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Original Research Paper

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UNIQUE MANUFACTURING DEFECT IN PVC ENDOTRACHEAL TUBE- A DIAGNOSTIC DILEMMA

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ABSTRACT Cuffed endotracheal tube is the gold standard of airway control in anaesthetized patients and in those patients, who have unprotected cough reflex. Along with the expertise in technique of insertion of endotracheal tube, its physical as well as functional integrity is essential. According to anaesthesia (ASA/ASTM) standards, pre checking of endotracheal tube (ETT) is must, which involves visual inspection along with observation of inflated cuff. We here describe a case of manufacturing defect in endotracheal tube which could not be detected by routine endotracheal tube checking.

KEYWORDS :

INTRODUCTION AND CASE REPORT

A 35 years-old female ASA grade I with chronic cholelithiasis was posted for laparoscopic cholecystectomy. Standard monitoring was attached as per ASA guidelines. Disposable PVC ETT size 7 mm was checked for any visible defect and cuff inflation system was checked. General Anaesthesia was induced as per standard anaesthesia protocol followed at our institute. Cuff was inflated with 4 mL of air and bilateral air entry was checked. There was leak and tidal volume of expiration was low along with low peak airway pressure. We inflated cuff with another 4 mL of air. Still leak was present and adequate tidal volume could not be delivered. We changed the ETT with one size larger (7.5 mm) and this time there was no leak. Surgery was uneventful and patient was discharged on next day.

On removing the ETT, we again were unable to find any obvious defect. The cuff was then inflated and immersed under water to see any leaks. This was done to check any micro leaks which may occur and may remain undetected in pre checkup, specially when adequate time is not given for observation of inflated cuff. The possibility of micro leaks has been described due to heat involved in the process of manufacturing cuffed endotracheal tube. In search of literature we found different patents with regard to manufacturing of endotracheal tubes, process of heating the thermosensitive tube and then embedding the inflating tubing into the wall being one common step. The defect we found was at the point of inflation tubing going into wall of the endotracheal tube where it might have had defect due to unique difficulties in manufacturing of medical grade cuffed tubes (Figure 1 and 2).

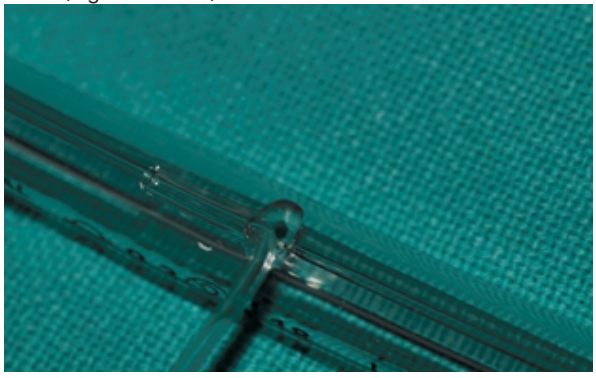

Figure 1: Defect in ETT

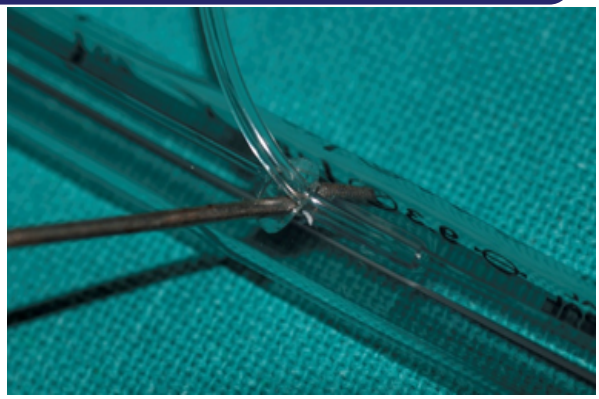

Figure 2: Defect in ETT

DISCUSSION

The process of manufacturing of cuffed endotracheal tubes involves numerous patents. There are two distinct ways of formation of cuffed tubes. One system involves making of main tube and cuff system (cuff, inflation tubing and pilot balloon) separately and then joining both together by various means like molding, casting or dipping, which may be into the preformed groove in the main lumen.(1) Another way is to use two different thermoplastic PVC material which behave differently with changing conditions of temperature and pressure to form cuff from single unit of molded endotracheal tube and then extending the inflation tube from the formed cuff.(2)

The main crux in all these manufacturing processes is utilization of thermoplastic quality of PVC material used in endotracheal tube and its cuff. This involves strictly controlled heating which may be by hot air blowing (1,2) or otherwise under specific pressure changes and either embedding the preformed inflation tube or forming the cuff in the same tube and extending the inflation tube through the wall of the main lumen. This change in temperature lends chances of persisting defects in the cuffed endotracheal tube which might have been in our case.

Also, the point of stress is that this is one area which can remain obscure to pre use visual inspection of endotracheal tube and also will not affect cuff inflation. Thus tube with undetected defect can be erroneously used and can lead to inadequate mechanical ventilation and re insertion of tubes which may lead to hypoxia and trauma.

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