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SUBCUTANEOUS EMPHYSEMA DUE TO PNEUMOTHORAX FOLLOWING TRACHEOTOMY

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ABSTRACT

Because of the decrease in life-threatening obstructive upper airway infections and the ongoing improvement in intensive care medicine, the role of tracheotomy in children has changed considerably. The incidence of pneumothorax following tracheotomy is reported to be 0% to 17%, depending on the age group studied.

Case: A 2.5-year-old boy had undergone two tracheotomies at different times due to respiratory difficulties, and when his respiration improved he was decannulated, and one week later discharged from the hospital. The patient was admitted to our hospital with respiratory difficulties, and the diagnosis was established as subglottic stenosis. Therefore, a tracheotomy was performed. Early the next morning, the patient had respiratory difficulty and then tachypnea, tachycardia, cyanosis of the lips, and widespread subcutaneous emphysema in the cervical, thoracal, and abdominal areas were observed. Although the cannula was replaced, ventilation with 100% O_2 was performed, and steroid and theophylline were administered, SpO_2 value did not rise above 72%. The pulmonary sounds were weaker on the left side than on the right, which suggested pneumothorax. Upon this finding, the intrapleural space was penetrated with a 16 G catheter on the left midclavicular line through the 2nd intercostal space, and approximately 30 cc of air was aspirated. One minute after this intervention, SpO_2 value gradually rose as high as 96%.

Conclusion: When pneumothorax is suspected in a patient under anesthesia or awake, the diagnosis should be established immediately by taking the symptoms and physical examination findings into consideration and air should be aspirated without delay through the 2nd intercostal space on the midclavicular line.

Key Words: Tracheotomy, Pneumothorax, Subcutaneous Emphysema

TRAKEOTOMİDEN SONRA GELİŞEN PNÖMOTORAKSA BAĞLI DERİALTI AMFİZEMİ

ÖZ

Yaşamı tehdit eden obstrüktif üst solunum yolu enfeksiyonlarındaki azalma ve yoğun bakım tedavisindeki gelişmeyle çocuklardaki trakeotomi uygulamaları oldukça fazla değişikliğe uğramıştır. Trakeotomiden sonra gelişen pnömotoraks insidansı, yaş grubuna bağlı yapılan çalışmalarda % 0 - % 17 arasında rapor edilmiştir.

Olgu: 2,5 yaşında, erkek çocuk hasta, solunum sıkıntısı nedeniyle farklı zamanlarda 2 kez trakeotomi yapılıp, solunumu rahatlayınca dekanüle edilerek bir hafta sonra taburcu edilmiştir. Hasta daha sonra solunum sıkıntısı nedeniyle hastanemize başvurdu. Subglotik stenoz tanısı konulan hasta hastaneye kubul edildi ve trakeotomi açılıp, kanül yerleştirildikten sonra servise yollandı. Ertesi gün sabaha karşı solunum sıkıntısı olan hastada; takipne, taşikardi ve dudaklarda siyanoz ile birlikte boyun, göğüs ve karın bölgesinde yaygın derialtı amfizemi gözlendi. Kanülün değiştirilmesi, %100 O_2 ile ventile edilmesi, steroid ve teofilin verilmesine rağmen SpO_2 değeri %72'nin üzerine yükselmedi. Dinlemekle akciğer sesleri sol tarafta sağa göre çok zayıftı. Bunun üzerine pnömotoraks olduğu düşünülerek, 16 G intraket ile midklavikular hat üzerinde 2. interkostal aralıktan interplevral boşluğa girilerek yaklaşık 30 cc hava aspire edildi. Bundan 1 dakika sonra, SpO_2 değeri yavaş yavaş %96' ya kadar yükseldi.

Sonuç: Anestezi altında ya da uyanık hastada pnömotoraks olduğu düşünüldüğünde, semptomlar ve fizik muayene bulguları gözönünde bulundurularak tanı hemen konulmalı ve midklavikular hat üzerinde 2. interkostal aralıktan gecikmeksizin hava aspire edilmelidir.

Anahtar Kelimeler: Trakeotomi, Pnömotoraks, Subkutanöz Amfizem.

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INTRODUCTION

Tracheotomy is an operation with many potential complications (1). Because of the decrease in life-threatening obstructive upper airway infections and the ongoing improvement in intensive care medicine, the role of tracheotomy in children has changed considerably (2). Pediatric anatomical anomalies that may necessitate tracheotomy are most often manifested in the neonatal period or in infancy, although some may not appear until childhood. The most common abnormalities include vocal cord paralysis, subglottic and tracheal stenosis, cystic hygroma, tracheal hemangioma, and laryngeal cyst (3-5). Intraoperative and postoperative complications specifically associated with this procedure have been well established. The incidence of pneumothorax ranges from 0% to 17%, depending on the age group studied (6).

Pneumothorax, regardless of its aetiology, presents with clinical symptoms depending on the amount of intrapleural air contained. The air accumulating above a certain level may lead to life-threatening effects on the respiratory and circulatory systems. Thus, timely diagnosis and urgent intervention are crucial.

CASE REPORT

A 2.5-year-old male patient weighing 13 kg had undergone two tracheotomies at different times due to respiratory difficulties, and when his respiration improved, he was decannulated. The patient was admitted to our hospital with respiratory difficulties, and the diagnosis was established as subglottic stenosis. Cervical CT did not reveal any pathologic abnormality. Therefore, laryngoscopy followed by bronchoscopy was performed under general anaesthesia. During the intervention, a hemangioma was detected on the posterior wall of the trachea. Then a tracheotomy was performed and the patient sent to the pediatric clinic. Early the next morning, the patient had respiratory difficulty; thus, oxygen and steroid were administered. In the following hours, tachypnea, tachycardia, cyanosis of the lips, and widespread subcutaneous emphysema in the cervical, thoracal, and abdominal areas were observed. The patient was then immediately wheeled into the operation room and was infused iv with ketamine 1 mg/kg-1 for anaesthesia in order to check the position of the tracheotomy cannula. Then the cannula was replaced, ventilation with 100% O_2 was performed, and steroid and theophylline were administered; despite all these, the SpO2 value did not rise above 72%. The pulmonary sounds were weaker on the left side than on the right, which suggested pneumothorax. Upon this finding, the intrapleural space was penetrated with a 16 G catheter on the left midclavicular line through the 2nd intercostal space, and approximately 30 cc of air was aspirated. One minute after this intervention, the SpO_2 value gradually rose as high as 96%. Since urgent intervention was necessary, a chest radiograph could not be obtained before the procedure. However, the chest ra-

diography performed after the intervention did not reveal any pathology. When the patient's respiration improved, he was moved to the ward with recommendations of frequent aspiration through the cannula and O_2 and steam application.

DISCUSSION

Within recent decades, long-term intubation and congenital anomalies of the upper respiratory tract have become increasingly prevalent, whereas inflammatory diseases have become less and less an indication for tracheotomy. Endotracheal intubation as an alternative has resulted in less frequent tracheotomies in general. Children can be ventilated for months without considerable complications. However, individual, clinical, and fiberoptical controls are necessary (2). Age, underlying disease, and prior endotracheal intubation are correlated with increased complications (7,8). Tracheotomy-related complications have not changed significantly. The most frequent causes of tracheotomy-related death are cannula obstruction and accidental decannulation. The most frequent early complications are pneumomediastinum, pneumothorax, wound complications, and bleeding. Subsequent complications most often are granulations and tracheal stenosis (2). In infants and children, the apices of the pleura may reach the base of the neck. Direct injury to the pleura during tracheotomy may result in pneumothorax (9). The incidence of pneumothorax following tracheotomy in children is reported to be 7.4% to 17% (5,7,9). Tension pneumothorax may account for as much as 25% of pneumothorax cases in children (10).

Tissue trauma during tracheal dilatation or tracheotomy may cause pneumothorax when positive pressure ventilation is employed (11). Following tracheotomy, dissection of air through the fascial planes in the neck may cause pneumomediastinum or subcutaneous emphysema, but is unlikely to cause pneumothorax. Posterior tracheal wall injury in the absence of applied positive pressure is unlikely to produce pneumomediastinum or pneumothorax. An increased intrathoracic negative airway pressure may facilitate the dissection of air through the tracheotomy wound into the thoracic cavity when the patient struggles to breathe against an upper respiratory tract obstruction (9).

Our patient, who was suffering from acute respiratory distress, was urgently admitted to the operating room upon suspicion that his tracheotomy cannula was clogged. Although his cannula was replaced with a new one and he was respired with 100% O2, his situation did not improve. Consequently, he was then given theophylline and steroid based on the idea that there existed laryngeal edema and broncnospasm. Despite all these, the SpO2 value did not rise above 72%. The pulmonary sounds were weaker on the left side than on the right, which suggested pneumothorax.

Pneumothorax detected in our patient (Figure) was considered to be associated with the parietal pleural penetration rather than tissue damage. The severe respiratory difficulty of the patient observed after 24 hours can be accounted for as follows: throughout the tracheotomy procedure, the pleura

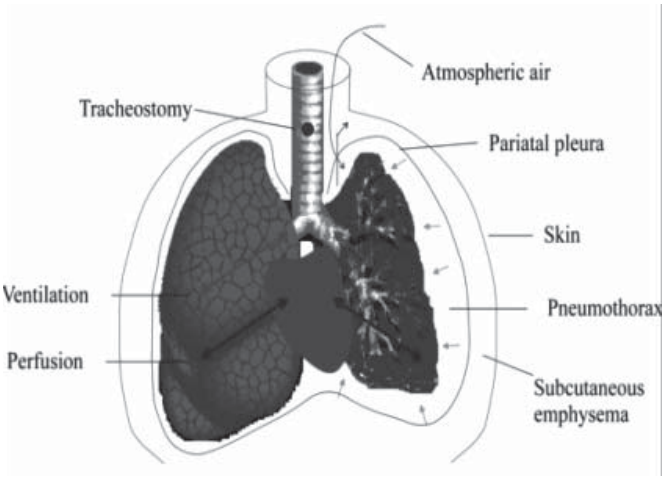

Figure: The mechanism of pneumothorax and subcutaneous emphysema.

was opened; hence, at each inspiration, some air had entered into the pleural space. The intrapleural pressure that increased during the expiration of the patient resulted in closure of the pleural hole with the ventil mechanism, and as a result the air in the pleural space was pushed into the subcutaneous space rather than into the atmospheric area. The increased subcutaneous tissue pressure responsible for the widespread emphysema had exceeded the intrapleural pressure, and the air had started to accumulate in the pleural space. Thus, tension pneumothorax developed and the patient started to have respiratory difficulties. Subcutaneous emphysema is not always a symptom of pneumothorax for patients with tracheotomy. However, the risk of pneumothorax must always be taken into consideration in cases in which subcutaneous emphysema is encountered. The subcutaneous emphysema delayed the signs of tension pneumothorax. The patient was relieved after the aspiration of the approximately 30 cc of air in the intrapleural space with a 16 G catheter. One minute after this intervention, the SpO_2 value gradually rose as high as 96%. Since there was no tissue trauma, the patient had no respiratory difficulties afterwards.

Emergency physicians should be able to quickly evaluate and initiate therapy for tracheotomy tube obstruction, tracheal hemorrhage, interstitial air leading to pneumothorax, and infections throughout the lower respiratory tract. Prompt diagnosis and treatment will markedly decrease associated morbidity and mortality (11,12). Percutaneous needle puncture of the involved hemithorax may be used for emergency treatment of tension pneumothorax. This will make pleural pressure atmospheric and allow subsequent treatment of the pneumothorax as a simple pneumothorax (13,14). Tracheotomy is a safe operation even in small children, but cannula-related complications may lead to life-threatening events. The management of tracheotomized small children and infants in a highly staffed and monitored intensive care unit has allowed better handling of complications and decreased cannula-related deaths (5,15).

In pediatric patients, some authors concluded that it would be prudent to continue obtaining postoperative chest ra-

diographs following all pediatric tracheotomies (16), while some authors concluded that chest radiographs of all pediatric patients after tracheotomy may be unnecessary with the use of flexible endoscopy and screening restrictions that are both health-conscious and cost-effective. Chest radiograph-screenable complications occurred in patients who underwent emergent recannulation, as well as those who exhibited ventilatory distress (oxygen saturation level of <90%) and specific changes in postoperative symptoms (17).

After tracheotomy and cannulation, it is more appropriate to have chest radiographs, particularly for pediatric patients, like in ours. However, immediately after this process, regardless of their normal chest radiograph results, in order to eliminate the risk of pneumothorax and other complications, which may develop in the subsequent hours, patients of these types must be closely screened for at least 24 hours.

In conclusion, when pneumothorax is suspected in a patient under anesthesia or awake, the diagnosis should be established immediately by taking the symptoms and physical examination findings into consideration. Planning to determine the diagnosis based on chest radiography before the treatment will delay diagnosis, which can be life threatening for the patient. In such cases, similar to as in ours, a suitable catheter should be inserted though the 2nd intercostal space on the midclavicular line and the air should be aspirated without delay.

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REFERENCES

1- Jacobs JR, Thawley SE, Abata R, Sessions DG, Ogura JH. Posterior trachea laceration: A rare complication of tracheostomy. Laryngoscope 1978; 88: 1942-6.

2. Kremer B, Botos-Kremer Al, Eckel HE, Schlondorff G. Indications, complications, and surgical techniques for pediatric tracheotomies - an update. J Pediatr Surg. 2002; 37: 1556-62.

3. Cohen SR, Eavey RD, Desmond MS, May BC. Endoscopy and tracheotomy in the neonatal period: a 10-year review, 1967-1976. Ann Otol Rhinol Laryngol. 1977; 86: 577-83.

4. Schild JA and Holinger LD: Peroral endoscopy in neonates. Int J Pediatr Otorhinolaryngol 1980; 2: 133-8.

5. Simma B, Spehler D, Burger R, Uehlinger J, Ghelfi D, Dangel P, Hof E, Fanconi S.Tracheostomy in children. Eur J Pediatr. 1994; 153: 291-6.

6. Smith DK, Grillone GA, Fuleihan N. Use of postoperative chest x-ray after elective adult tracheotomy. Otolaryngol Head Neck Surg. 1999; 120: 848-51.

7. Gaudet PT, Peerless A, Sasaki CT, Kirchner JA. Pediatric tracheostomy and associated complications. Laryngoscope. 1978; 88: 1633-41.

8. Line WS Jr, Hawkins DB, Kahlstrom EJ, MacLaughlin EF, Ensley JL. Tracheotomy in infants and young children: the changing perspective 1970-1985. Laryngoscope 1986; 96: 510-5.

9. Berg LF, Mafee MF, Campos M, Applebaum EL. Mechanisms of pneumothorax following tracheal intubation. Ann Otol Rhinol Laryngol. 1988; 97: 500-5.

10. Nakayama DK, Ramenofsky ML, Rowe MI. Chest injuries in childhood. Ann Surg 1989; 210: 770-5.

11. Grambrill VL. Diagnosis and treatment of tension pneumothorax under anesthesia: A case report. AANA J. 2002; 70: 21-4.

12. Tayal VS. Tracheostomies. Emerg Med Clin North Am. 1994; 12: 707-27.

13. Mattox KL and Allen MK. Systematic approach to pneumothorax, haemothorax, pneumomediastinum and subcutaneous emphysema. Injury 1986; 17: 309-12.

14. Obeid FN, Shapiro MJ, Richardson HH, Horst HM, Bivins BA. Catheter aspiration for simple pneumothorax (CASP) in the outpatient management of simple traumatic pneumothorax. J Trauma 1985; 25: 882-6.

15. Saad SA, Groff DB. Tracheostomy in children without heart disease. Am Surg. 1978; 44: 296-9.

16. Greenberg JS, Sulek M, de Jong A, Friedman EM. The role of postoperative chest radiography in pediatric tracheotomy. Int J Pediatr Otorhinolaryngol. 2001; 60: 41-7.

17. Darden D, Towbin R, Dohar JE. Pediatric tracheotomy: is postoperative chest X-ray necessary? Ann Otol Rhinol Laryngol. 2001; 110: 345-8.