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Two different endotracheal tube-manufacturing defects

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ABSTRACT

Introduction: Although manufacturing defects related to airway equipment are not so common in practice, it risks the safety of airway. The case report was presented to highlight two such manufacturing defects. Because prompt recognition of equipment malfunction can prevent life threatening complications. Case Series: Case 1: A 25 year old patient had anesthesia induction for septorhinoplasty surgery. After the patient was ventilated via mask and intubated without problem, peak and plateau pressures increased above 35 cmH2O on controlled ventilation. It was noticed that the anesthetic reservoir bag did not maintain adequate compliance in a setting of high peak and plateau pressure and was thought to be due to a faulty ETT connecter. We noticed that lumen of ET tube connecter was narrow and connecter has been changed. After this move, the relaxation of the balloon and a decrease in the ventilator pressures were noted. Case 2: A 45 year old female patient had anesthesia induction for hysterectionomy. After induction it was noted that there was a leak in the circuit, which was traced to the connection between the ETT and the inflation tube.. An opening at the point of the connection of the EET with the inflation tube was detected. ETT was changed upon that and anesthesia was maintained with no further problems. Conclusion: Difficult ventilation after successful endotracheal intubation can be due to equipment failure such as faulty ETT connecter and faulty inflation tube.

KEYWORDS

Endotracheal tube, Manufacturing defect, Leakage, Increased pressure

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INTRODUCTION

Endotracheal (ET) tubes are used for facilitating ventilation during various surgical procedures performed under general anesthesia. But, It is a known fact that there can be manufacturing defects of ET tubes used during anesthesia application [1, 2, 3]. Equipment should be checked for defects prior to anesthetic induction. If not recognized, they can be caused life-threatening problems during anesthesia application. We presented two cases to remind ET tubes’ manufacturing defects which caused adversely affected of ventilation.

CASE SERIES

Case 1: A 25 year old patient planned to undergo septorhinoplasty was evaluated as ASA I upon preoperative examination. The patient was taken to the operating theater and vascular access was inserted. His heart rate, peripheral oxygen saturation and blood pressure were monitored non-invasively. Anesthesia was induced with routine doses of propofol, vecuronium and fentanyl and the patient was ventilated via mask without problem. He was intubated with an ET tube with transparent and spirals (Saviour, LOT: 070801, size II/7.5mm, REF: 6675, Hangzhou Shanyou Medical Equipment CO. LTD, Hangzhou, C.H.C.). After it was observed that both lungs were equally ventilated, the ET tube cuff was inflated and ventilation was pass into control mode from manuel mode. Because peak and plateau pressures increased above 35 cmH2O during controlled ventilation, the ventilation was changed to manual mode. The lungs were auscultated again and normal lung sounds were heard. It was detected that the breathing bag did not inflate well during expiration along with inspiratory difficulty. The anesthesia devices were checked by detaching the ET tube from the anesthesia machine, and no problem was detected. Simultaneously, the patient was ventilated via an ambu-bag. Upon inspecting the ET tube, it was noticed that lumen of ET tube connector was narrow and connecter was immediately changed (figure 1). As soon as it was changed, the relaxation of the breathing bag and a decrease in the peak and plato pressures were noted. Difficulty with insertion of slyet was incidentally noted prior to intubation. In this process, there wasn’t decrease in the patient’s SpO2 level, its level continued 98-99 %.

Case 2: A 45 year old female patient in ASA II with a planned hysterectomy had anesthesia induction by routine doses of propofol, vecuronium and fentanyl for her surgery. She was intubated with a transparent ET tube of 7.5 mm (Kaishou LOT: 20061205, size 30/7.5, Jiangsu Kaishou Medical Apparatus Co., Ltd-PROC). Upon hearing the leaking air after the patient was intubated and the cuff was inflated, the system and ET tube was checked. No problems in the system were detected. Air leakage's localization was found by palpated and by listening leakage flow, a hole at the point of the connection of the ET tube with the inflation tube was detected (figure 2). ETT was changed upon that and anesthesia was maintained with no further problems. In this process, there wasn’t decrease in the patient’s SpO2 level.

DISCUSSION

Improperly checking anesthesia equipment and instrument prior to use can lead to patient injury and has also been associated with an increased risk of severe postoperative morbidity and
mortality. Therefore, in 2008, ASA recommendations for equipment checkout are recommends by Sub-Committee of ASA Committee on Equipment and Facilities. According to this guide, the following steps should be verified on a daily basis: 1) auxiliary oxygen cylinder and self-inflating manual ventilation device are available and functioning, 2) patient suction is adequate to clear the airway, 3) Turn on anesthesia delivery system and confirm that AC power is available, 4) availability of required monitors and check alarms, 5) pressure is adequate on the spare oxygen cylinder mounted on the anesthesia machine, 6) piped gas pressures are ≥ 50 psig, 7) vaporizers are adequately filled and, if applicable, that the filler ports are tightly closed, 8) there are no leaks in the gas supply lines between the flowmeters and the common gas outlet, 9) Test scavenging system function, 10) Calibrate of the oxygen monitor and check the low oxygen alarm, 11) carbon dioxide absorbent is not exhausted, 12) Breathing system pressure and leak testing, 13) gas flows properly through the breathing circuit during both inspiration and exhalation, 14) document completion of checkout procedures, and 15) confirm ventilator settings and evaluate readiness to deliver anesthesia care. Step 2, 4, 7, 11, 12, 13, 14 and 15 should be done prior to each procedure. In our department, anesthesia equipment are prepared in accordance with ASA recommendation (4).

For a safe airway and ventilation, not only anesthesia machine and equipment, but also the equipment used to provide the airway should be checked. There have been case reports of various equipment failures with respect to face masks and double lumen endotracheal tubes [1, 2, 10]. ET tube manufacturing defects are usually noticed during the preoperative preparation period. In preoperative preparation period, ET tube, particularly its cuff and lumen, should be checked. If manufacturing defect is not noticed in preoperative period, it can result in serious airway obstructions [1, 3, 7, 8, 9, 11] or air leakage during anesthesia [5, 6, 12]. If manufacturing defect of ET tube is suspected, then the faculty equipment must be immediately changed.

An airway obstruction should be kept in mind if the airway and breathing bag pressures are increasing or if there is ventilation difficulty before enough tidal volume is reached. When this happens one should switch to manual mode from controlled mode and the anesthesia system should be checked. If there is no problem in the system, the ET tube should be checked. Herniation of the ET cuff, kinking of the tube, intraluminal plastic film or obstruction by meniscus and obliteration of the ETT connector are the known manufacturing defects that can result in difficulty in ventilation [1, 3, 7, 8, 9, 11]. In case 1, there was a narrowing of the tube connector making ventilation difficult. There was a reported difficulty in inserting the stylet inside the tube which makes us think that this may have happened due to narrow lumen itself or total or near total occlusion or narrowing of the tube which may have been dilated by inserting the stylet.

Some manufacturing defects may cause air leakage and it may cause adverse effects on the ventilation [5, 6, 12]. When this happens, one can hear the leakage sound, a tidal volume is not enough and balloon and airway pressures decrease. Two cases reported in the literature were similar to our second case where they reported air leakage from the point of connection of inflation tube and air leakage due to an asymmetric cuff [5, 6, 12].

CONCLUSION

Although manufacturing defects are not so common, they risk the safety of airway. Therefore, it is important detailed control of anesthesia equipment against a possible manufacturing defect as well as anesthesia machine in preoperative period. When ventilation problems happen after a successful intubation, ventilator, anesthesia instruments (ETT, mask, LMA), devices and lungs
should be checked. Problem should be identified with a systematic approach and fixed. The case report was presented to highlight two such manufacturing defects. Because prompt recognition of equipment malfunction can prevent life threatening complications.

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Figure 1: Narrow orifice of tube connector (above) as compared to other tube of same size (below).

Figure 2: An opening at the point of the connection of the EET with the inflation tube.