

**Trachea and Laryngeal Rupture Induced Pneumomediastinum in Psychiatric Patients :
A Case Report**

Wa Ode Zerbarani^{1,*}, Sri Asriyani¹, Eny Sanre¹

¹Department of Radiology, Medical Faculty of Universitas Hasanuddin, Makassar, South Sulawesi, Indonesia

*Corresponding Author. Email: waodezerbarani@gmail.com, Telp: +6281346418215

ABSTRACT

Introduction: Laryngeal rupture is a potentially life-threatening aerodigestive injury, especially in cases with slow treatment, which can occur spontaneously, iatrogenic or as a result of trauma.

Case: We present a case of pneumomediastinum due to sharp trauma causing a laryngeal rupture in a patient with psychiatric disorders. Pneumomediastinum is one of the complications that occur.

Discussion: Trauma history and clinical complaints are very helpful in establishing the diagnosis, and imaging has an important role in describing pneumomediastinum and other air leak syndromes so that early treatment can be done immediately.

Conclusion: The approach to diagnosing pneumomediastinum with imaging in psychiatric patients has an important role because of the lack of information about complaints and mechanisms of pneumomediastinum.

Keywords: laryngeal rupture, pneumomediastinum, psychiatric disorder, sharp trauma.



JMHSJ
Jambura Medical and
Health Science Journal

Article History:

Received 24 February 2022

Accepted 28 February 2022

Published 28 February 2022

Published by:

Universitas Negeri Gorontalo

Address:

Jl. Jend. Sudirman No.6, Gorontalo
City, Gorontalo, Indonesia

Mobile number:

+62852 3321 5280

Email:

jmhsj@ung.ac.id

Introduction

Pneumomediastinum or mediastinal emphysema is defined as the presence of air in the mediastinal space that occurs spontaneously or secondary to thoracic and iatrogenic trauma resulting from surgical, diagnostic or therapeutic procedures.¹⁻³ Traumatic perforation of the upper aerodigestive tract can cause significant morbidity and mortality. Clinical symptoms that arise are varied and sometimes non-specific, so pneumomediastinum is often missed at the time of diagnosis. Complaints such as chest pain, shortness of breath, sore throat, dysphagia and fever are frequently reported in patients with pneumomediastinum and emphysema or cervical subcutaneous crepitus, or a combination of the two is considered diagnostic of aerodigestive injury.^{1,4,5}

Imaging has a major role in establishing pneumomediastinums, such as chest X-rays, chest ultrasonography, and chest CT scans of pneumomediastinum.^{2,5,7} Management of aerodigestive trauma in patients with psychiatric disorders is a challenge because of the lack of information about complaints and trauma mechanisms that can complicate the early diagnosis of pneumomediastinum.⁶⁻⁸

Case

A 32-year-old man was admitted to the Emergency Department through a referral from a regional hospital with complaints of stab wounds to the neck experienced since 8 hours earlier. According to the family, the patient suddenly stabbed a knife into his neck, and several stab wounds appeared on the front side of the neck. The patient had received treatment at the previous hospital in suturing on several wounds. There was a disturbance in the voice but no breathing problems, difficulty swallowing, a history of fainting, and blood coming out through the nose and mouth. The patient has a history of self-talk with a chaotic flow, is difficult to understand the meaning and often hears whispers from unknown sources. The patient also had a history of smoking and using drugs for a long time.

The patient appeared conscious with normal vital signs and good orientation to the surrounding environment on physical examination. From inspection, there were several wounds with stitches on the right neck with pain status 4-6/10 with continuous intensity, the voice sounded hoarse, the patient did not appear short of breath, the patient was quite calm, but often daydreamed, eye and verbal contact were present, blunted affect, talk constantly, the content of thought is quite relevant but sometimes blocking. On palpation, crepitus was found in the area around the stab wound and also tenderness.

On laboratory examination, it was found that the leukocyte value was increased (16.000/UL). The patient underwent a chest X-ray and CT scan of the neck without contrast. A chest x-ray examination was carried out in the AP position and obtained a picture of pneumomediastinum and emphysema subcutis (Figure 1).

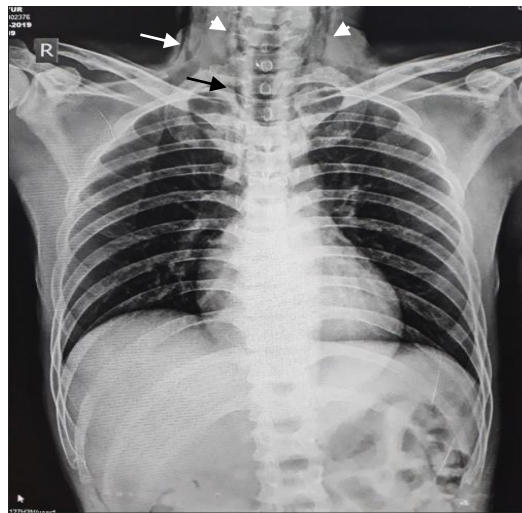


Figure 1. AP position chest radiograph showing linear lucency along the bilateral paratracheal planes (arrowheads). A lucent shadow surrounds the bilateral brachiocephalic trunk with a tubular artery sign (black arrow). And also found a lucent shadow in the Colli region impression on soft tissue (white arrow)

On CT scan of the neck without contrast, Pneumomediastinum was seen due to rupture of the trachea and larynx, skin defect of the anterior wall Colli at CV C5-C6 and right submandibular as high as CV C3 associated with lateral pharyngeal space, right submandibular fossa to retropharyngeal space, and emphysema subcutis neck region (Figure 2-4).

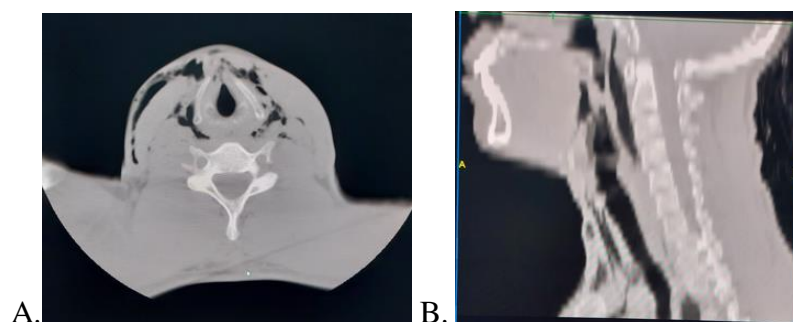


Figure 2. A laryngeal discontinuity is seen in relation to the anterior mediastinal wall at the level of CV C7

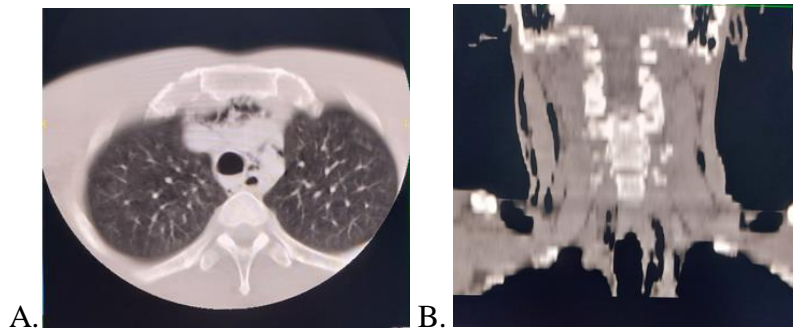


Figure 3. It is also seen that the tracheal discontinuity is as high as CV T3

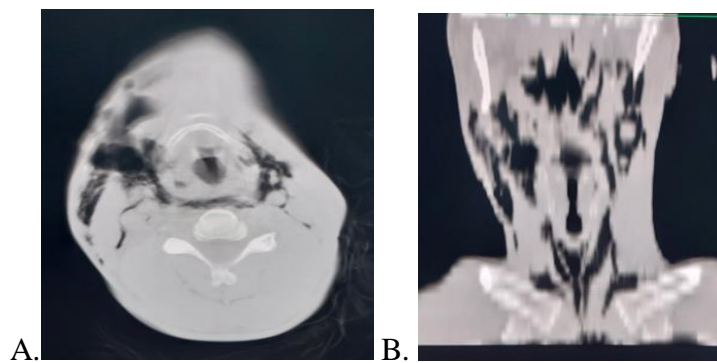


Figure 4. Multiple soft tissue defects in the anterior neck and submandibular which indicate a subcutis emphysema

The patient was treated for three days by three different departments, namely the surgical department, the ENT department and the psychiatry department. The patient showed a stable general condition, and if there were a worsening, the surgical department would perform a mediastinectomy. The ENT section failed to install the NGT because the patient refused. The psychiatry department diagnosed the patient with schizophrenia with signs of depression and was treated to stabilize the patient further.

Discussion

Laryngeal rupture is a potentially life-threatening aerodigestive injury, especially in slow-treated cases that can occur spontaneously, iatrogenic or as a result of trauma. Traumatic injuries to the larynx and cervical trachea are rarely reported in all age groups because some victims die before being brought to medical services. Complications caused by aerodigestive injuries in the form of pneumomediastinum, pneumothorax, pneumopericardium, pneumoperitoneum, to subcutaneous emphysema are included in the air leak syndrome, which can be life-threatening due to severe airway obstruction. Early recognition of laryngeal damage is the key to the life-saving management of the patient.^{1,6,8}

Pneumomediastinum or mediastinal emphysema is defined as the presence of air in the mediastinal space that can occur spontaneously or as a result of various processes that occur in the intrathoracic and extrathoracic. The causes of an iatrogenic pneumomediastinum include alveolar rupture, tracheobronchial branch laceration, bleb rupture, several conditions that cause increased intrapulmonary pressure, chronic lung diseases such as asthma, and violent coughing, and vomiting. At the same time, the causes of extrathoracic origin include facial trauma, laryngeal injury, tracheostomy action, from the retroperitoneum (e.g. from a diverticulum or duodenal ulcer), or the chest wall (subcutaneous emphysema around the tracheostomy drain). In our case, pneumomediastinum occurred due to sharp trauma to the larynx and trachea.^{1,3,9}

Research conducted by Damore (1991) and Stack (1996) stated that pneumomediastinum is most often found in men than women due to a tendency to activities that increase the risk of barotrauma, such as diving or frequent work that holds your breath. Traumatic injuries to the cervical larynx and trachea are rare in all age groups. This condition can present with subtle symptoms and signs and may seem trivial but life-threatening. In diagnosing tracheal and laryngeal injuries, it is important to know the mechanism of injury, changes in voice, and the patient's respiratory status. And it becomes difficult to establish an early diagnosis in psychiatric patients who are less able to describe the mechanism of injury and complaints that describe the process and causes of pneumomediastinum. Other important symptoms and signs listed can be seen in Table 1.^{2,9-11}

Table 1. Symptoms and signs of laryngeal or cervical tracheal injury

Pain over the anterior neck
Shortness of breath
Stridor
Inability to tolerate supine position
Inability to tolerate head extension
Hoarse, weak or absent voice
Haemoptysis
Bruising, lacerations or haematoma over the neck
Subcutaneous emphysema

Radiographic signs of pneumomediastinum depend on delineating the normal anatomic structures described by air as it leaves the mediastinum (Table 2).²

Table 2
Radiographic Signs of Pneumomediastinum

Subcutaneous emphysema
Thymic sail sign
Pneumoprecardium
Ring around the artery sign
Tubular artery sign
Double bronchial wall sign
Continuous diaphragm sign
Extrapleural sign
Air in the pulmonary ligament

Spinnaker sail sign

The spinnaker sail sign is a sign of the presence of air in the mediastinum seen on the chest X-ray of the neonate. This term refers to the visible appearance of the thymus being demarcated by air, the two lobes of the thymus being pushed laterally and seen as an elevated thymus resembling a “sail” image. Spinnaker sail sign (Fig. 5) is common with spontaneous anterior pneumomediastinum and usually resolves independently without specific treatment.^{1,2}

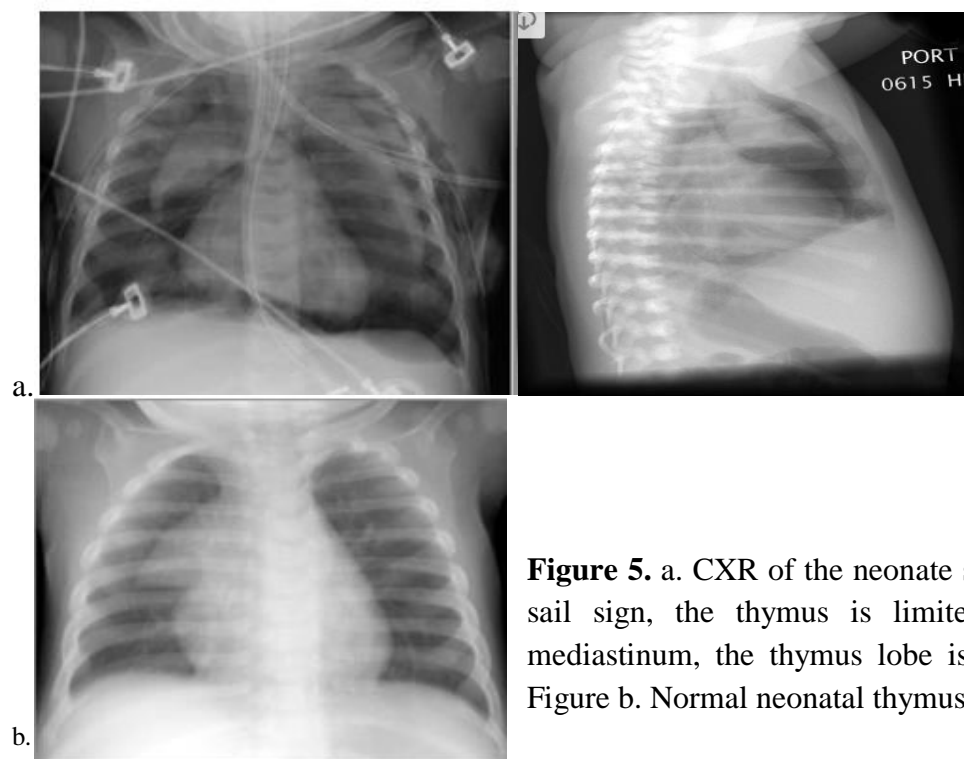


Figure 5. a. CXR of the neonate shows Spinnaker's sail sign, the thymus is limited by air in the mediastinum, the thymus lobe is shifted laterally. Figure b. Normal neonatal thymus appearance.^{1,2}

Pneumoprecardium

Pneumoprecardium is the presence of air in the anterior pericardium, namely between the sternum and the heart, which can be seen on the lateral radiograph. Spontaneous

pneumoprecardium is a rare case, especially in children. The most common cause was asthma (0.3%) and acute attack. Other causes are bronchiolitis caused by viruses, or respiratory tract irritation should also be considered.^{1,2}

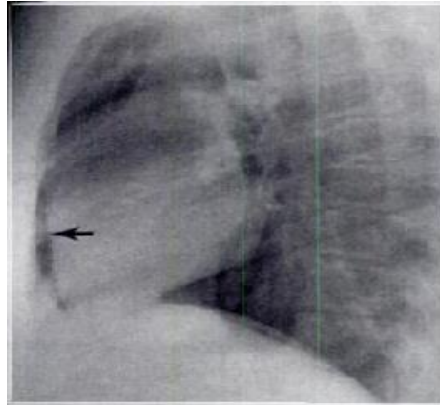


Figure 6. Pneumoprecardium in a post-tonsillectomy patient.^{1,2}

Ring around the artery sign

The ring around the artery sign is an image of air surrounding the pulmonary artery or one of its main branches, which produces a ring around the pulmonary artery, especially when air surrounds the intramediastinal segment of the right pulmonary artery. Ring around the artery sign may be seen on lateral projection radiographs, seen as a lucency around or around the right pulmonary artery (Figure 7 and 8).^{1,2}



Figure 7. Lateral CXR, showing air around the right pulmonary artery. Free air is also seen in the anterior pericardium (pneumoprecardium).^{1,2}

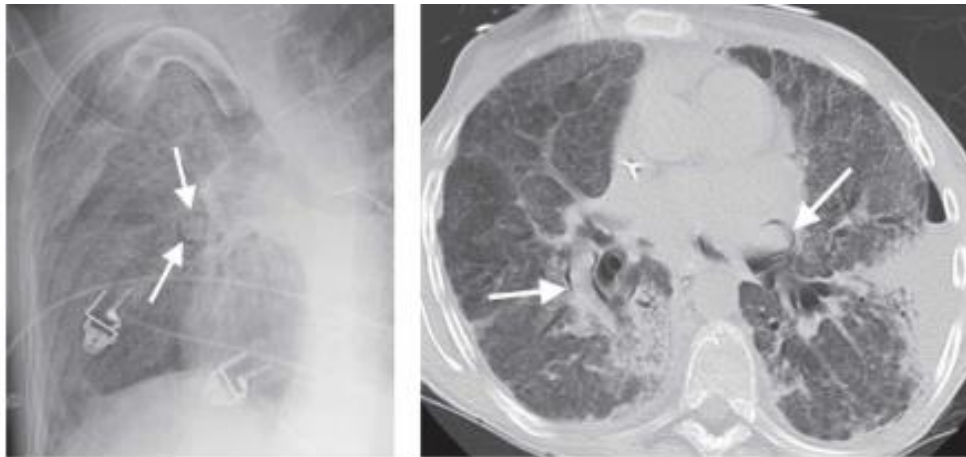


Figure 8. Ring around the artery sign. A: PA chest X-ray of a patient with acute respiratory distress syndrome showing a lucent ring around the right pulmonary artery (arrows) as a marker of pneumomediastinum. B: Thorax CT scan confirms air around both pulmonary arteries (arrows).^{1,2}

Tubular artery sign

The tubular artery sign is the presence of air adjacent to the main branch of the aorta and depicts both sides of the blood vessel. Air in the mediastinum will outline the main lateral artery pulmonary and aortic arch, where this pleural line is formed from both the mediastinal parietal pleura and the visceral pleura (Figure 9-11).^{1,2}



Figure 9. PA chest radiograph showing some of the typical signs of pneumomediastinum, namely air in the aortic branch called the tubular artery sign (white arrow), air at the border of the descending aorta (black arrow), air in the mediastinal pleura around the aortic arch (white arrow) and around the heart (black arrowhead).^{1,2}



Figure 10. Lateral chest radiograph showing air surrounding the brachiocephalic vessels (black arrowhead). The lucent line is also seen in the prespinal soft tissue (white arrow). There is also a ring around the artery sign (white arrowhead).^{1,2}

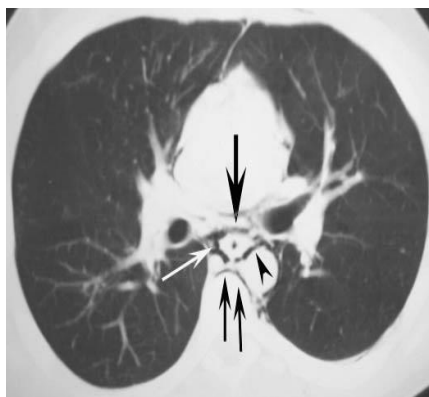


Figure 11. Axial CT scan image showing air surrounding the descending aorta (black arrowhead), azygos vein (white arrow), oesophagus (black arrow), and anterior portion of the spine (two black arrows).^{1,2}

Double bronchial wall sign

The double bronchial wall sign is the presence of air in the mediastinum in the area around the bronchus, thereby clarifying and emphasizing both sides of the bronchus (Figure 12).^{1,2}



Figure 12. For a 35-year-old patient with status asthmaticus, the AP photo showed air in the mediastinum and left main bronchus, which was visualized by visible both sides of the bronchial wall.^{1,2}

Continuous diaphragm sign

The continuous diaphragm sign is the presence of air in the mediastinum that forms a boundary on the superior surface of the diaphragm and appears to separate the diaphragm from the heart. This sign can be seen on the AP/PA radiograph when the air in the mediastinum separates the heart and the superior surface of the diaphragm, which can be seen in both the erect and supine positions. This sign resembles the pneumopericardium, but the pneumopericardium will show air that outlines the heart in a circle.^{1,2}

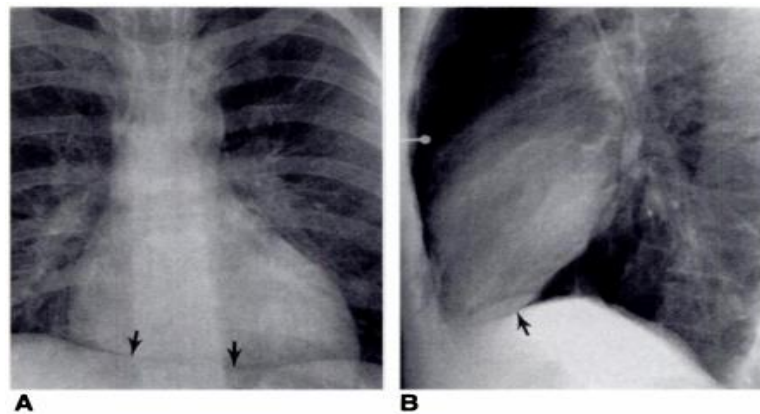


Figure 13. A, PA Thorax radiograph taken during expiration shows a thin band of air (arrow) between the heart and the diaphragm, making the diaphragm visible where normally obscured by the heart. This finding is known as the continuous diaphragm sign. B, Lateral chest radiograph, air outlines the superior surface of the left hemidiaphragm (arrow), which is usually obscured by the liver. This finding is the continuous diaphragm sign.^{1,2}

Extrapleural sign

The extrapleural sign is the presence of air in the mediastinum, causing an area of lucency outside the pleura, usually at the lateral edge of the descending aorta (Fig. 13). The extrapleural sign can also form a radiolucent pocket, a sign of free air in the parietal pleura and diaphragm and posterior to the hemidiaphragm dome. In these circumstances, the air can disappear spontaneously within 10 days.^{1,2}

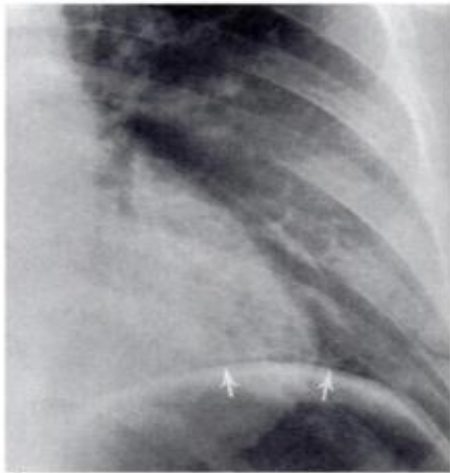


Figure 14. Pneumomediastinum from asthma. The radiograph shows gas (arrows) extending from the mediastinum and separating the pleura (parietal and visceral layers) from the diaphragm. This finding is known as the extrapleural sign.^{1,2}

Naclerio's V sign

Naclerio's V sign can be seen on a frontal chest X-ray forming a 'V'-shaped air lucency in the lower-left area of the mediastinum. This sign is formed by air in the mediastinum, which gives the lower left lateral border of the mediastinum and is formed by air present in the parietal pleura and medial portion of the left hemidiaphragm. Usually, this sign is found in cases of oesophageal rupture, where air enters the mediastinum from the ruptured oesophagus. This sign can also be a complication of endoscopic examination, where it occurs in 1 in 1000 cases of patients with the endoscopic examination.^{1,2}

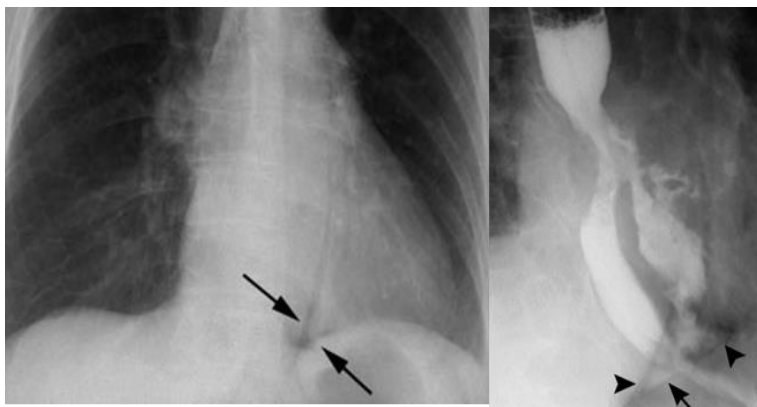


Figure 15. CXR image showing the pneumomediastinum forming the Naclerio's V sign (arrow). Using Iopamidol contrast material, it is clear that extra-passage contrast.^{1,2}

Chest Ultrasonografi

The diagnosis of pneumomediastinum is usually based on a chest radiograph and physical examination. However, a chest radiograph may not be diagnostic, especially when there is a very little gas collection in the chest cavity. In some conditions, ultrasonography has a fairly good role in visualizing a pneumomediastinum, such as in infants who experience spontaneous pneumomediastinum that occurs after birth. The most common sonographic

finding is a thick echogenic line along the anterior border, lateral border and in the thymic parenchyma (Figure 16 and 17).^{10,12}

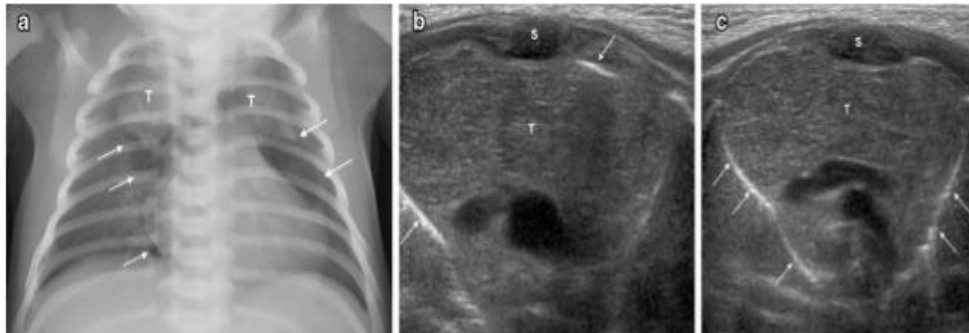


Figure 16. Pneumomediastinum in a 2-day-old boy with dyspnea. Chest radiograph shows abnormal radiolucency along both cardiac junctions (arrows) at thymus elevation. b, c Ultrasonographic scan of the transverse mediastinum showing thick echogenic lines (arrows) along the anterior and lateral borders of the thymus due to pneumomediastinum. Note that the sternum is cartilage, allowing the transmission of sound beams. T thymus, S sternum.^{10,12}

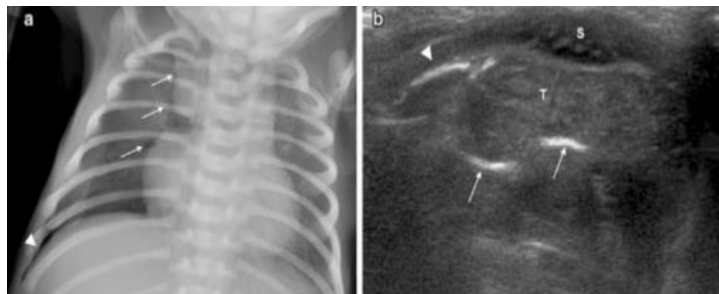


Figure 17. Pneumomediastinum in a 0-day-old boy with dyspnea. Chest radiograph shows an abnormal radiolucency (arrow) along the right border of the thymus and heart. The deep costophrenic sulcus (arrow) on the right indicates a pneumothorax. b Transverse sonogram reveals a thick curved echogenic line (arrow) between the posterior margin of the thymus and the great vessels due to the pneumomediastinum. An echogenic curvature (arrow) also outlines the right anterior lung, possibly due to a combined pneumothorax. T thymus, S sternum^{10,12}

According to most authors, early surgical repair of healthy tissue remains the treatment of choice. Surgery is the preferred treatment for most patients with acute tracheal rupture. However, conservative management is an alternative for patients judged unsuitable for surgery and minor tears.^{6,7,10}

Percutaneous drainage is a first-aid measure in the event of tension pneumomediastinum (a condition in which air is trapped in the mediastinum and cannot escape). This action is very important to overcome the decrease in venous return pressure.^{7,9}

The prognosis of pneumomediastinum is known to be quite good. In stable patients, it is adequately treated with complete rest and analgesics. Morbidity or mortality of patients

with pneumomediastinum is usually caused not by the pneumomediastinum but by other causes that underlie the occurrence of pneumomediastinum.^{6,7,10}

Complications of pneumomediastinum occur when the air in the mediastinal space cannot be completely absorbed, namely tension pneumomediastinum and mediastinitis. Tension pneumomediastinum causes compression of the large veins, resulting in decreased venous return and hypotension. Mediastinitis is an infection of the mediastinal space caused by massive and frequent vomiting, known as Boerhaave syndrome.^{6,9}

The diagnosis of this patient was Pneumomediastinum rupture of the trachea et larynx due to a sharp trauma perforating wound, which was carried out by the patient himself with the discovery of several stab wounds that appeared on the neck, which resulted in tearing of the trachea and larynx. This tear causes the air that can spread to the surrounding area, such as the cuticle tissue, which causes subcutaneous emphysema and can even cause other complications such as pneumomediastinum and several other air leak syndromes. Patient complaints also support aerodigestive trauma such as hoarseness, painful swallowing and crepitus on examination of the cuticle tissue around the trauma site. Laboratory examination found an increase in leukocytes, which is a support for the occurrence of pneumomediastinum. On examination of the AP chest X-ray, a pneumomediastinum image was found with emphysema subcutis at neck regio, then the diagnosis on the AP chest X-ray was confirmed by the findings obtained on a non-contrast MSCT scan of the neck where pneumomediastinum was suspected to be from rupture of the trachea et larynx due to sharp trauma from a sharp stab wound. CT scan can also describe the expansion of air due to aerodigestive trauma in this patient. This result follows the earlier theory that CT scans can help confirm the diagnosis of a pneumomediastinum and explain the extent of air expansion in organs that are decomposed by air in cases of pneumomediastinum.

There is marked expansion of the air in this patient due to aerodigestive trauma. Several possible mechanisms may explain this phenomenon. First, the patient was a male patient with young adult age, whereas pneumomediastinum was most often reported in young patients and male gender. Second, the patient had a history of smoking and long-term drug use, both of which were also risk factors for pneumomediastinum.

Conclusion

We describe a case of pneumomediastinum resulting from laryngeal rupture due to sharp trauma in a psychiatric patient. This is a challenge in making a diagnosis because of the

lack of information about the etiology of trauma and complaints that can be fatal due to delay in therapy. Radiology is one of the best diagnostic supports in describing pneumomediastinum and other air leak syndromes either by chest X-ray, ultrasound or CT scan.

Conflict of Interest

Nothing to declare

Funding Sources

None

Acknowledgments

We thank the clinicians who are directly involved in the enforcement and management of this patient. We also express our gratitude to the Department of Radiology at Hasanuddin University and the Radiology Section of Wahiddin Sudirohusodo Hospital for facilitating the authors in carrying out this case.

References

1. Atalay OY, Cengiz Kaya, Serap Aktas, Kamil Toker. A complication of the laryngeal mask airway: *Pharyngolaryngeal rupture and pneumomediastinum*. Eur J Anaesthesiol 2015; 32:439–450. DOI:10.1097/EJA.000000000000195
2. Kim JD, MD, Franklin DS, Scott RG, Tom BS, Charles EG. Traumatic Laryngeal Fracture in a Collegiate Basketball Player. Orthopaedic Surgery.2013. DOI: 10.1177/1941738112473417
3. Stephen M. Bejvan¹ and J. David Godwin. Pneumomediastinum: Old Signs and New Sign. AJR 1996;166:1041-1048 0361-803X/96/1665-1041
4. C. Rousié, H. Van Damme, M. A. Radermecker, P. Reginster, C. Tecqmenne & R. Limet (2004) Spontaneous Tracheal Rupture: a Case Report, Acta Chirurgica Belgica, 104:2, 204-208, DOI: 10.1080/00015458.2004.11679537
5. Steven L. Goudy, MD; Frank B. Miller, MD; Jeffrey M. Bumpous, MD. Neck Crepitation: Evaluation and Management of Suspected Upper Aerodigestive Tract Injury. Laryngoscope 112: May 2002
6. Won Ho Kim¹ , and Byoung Ho Kim. Bilateral pneumothoraces, pneumomediastinum, pneumoperitoneum, pneumoretroperitoneum, and subcutaneous emphysema after percutaneous tracheostomy -A case report. Korean J Anesthesiol 2012 May 62(5): 488-492. <http://dx.doi.org/10.4>
7. Christopher M. Zylak, MD • James R. Standen, MD • George R. Barnes, MD • Carl J. Zylak, MD. Pneumomediastinum Revisited. RadioGraphics 2000; 20:1043–1057
8. Kouritas VK, Papagiannopoulos K, Lazaridis G, Baka S, Mpoukovinas I, Karavasilis V, Lampaki S, Kioumis I, Pitsiou G, Papaiwannou A, Karavergou A, Kipourou M, Lada M, Organtzis J, Katsikogiannis N, Tsakiridis K, Zarogoulidis K, Zarogoulidis P. Pneumomediastinum. J Thorac Dis 2015;7(S1):S44-S49. doi: 10.3978/j.issn.2072-1439.2015.01.11.
9. Toshimichi Kaneki, Keishi Kubo, Akira Kawashima, Tomonobu Koizumi, Morie Sekiguchi, Shusuke Soneb. Spontaneous Pneumomediastinum in 33 Patients: Yield of Chest Computed Tomography for the Diagnosis of the Mild Type. Respiration 2000;67:408–411
10. Matsumoto T, Matano H, The still lung point: new sonographic evidence for pneumomediastinum, Am J Emerg Med (2015), <http://dx.doi.org/10.1016/j.ajem.2015.06.029>
11. S. KEEL, J. GOWARDMAN. Traumatic Laryngeal Injury in a Nine Year Old Child - The 'Padded Dash' Syndrome Revisited. Critical Care and Resuscitation 2000; 2: 30-33
12. Ah Young Jung • Ik Yang • Hee Sun Go • Su-Mi Shin • Hye-Kyung Yoon • Ji Young Woo • Hye-Suk Hong • Han Myun Kim. J Med Ultrasonics (2014) 41:45–49. DOI 10.1007/s10396-013-0454-3