

Characteristics of radiology: Giant bullous emphysematous compare pneumothorax

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ARTICLE INFO	ABSTRACT
Article history: Received May 4, 2025 Revised May 7, 2025 Accepted May 16, 2025 Keywords: Characteristics of Lesions Chest CT Scan Chest X Ray Giant Bullous Emphysematous Pneumothorax	Background: Giant Bullous Emphysematous (GBE) or Vanishing Lung Syndrome is developed from bullous lung parenchyma diseases and can have multiple causes. The Images between GBE with pneumothorax are similar and difficult to differentiate bullae from pneumothorax. Case Presentations. A 27-year-old-man to emergency room with dyspnoea. Respiratory rate 32 and coarse upper breath sounds and diminished breath sounds in the right lung. Chest Computed Tomography (Chest CT) and Chest Smaller such bullous lesions are also seen in the left upper lobe. Discussion. Characteristics Chest CT and CXR GBE compare pneumothorax are: 1) the location of lesions: GBE contained within the lung and pneumothorax is collection of air in pleural space; 2) The shape of the lesions: GBE, oval, thin walled-less than 1 mm may be formed by pleura, septa or compressed lung tissue. Pneumothorax: with linear density outlining distinctive luscent area with bronchovascular markings are absent; 3) Complications: GBE caused minimal mediastinal line shifts and spontaneous pneumothorax. Pneumothorax with large areas caused greater mediastinal shift line. Summary. Chest CT and CXR are important to determine the diagnosis of GBE with pneumothorax: the location of lesions, The shape of the lesions and complications. They are important because both are cases of emergency that diagnosis can be implemented immediately so that handling can be rendered optimally. <i>This is an open access article under the CC BY-NC license.</i>



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INTRODUCTION

Giant Bullous Emphysematous (GBE) or Vanishing Lung Syndrome is the presence of air in the cavity that can occupy more than one third of the hemithorax, is an abnormality in the lung parenchyma that can be a continuation of lung damage due to paraseptal and centrilobular Emphisematous lung in Chronic Obstructive Pulmonary Disease (COPD). Clinical symptoms are often asymptomatic but can also be accompanied by complaints of chest pain, shortness of breath and chest like being pressed. The size of GBE varies from 1-20 cm and an average of 2-8 cm,

asymmetrical and can enlarge in the hemithorax where the bullae are located. Giant Bullae Emphysematous predominantly located in the subpleura is in the lung parenchyma and this air-filled cavity if large can cause compression of the surrounding normal lung tissue, has thin walls of less than 1 mm and can cause loss of volume in the ipsilateral hemithorax (Pednekar et al., 2021).

These bullae are bordered by lung parenchyma which is a fibrous tissue in the form of trabeculations that can form alveolar septa (Schumann et al., 2019). Some causes of GBE include immunodeficiency syndrome (alpha 1-anti protease deficiency), smoking, injection drug abuse, sarcoidosis, genetic disorders such as Ehlers-Danlos or Marfan syndrome and cystic lesions in the lungs (Gelabert & Nelson, 2015). Damage to the lung parenchyma that progresses to bullae often occurs in young to middle-aged men due to habits such as smoking or injecting drug users (Liang et al., 2014; Waitches et al., 2000). Chest X Ray (CXR) chest radiography of GBE or lung disease including Bullous Lung Diseases is similar to Pneumothorax, it is difficult to differentiate and is an emergency case whose management is very different (CHAPTER, nd)(Prihadi et al., 2021)(Meran Dewina et al., 2023)(Sonda & Sit, 2024). Surgical action is very necessary in cases of GBE, while in Pneumothorax, treatment involves installing a tube to remove air so that lung compression can be minimized (Salsabila & Nusadewiarti, 2023)(Rahmatika et al., 2023)(Adila, 2024). A quick and accurate diagnosis is essential because both GBE and Pneumothorax are emergency cases that require immediate treatment to save the patient, namely to prevent further complications and reduce the patient's mortality and disability rates.

Further complications of GBE can cause pneumothorax, so that in one radiological examination two abnormalities can be found which require careful observation (Santoso, 2020)(Rahman et al., 2021)(Abdillah et al., 2022). CXR images are sometimes inadequate to diagnose this case, so other radiological examinations such as Thoracic Computer Tomography Scanning (Chest CT) and Thoracic Ultrasonography are needed.

The purpose of this case report is to determine the radiological characteristics, namely CXR and CT scan of the thorax between GBE and Pneumothorax so that immediate diagnosis and treatment can be carried out and complications can be minimized.

RESEARCH METHOD

Case Report

A 27-year-old man was brought to the Emergency Room (IGD) of the hospital with complaints of chest pain, shortness of breath and pressure. History of smoking (+) for about 5 years. History of frequent coughing and shortness of breath (+). General condition appears short of breath with chest wall retraction. Vital signs show blood pressure of 130.90 mmHg, pulse 99x/minute, respiration 32x/minute and body temperature 37.0°C. Inspection: sternal and intercostal retraction, vesicular auscultation weakened in the right hemithorax mediobasal aspect and at the apex and medial rhonchi sounds were heard. On tactile palpation the fremitus of the right chest was left behind and not palpable compared to the left chest. Chest radiography (CXR) showed extensive luculent lesions, oval shape, clear boundaries in almost the entire right lung, thin walls, smooth with an air fluid level (+), costophrenic sinus and right diaphragm were not clearly visible. The lung parenchyma is pushed medially with minimal midline shift of the mediastinum to the contralateral side. Hyperaeration of both lungs. Chest CT scan shows extensive luculent lesions in almost the entire right lung that push the right lung parenchyma medially. Centrilobular and paraseptal luculent lesions are seen in the left lung with hyperaeration of both lungs, the right diaphragm is flat. The mediastinum and trachea are pushed minimally to the left. Bronchovascular marking in the left lung is increased.

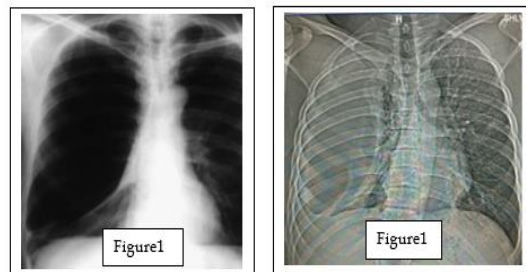


Figure 1 and 2. CXR

Patient: there is a wide oval lucusent lesion, clearly defined in the right lung, with thin walls, lung tissue is pushed to the basal and medial parts, leading to the Giant Bullae image in the right lung. Hyperaeration of both lungs, the right diaphragm appears flat. The mediastinum and trachea are slightly pushed to the laterosinus.

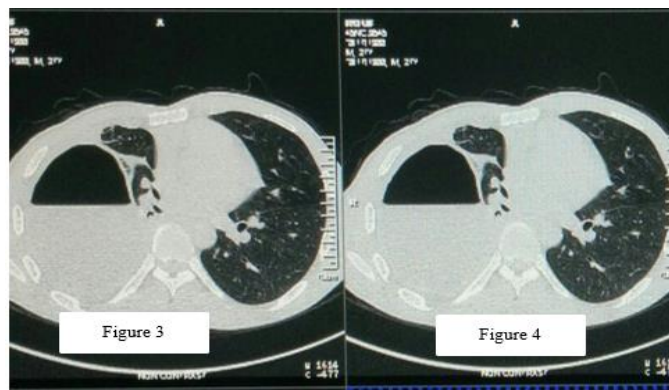


Figure 3 and 4. CT scan image of the patient's thorax (axial section)

Luscent lesion oval shape in lung dextra, wide, with picture of lesion fluid density (air fluid level) intra lesion. seen picture of pulmonary parenchyma that is pushed medially. Luscent lesion, small, thin wall, multiple, clear boundary in lung left. Bronchovascular marking in lung left appears increased.

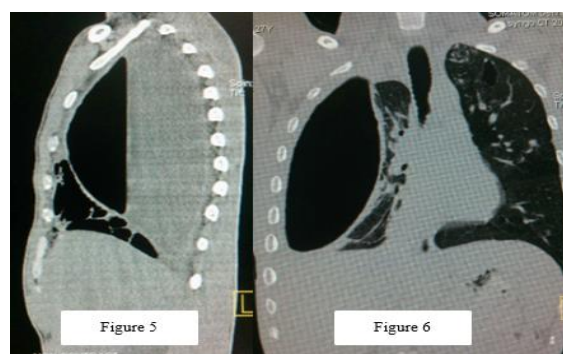


Figure 5 and 6. CT scan of the thorax sagittal and coronal sections

Luscent lesion, oval shape, clear boundary in the right lung with thin wall. Luscent septate lesion is seen in the anterior-basal aspect of the right lung. The right lung parenchyma is pushed medially with fibrotic and luscent lines. Left lung: oval luscent lesion with diameter of 1-3 cm, multiple, oval shape especially in the superior lobe (paraseptal and centrilobular) with

hyperaeration in the left lung. The mediastinum and trachea are slightly pushed latero-sinusally. The right diaphragm appears flat.

RESULTS AND DISCUSSIONS

The radiographic picture between GBE and Pneumothorax is very similar. Both are filled with air so that they appear as a wide lucent picture that almost fills the hemithorax and has clear boundaries. Both cases, if the lesion is wide, are equally emergency cases which if not diagnosed and treated immediately will cause respiratory failure, due to compression of the lungs resulting in hypoxia and respiratory depression which can lead to death. Complications that occur can cause permanent lung tissue damage (destroyed lung) and even in GBE can cause pleural tears which can cause Pneumothorax (Saputra, 2023). Giant Bullae are different from emphysematous Giant Bullae based on the occurrence of bullae, can be divided into 2 according to Klingman, namely 1. Giant Bullae with lung tissue around the bullae is normal (20% of patients), usually caused by smoking habits, the presence of immunodeficiency syndrome (alpha 1-anti protease deficiency) which is characterized by widening of the lung parenchymal air space.

The location of the lesion is usually symmetrical at the apex or superior lobe of both hemithorax (Tika, 2020)(CLAUDIA, 2022)(Tanuwidjaja et al., n.d.)(MARYO & MAXIMIANUS NALDORIS, 2024). Giant Bullae is commonly called Vanishing Lung syndrome, Bullous disease, Bullous pneumopathy or Primary bullous disease of the lung type 1(8,9). 2. Type 2, occurs because it is a continuation of chronic lung tissue damage (Emphysematous lung or COPD) which causes widening of the lung parenchymal air space (centrilobular and paraseptal) or a combination of several small lucent lesions in the form of bullae with small sizes that can unite to form large air-filled lucent lesions, called GBE. The sign of GBE is that around the bullae there is abnormal lung tissue, centrilobular or paraseptal. The incidence is higher than Giant Bullae without lung tissue damage (80%). The location of the lesion is often asymmetrical on one side of the hemithorax, occupying the superior lobe sometimes extending to the middle lobe of the lung(Desai & Steiner, 2016; Ladizinski & Sankey, 2014).

Establishing the diagnosis of GBE and Pneumothorax is important early CXR is performed, to provide an overview of the condition of the lungs and surrounding tissue which is useful as a screening. Chest radiography is easy to do, cheap and almost all services have x-ray equipment. The weakness of CXR is its less accuracy because there are some lesion images that are covered or not visible due to superposition. Other radiological examinations are needed, namely Chest CT which has better accuracy than CXR. Lesions in the lung field can be seen more clearly because the thorax is cut thinly and the cut line can be confirmed in 3 dimensions, namely axial, coronal and sagittal sections. Lesions or bullae or small pneumothorax can be seen more clearly than CXR(Golzari, 2010; Liang et al., 2014).

Differential diagnosis of GBE is several, including Pneumatocele, Cavity, Cystic mass, Bleb and Pneumothorax. In this case report, it is very important to note several things that differentiate the picture of GBE from Pneumothorax, because both have very similar pictures and are emergency cases that require immediate treatment. Characteristics of chest radiography (CXR) and chest CT scan (Chest CT) in GBE compared to Pneumothorax, include: 1) location and type of lesion: GBE, in the form of an air-filled cavity due to damage to the air space of the lung parenchyma, often in the superior and middle lobes Pneumothorax in the form of air in the pleural cavity, the location can be anywhere from the hemithorax 2) Form of lesion: GBE, tends to be oval, firm boundaries, thin walls <1 mm can be formed from the visceral pleura and the lung parenchyma on the other side, septate; Pneumothorax: a lucent lesion without lung markings in the pleural cavity, with parietal and visceral pleural borders/walls; 3) Complications: GBE minimal contralateral mediastinal shift, Pneumothorax with a large area causes a large mediastinal shift. The lung parenchyma around the lesion in GBE can be damaged, but can also be normal. Pneumothorax can cause a picture of collapsed lung tissue (atelectasis) accompanied by fissure

retraction. 4) In GBE accompanied by a flat diaphragm on the side of the lesion, while in Pneumothorax there is no flattening of the diaphragm. 5) The difference between GBE and Pneumothorax, in the installation of a chest tube, in pneumothorax after chest tube installation on CXR evaluation, the collapsed lung expands again along with the release of air (lung decompression), while in GBE when the tube is installed the lung image remains collapsed or shrunk accompanied by damage to the surrounding lung parenchyma. the lung field image is narrower after tube installation(8,4),10).

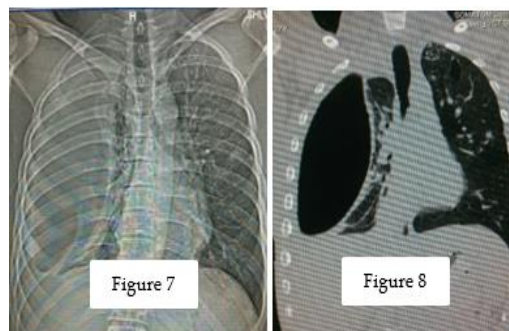


Figure 7 and 8. GBE in COPD (Type 2), centrilobularemphysematous in the left lung, asymmetrical

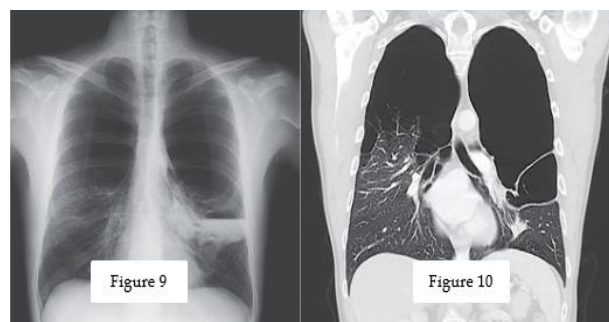


Figure 9 and 10. CXR and Chest CT coronal Giant Bollous image in normal lung (Type 1)

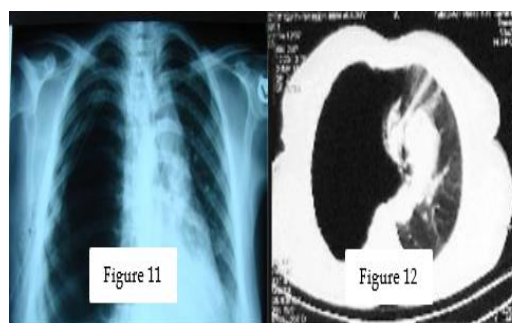


Figure 11 and 12. Pneumothorax

Shows a luscent area without pulmonary markings in the right hemithorax that pushes the mediastinum and trachea laterolaterally, compared to the midline shift in GBE, Pneumothorax has a greater mediastinal shift to the contralateral side.

Common complications of GBE include Pneumothorax. CXR radiographic images are difficult to distinguish GBE from Pneumothorax complications. Chest CT modality is very helpful to see more clearly the presence of pneumothorax due to tearing of the visceral pleura that limits the bullae wall so that air enters the pleural cavity. An important sign that must be recognized on

the CT scan image of pneumothorax in GBE is the Double-Wall Sign. 5 Indications for surgical action in GBE are, increasing size of bullae, Pneumothorax, decreased lung function, hemoptysis and infected bullae.^{2,4}

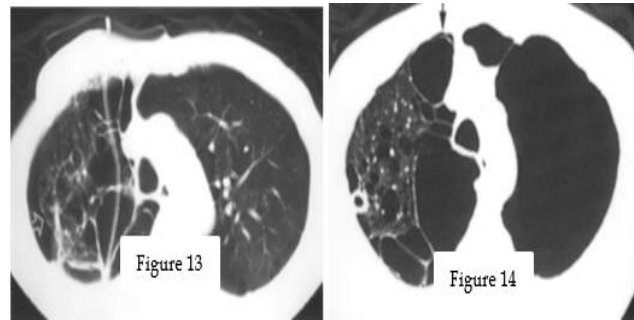


Figure 13 and 14. The arrow indicates the presence of a double wall sign, which means that GBE has a complication of pneumothorax

CONCLUSION

Thoracic radiography and Chest CT Scan are important to determine the diagnosis of GBE with Pneumothorax which includes the location and type of lesion, the shape of the lesion and the complications that occur. Several characteristics of GBE and Pneumothorax are important to know and observe because both are emergency cases that require immediate treatment. GBE treatment includes surgery, lobectomy, thoracotomy. The patient in the case report above based on clinical symptoms, CXR images and Chest CT scans was diagnosed with type 2 GBE with COPD images and the therapy performed was thoracotomy, lobectomy on the lung containing GBE lesions.

The results of this study can be used as clinical guidelines and educational materials for medical personnel in primary health care facilities to increase awareness of the radiological differences between GBE and pneumothorax. Structured clinical education needs to emphasize the importance of interpreting CXR and CT images of the chest in cases of acute dyspnea with extensive radiolucency, especially in patients with a history of smoking or symptoms of COPD. Knowledge of the typical characteristics of GBE, such as the oval shape of the lesion with thin walls and the location that remains in the lung parenchyma, can help avoid fatal misdiagnosis, such as chest tube placement in GBE lesions that can worsen the patient's condition. Therefore, it is recommended that there be an initial radiological protocol that requires a CT chest examination if the CXR results show an ambiguous extensive image without any typical signs of pneumothorax, such as loss of lung markings with a large midline shift. Recognition of the "double wall sign" on CT scans should also be part of the early detection algorithm for pneumothorax complications in GBE. Integration of this radiological approach into the emergency management flow will greatly assist primary care physicians in making an accurate diagnosis and avoiding inappropriate invasive procedures.

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