and 90 min were comparable in both the groups.

Table-1:Comparison of Outcomes

Parameters	MPTT	CETT	P value
ETT Sealing Pressure (Mean ± SD)	12.74±1.62 cmH2O	21.34±2.67 cmH2O	0.001
Initial Cuff pressure (Mean ± SD)	14.4±1.85 cmH2O	23.2± 3.05 cmH2O	0.001
Sore throat(n)	2	9	
Hoarseness(n)	1	4	0.023
Tube exchange(n)	1	2	

One of the primary objectives was to compare sealing pressure between the two groups. The mean sealing pressure was lower in the MPTT group compared to CETT group (table 1) which was statistically highly significant (P value of 0.001).[8,9]

In our study (table 1), the initial cuff pressure was lower in the MPTT group compared to CETT group which was statistically highly significant (p value of 0.001).



Graph-2:ETT Cuff Pressure at Different Intervals

The cuff pressure changes at different time intervals was lower in the MPTT group compared to CETT group.[10]

Post extubation complications like sore throat was seen in 6.9% and 30% of patients in MPTT group and CETT group respectively(Table 1).[11]

In our study, the incidence of hoarseness of voice was 3.3 % and 6.6 % of patients in MPTT group and CETT group respectively. Tube exchange rate was comparable in both the groups. None of the patients developed post extubation stridor, airway obstruction or desaturation.

CONCLUSION

Microcuff Paediatric tracheal tubes can be used safely in paediatric laparoscopic surgeries with lower sealing pressures and minimal intra cuff pressure variations, thus reducing post-operative complications provided the cuff pressures are monitored intra operatively. Paediatric cuffed endotracheal tubes can be replaced with Microcuff paediatric tracheal tubes whenever feasible as these have superior outcomes when compared to the cuffed tubes.

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