Initial Misdiagnosis as a Tracheal Laceration: What Happens in Case of an Endotracheal Tube Cuff Over-Insufflation?

Endotracheal Tüp Kafının Aşırı Şişirilmesi Durumunda Ne olur? Trakeal Laserasyon Olarak Yanlış Ön Tanı

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ABSTRACT

Trauma is one of the main causes of death and disability in children. Depending on the severity of the trauma, the first intervention of pediatric trauma patients takes place at the trauma site and then they are transferred to a trauma center. In the meantime, due to the complications that may arise, necessary precautions should be taken quickly. An eleven-year-old boy was brought to our hospital with the pre diagnosis of chest blunt trauma caused by a car collision. During preliminary evaluation, chest X-ray and computed tomography revealed a sphere radiolucency that initially suggested a pneumomediastinum due to tracheal laceration. But after careful inspection, it was understood to be an endotracheal tube cuff over inflation. Endotracheal intubation is one of the first interventions that may be performed in emergency conditions, as well as being an elective intervention in operating theatre. Intubations performed in the trauma-scene, in the ambulance or operation room, where patient’s vital signs are in jeopardy -such as traffic accident or firearm injury- mistakes may arise and the end of the tube may not always go to the right place. It can end up in the esophagus or, thanks to its anatomical inclination, tip of the tube could easily be directed to the right main bronchus. In very rare cases, iatrogenic injuries can be encountered. Our case of overinflated endotracheal tube cuff is a good example of how a simple intubation maneuver can expose us to a highly morbid clinical condition such as tracheal rupture or pneumomediastinum.

Key Words: Tracheal laceration, endotracheal tube cuff over-insufflation, pneumomediastinum, trauma, childhood

Received: 07.25.2021 Accepted: 08.19.2021

ÖZET

Travma, çocuklarda ölüm ve sakatlığın önde gelen nedenlerinden biridir. Pediatrisk travma hastalanan travmanın şiddetine göre ilk müdahale travma yerinde yapılır ve travma merkezine sevk edilir. Bu esnada ortaya çıkabilecek komplikasyonlara karşı gerekli önlemler süratle alınmalıdır. Bir yıl es boysu endotrakeal tüp kafının aşırı şişirilmesi olduğu anlaşıldı. Endotrakeal intubasyon ameliyathanedede elektif olarak yapılan bir müdahale olmasının yarısı acil koşullarda yapılmasının gerekçelikle ilk müdahalelerden biridir. Koşulların zorlu olduğu (trafik kazası veya ateşi silah yaralanması gibi durumlarda) olay yerini, ambulans ve ya da serviste yapılan entubasyonlarda hata yapılabılır ve tümUCHER HAZIR step gidebilen bir anormi de görülebilir. Yekem borusuna kadar gidebilir veya anatomik eğimi sayesinde kolyaklıkla sağ ana bronş yönlendirebilir. Çok nadirde de olsa iatrojenik yaralanmalara sebep olabilir. Endotrakeal tük kafının aşırı şişirildiği bu olgumuz, basit bir entubasyon manevrasının bir trakeal ruptürü veya pnönomediastinum gibi morbidity deneyimlerin yüksek bir klinik durum ile nasıl karşı karşıya bırakabileceğinin güzel bir örneğidir.

Anahtar Sözcükler: Trakeal laserasyon, endotrakeal tük kafının aşırı şişirilmesi, pnönomediastinum, travma, çocuk

Geliş Tarihi: 25.07.2021 Kabul Tarihi: 19.08.2021

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INTRODUCTION

Trauma is one of the main causes of death and disability in children. Depending on the severity of the trauma, the first intervention of pediatric trauma patients takes place at the trauma site and then they are transferred to an emergency department (ED). Trauma mechanisms and the severity of trauma dictates the number of further disabilities or even death along with the effectiveness of interventions at the trauma scene and during ambulance transport as well as in the hospital.

From the simplest to the advanced life support, on-scene trauma care has a wide variety of interventions. At the very first stage, the most important attempt is to provide airway patency and oxygenation. Pre-hospital endotracheal intubation (ETI) is a lifesaving intervention which is usually difficult and can be associated with severe complications. If the team is inexperienced, ETI can lead to serious complications (1,2). Under pressure such as traffic collision site or firearm injury aftermath, an inexperienced hand may err, and tip of the tube doesn’t go in the right place. It may end up in esophagus or it may easily be directed to the right bronchus thanks to its anatomical inclination. Furthermore, one can cause serious injuries during the intubation process.

In this article, we present a pediatric trauma patient whose ETI was conducted at the trauma scene, then transferred to our center for subsequent trauma management. Through his radiology work-up, chest X-ray and chest computed tomography (CT) initially revealed a spherical radiolucent image resembling a pneumomediastinum around the endotracheal tube, suggesting a possible tracheal laceration but after careful physical and clinical examination, this clinical case was then diagnosed as endotracheal tube cuff over-insufflation mimicking a tracheal laceration.

CASE REPORT

An eleven-year-old boy was brought to the ED of our hospital for post-resuscitative care with the pre-diagnosis of chest blunt trauma caused by a car collision. The patient was intubated at the scene by emergency medical services staff, and he was brought to our ED with an endotracheal intubation. The medical history of under which conditions ETI was performed could not be obtained.

Physical examination performed in the ED showed that the patient’s vital signs were stable, Arterial Tension: 100/70 mmHg, respiration rate was 36, pediatric Glasgow Coma Score was 11 and pulse oximetry saturations were at 95%. Nasogastric and foley catheters were inserted, laboratory tests were performed. Meanwhile the patient continued to be inhaled through the endotracheal tube by mechanical ventilation in assisted control (A/C) mode under sedatization (Intravenous infusion of Midazolam 0.06 mgr/ kg/ hour).

Chest X-ray in ED setting revealed air densities around the trachea suggesting a possible tracheal laceration accompanying a left lung contusion (Fig.1). Then, chest CT was performed. Similarly, it was visualized that there was the same air density around the trachea in chest CT (Fig 2). Preliminary bronchoscopy was planned for the patient. After the stabilization of the patient was undertaken in the ED, he was hospitalized in the pediatric intensive care unit. Evaluating the patient’s chest X-ray once again in the intensive care unit, it was seen that the endotracheal tube tip was located further ahead and directed toward the right main bronchus. The patient’s tube was 6F in size which was appropriate for the age and body weight of the child. When the air in the endotracheal tube balloon was evacuated, it was observed that it was filled with 30 cc air. Endotracheal tube was pulled-back 3 cm to relocate to its new position and endotracheal balloon was distended with 5 cc of air.

To validate the new position of the endotracheal tube, chest X-ray was taken again. It was observed that the air density around the trachea disappeared (Fig 3). The patient’s blood’s gases were normal. Therefore, although bronchoscopy was originally planned in first place, it was decided to monitor the patient without bronchoscopy.

As the blood gases of the patient who was follow-up in the mechanical ventilatory returned to normal, weaning protocol was initiated and then the patient was extubated subsequently. The patient was transferred to the pediatric surgery service from the intensive care unit the next day and was discharged 3 days later uneventfully. No finding of a tracheal stenosis was observed in the 6-month follow-up of the patient.
Endotracheal intubation is performed daily anywhere in and out of healthcare facilities such as an emergency department, intensive care unit or an outdoor trauma scene. Complications encountered in this process show up in a wide range from a mild airway edema to a life-threatening tracheal stenosis or rupture (3).

In our case, the patient was intubated at the trauma site. Since there is no way to radiologically evaluate the position of endotracheal tube outdoors, one has to depend on auscultation to understand that the tube is in the right place. If the case is a severe injury which is far away from a trauma center, there is no time to “play and stay” but to “scoop and run” as was possibly happened in our case. In such emergent situations, endotracheal intubation is maintained but there may not be enough time to evaluate any complications of the intubation procedure. According to Gellerfors et al, the success rate of pre-hospital tracheal intubation was 98.7% and complications arising from this procedure were recorded in 10.9% of the cases (2).

Pediatric intensive care units are another setting that the emergent endotracheal intubation is carried out. According to Carroll et al, emergency intubations in intensive care units in children, emergent endotracheal intubations were two-fold more likely to happen in off-hours and were associated with three-fold risk of complications compared to nonemergent intubations (4). In the absence of an intensivist or an anesthesiologist off-hours, most non-anesthesiology or pediatric trainees without enough experience perform these intubations and such complications may be attributed to this lack of experience.

In another study in children, it was shown that the complications of ETI are higher in rural areas. Ehrlich et al reported that complications were encountered in 23% of children with ETI. Approximately 9% of the outdoor cases had complications compared with 29% at the transferring hospitals and only 4% complications took place at the trauma center. As the attempt to intubate raised, airway complication risk inclined with repeated attempts as well with a 2.5-fold. They encountered aspiration and mainstem intubation as the most common complications (1).

In pediatric ETI, tube malposition and left lung atelectasis is encountered with a high rate due to malposition of endotracheal tube (ET). Simons et al reported that in pediatric trauma patients, approximately 33% cases had their endotracheal tubes in the right position (6). In our case initially left lung was visualized as a trauma related left lung contusion. However, it was understood that after the endotracheal tube balloon air was evacuated and the tube was withdrawn back 3 cm, radiology revealed no more lung contusion images in his new chest X-ray.

Tracheal rupture is a rare condition that causes a pneumomediastinum and is mostly associated with head, neck and thoracic trauma. Iatrogenic post-intubation tracheal ruptures are extremely rare but severe complications are estimated to occur in 0.005%-0.37% of intubations. This can result in significant morbidity and mortality. If the cuff of endotracheal intubation tube is over-inflated, it may cause complications (6,7).

Tracheal laceration has conventionally been repaired by surgical means (1,8). There is a growing inclination with non-operative management for certain patient groups, in some of whom have mild symptoms because of a minimal tracheal tear or have no complicated clinics along with an esophageal injury. Added to these group were also clinically stable patients with minimal mediastinal emphysema with or without nonprogressive air leaks (8,9).

Pneumomediastinum in children is a rare condition that can occur due to different etiologies. It occurs because of air entering the bronchoalveolar tissue and mediastinum after tracheal and bronchoalveolar rupture. In patients with pneumomediastinum, blunt trauma has been accounted for 10% of patients with severe blunt thoracic and cervical trauma (8).

It has also been reported in foreign body aspiration, cardiopulmonary resuscitation, after tonsillectomy, and spontaneously. It has also been reported in the literature among complications of endotracheal intubation. Its treatment is primarily conservative. Rarely surgical intervention may be required (6-9).

In our case, the appearance on the chest X-ray revealed a sphere-like radiolucency that initially suggested a pneumomediastinum due to tracheal laceration. Loss of air density in the mediastinum after ET’s cuff was evacuated did not rule out the possibility of damage to the trachea. However, the patient was followed up conservatively against a possible tracheal laceration in pediatric intensive care unit. The patient was also followed up for tracheal stenosis in our outpatient clinic that may develop as a long-term sequel. No complication occurred during the patient’s hospital stay or within 6 months follow-up after discharge.

CONCLUSION

In our case, although the diameter of the ET was suitable for the age and weight of the child, its cuff was filled with excessive air. But such ET’s are produced with a low pressure and high-volume cuff. The flexible cartilage structure of the child trachea at the stage of development was able to stretch without tearing the tracheal wall. Therefore, emergency clinicians, anesthesiologists, intensivists, and pediatric surgeons who give medical care to pediatric trauma patients should be aware of possible ETI complications and our case is a teaching example of how a simple intubation maneuver, even filling the tube balloon could mislead us to a highly morbid clinical entity such as tracheal tear or pneumomediastinum.

For this reason, meticulous attention should be paid to cuff pressure during preliminary intubation. Before carrying out the imaging procedures, the location of the intubation tube and the cuff pressure should be checked at all times.

Conflict of interest

No conflict of interest was declared by the authors.

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