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Case Report

A rare case of multiloculated thoracic empyema in a neonate[☆]

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ARTICLE INFO

Article history:

Received 5 March 2022

Revised 21 March 2022

Accepted 23 March 2022

Keywords:

Computed tomography scan

Pediatric radiology

Staphylococcus aureus

Thoracic empyema

ABSTRACT

Thoracic empyema, defined as the accumulation of pus in the pleural space, is a rare cause of respiratory distress in neonates. Its occurrence in neonate patients has been only described in few literatures, as opposed to cases in older children. Even though the diagnosis of thoracic empyema is confirmed by histopathological examination of pleural fluid, radiographic examinations have important roles in helping clinicians narrowing down the differential diagnoses. This case report describes a neonatal patient who exhibited symptoms of respiratory distress and imaging modalities revealed multiloculated thoracic empyema.

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Introduction

Thoracic empyema is defined as accumulation of pus in pleural cavity [1,2,3]. It is relatively common in children, especially in malnourished, and immunocompromised patients [2]. It may occur as a complication of pneumonia following infection from organisms like Staphylococcus aureus, Escherichia coli, hemolytic group B Streptococcus, hemolytic group A Streptococcus, Klebsiella spp. and Serratia spp. Even though it is quite common in older pediatric patients, thoracic empyema is less often seen in neonatal period. Rarity in the newborn may be due to immaturity of the immune system which limits localization of infection to the pleural space and the capacity of the pleura to produce enough exudates [2].

Case presentation

A 35 days old neonate with weight of 4775 gr came to our emergency room (ER) with shortness of breath which had worsened in the last 2 weeks. Patient also presented with fever, tachycardia, grunting, chest retraction, and low oxygen saturation. Breath sounds were markedly decreased on the right hemi-thorax. Points of maximal impulse were heard at the fourth intercostal space, right parasternal area. There was no murmur. Laboratory examination showed high white blood count and high C-reactive protein. SARS CoV-2 test was negative.

Patient was born at gestational age of 38 weeks and birth weight of 3600 gr. The patient was delivered by caesarean

[☆] Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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<https://doi.org/10.1016/j.radcr.2022.03.089>

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Fig. 1 – Chest radiograph revealed an inhomogeneous opacity with multiple lucent areas of the whole right hemithorax.

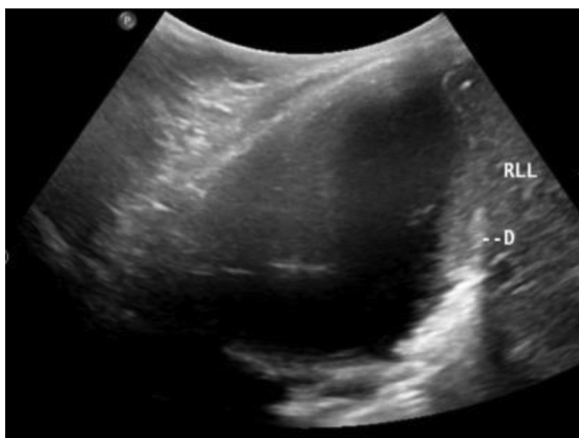


Fig. 2 – Ultrasound of the chest suggested right empyema.

section due to previous history of caesarean section. At delivery, the patient had good APGAR score without any perinatal risk factor. The patient cried immediately and did not require any resuscitation.

Radiology examination by chest x-ray at admission revealed inhomogeneous opacity with multiple lucent areas in the right hemithorax (Fig. 1). Further examination by chest ultrasonography (USG) showed presence of localized right empyema (Fig. 2); which prompted pleural fluid examination showing presence of staphylococcus aureus sensitive to several antibiotics within the fluid.

Patient then underwent chest Computed Tomography (CT) scan examination to confirm the true diagnosis and the result showed multiple loculated empyema with obtuse angle to the chest wall and split pleural sign in right upper to lower hemithorax accompanied by bronchopleural fistula and bilat-

eral pneumonia in the lateral and medial segments of the right middle lobe, as well as the antero-basal, and postero-basal segments of the left inferior lobe (Fig. 3).

The patient underwent a thoracotomy and multiple loculated pus-containing fluid was found in the right hemithorax (Fig. 4). All the pus was aspirated and expelled, then some pleural tissue was taken, and sent to our anatomy pathologic laboratory. The result of the histopathology examination suggested non-specific inflammation (Fig. 5).

Chest x-ray one day after the operation showed expansion of the right lung and there was no more lucent area in the right hemithorax (Fig. 6). Patient then underwent follow-up CT scan 1 month after the operation and the result was bilateral pleuropneumonia with compressive atelectasis in the postero-basal and latero-basal segments of the inferior lobe of the lung bilaterally, with no more empyema in the upper, and lower right hemithorax (Fig. 7).

Discussion

Thoracic empyema is defined as “pus in the chest” or presence of microorganism in the pleural fluid. Overall, 0.6% of childhood pneumonias are complicated by parapneumonic effusion which may progress to thoracic empyema. It predominantly involves the right lung and 7.1% of all cases are bilateral [1,2,3]. In the pre-antibiotic era, empyema was a common complication of pneumonia, usually caused by pneumococcal, and streptococcal organisms. However, with more controlled organisms by the use of the appropriate antibiotics, a whole new spectrum of infecting organisms, *S. aureus*, *Escherichia coli*, *Klebsiella*, *Pseudomonas* sp., *Bacteroides* sp., *Proteus* sp., *Aerobacter aerogenes*, and *Streptococcus pyogenes*, has emerged [4].

Thoracic empyema may occur at any age, but children, and elderly are more susceptible. In neonatal period, however, thoracic empyema is less likely due to the immaturity of the immune system; which limits localization of infection to the pleural space, and the capacity of the pleura to produce enough exudates. If it occurs in neonate, the appropriate treatment should be given immediately as thoracic empyema may lower the lung function and lead to more complications, such as formation of pneumatocele lead to persistent sepsis, disseminated abscess, bronchopleural or bronchocutaneous fistula or progress to restrictive lung [1,2,4,5].

The process of thoracic empyema consists of 3 stages. The first is exudative stage, where the infection cause immune responses and the fluid crosses the visceral pleura and accumulates in the pleural space, and make inflammation within pleura. The second stage is fibrinopurulent, where the immune response causes migration of neutrophils, and activation of coagulation cascade. In this phase, fibrin deposits will form which will form septa in the pleural cavity. The inflammatory process will begin to be filled by bacteria and phagocytic cells that have died. The third phase is organizational, the moving of fibroblast, which progress to development of pleural peel [6,7].

Due to the urgency of treatment especially in younger children, an accurate diagnosis should be made immediately.

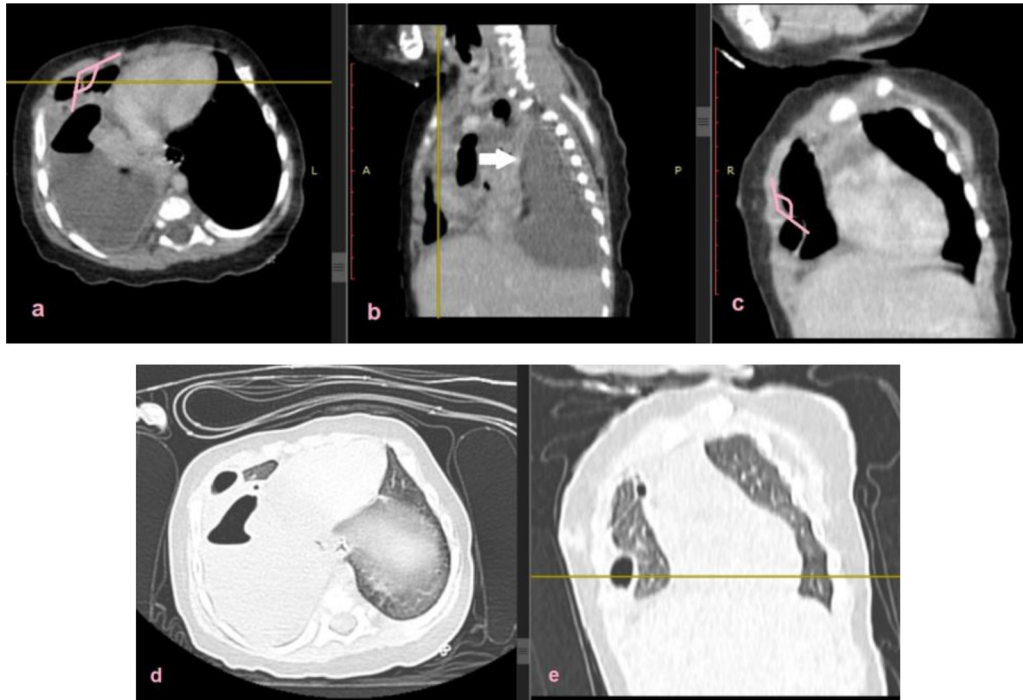


Fig. 3 – Chest CT Scan with contrast (A,B,C mediastinum window. D and E lung window.) revealed multiple cysts in the right hemithorax, pleural joining angle is obtuse ($>90^\circ$) (A and C), suggesting pleural origin than lung and split pleural sign (B, white arrow).

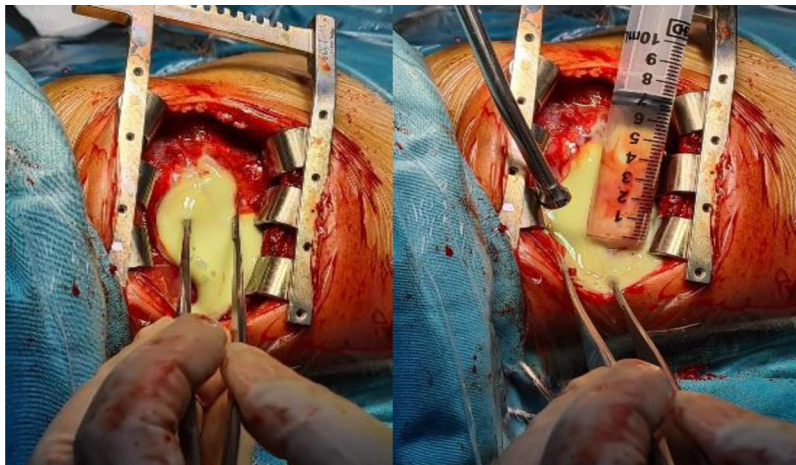


Fig. 4 – Intraoperative pus results.

Even though the true diagnosis is made by aspiration of the purulent material from the involved pleural cavity, proper radiological examinations help determine the presence of loculated empyema and exclude other differential diagnoses, such as lung abscess and cavitating lung lesion. Chest x-ray is usually done as the initial modality. In thoracic empyema, it usually shows markedly asymmetric pleural effusion with blunting of the costophrenic angle, and biconvex or lenticular shape. In some cases, it is quite difficult to differentiate fluid from pleural thickening due to the similar opacity. If the volume is large, it may cause mediastinal shift, away from the

affected side, or toward the affected side if there is lung collapse. Other views may give additional values; lateral view is helpful in small effusion and decubitus view can be obtained to assess any fluid layering or help to quantify the effusion [8–10].

Ultrasonography (USG) can also be used in cases of thoracic empyema. USG has several advantages over x-ray; as it is non-invasive and safely repeatable, gives non-ionized radiation and gives a dynamic evaluation of the chest. Moreover, it is cheap, easy to do, and able to differentiate pleural fluid from consolidation. In USG, empyema is an anechoic to hy-

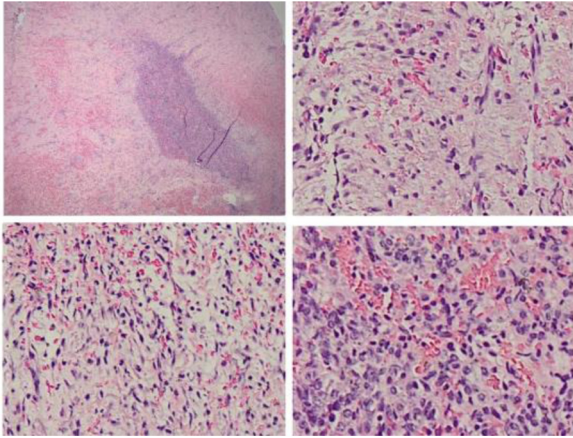


Fig. 5 – Histopathological examination of the pleural tissue biopsy showed non-specific inflammation.



Fig. 6 – Chest radiograph after thoracotomy showed expansion of the right lung.

poechoic area with dense internal echoes within the pleura, and it is usually septate. USG can help estimate the size of the effusion and guide the procedure of chest drain placement if needed [8–10].

Computed Tomography (CT) scan remains the imaging of choice for thoracic empyema, as it gives better image than chest x-ray and USG; however, the regular use in children may be debatable as it often needs general anesthesia or sedation especially in a young uncooperative child, and exposes the child to relatively larger doses of radiation. Non-enhanced CT scan shows pleural effusions along the mediastinum, thickened pleurae, loculations in the fissures, septa, or gas bubbles in the pleural space. Gas bubbles in the pleural space powerfully suggest an empyema. Lung window can show

pneumonia close to the abnormal pleural collection. Soft-tissue window can demonstrate a cause for the empyema, such as esophageal rupture or mediastinal surgery. Without gas bubbles in a pleural fluid collection or an enhancing pleura sign, the diagnosis of infection in pleural fluid depends on a high level of clinical suspicion confirmed with findings from thoracentesis. A pleural exudate without pleural thickening most likely delineates malignancy or uncomplicated pleural effusion. With most empyema, enhanced chest CT scans demonstrate the split-pleura sign. This sign can also be seen in chronic pleural effusions. Enhanced CT scans also represent parietal pleural thickening in most cases of empyema [8–10].

In neonate, loculated thoracic empyema may be hard to differentiate with congenital pulmonary airway malformation

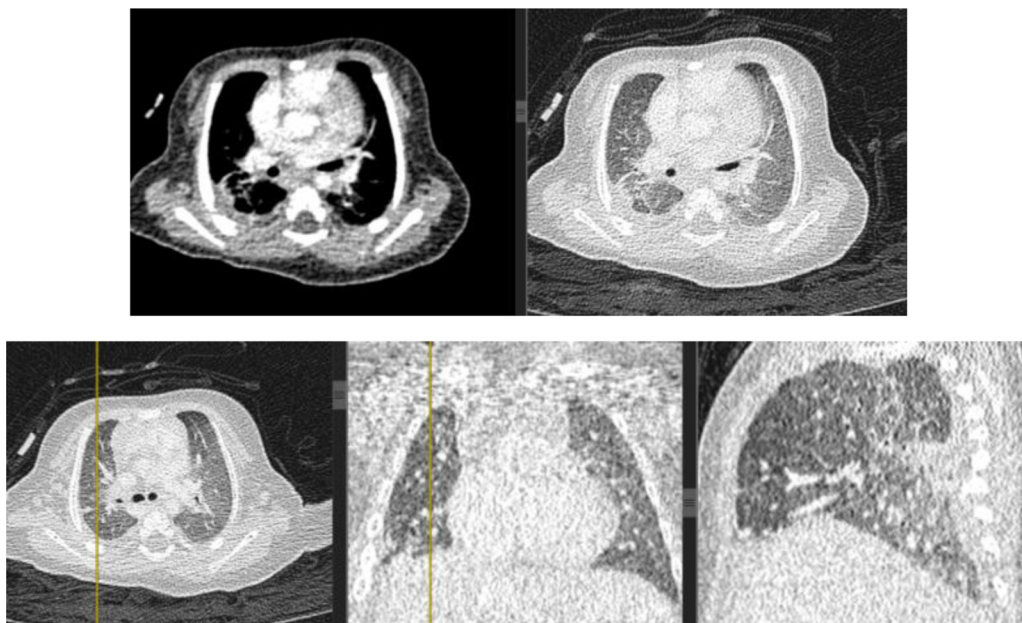


Fig. 7 – Chest CT Scan on 1 month after thoracotomy showed no more empyema and no cyst.

(CPAM), which also gives appearance of multiple lucent areas on chest x-ray. This emphasizes the importance of comprehensive radiological examinations to confirm the true diagnoses of multiloculated thoracic empyema, as CT scan will clearly show the presence of fluid within the pleural cavity as in thoracic empyema, while in CPAM it will show multiple cystic areas with pulmonary artery supply [11,12].

In this report, the neonatal patient suffered from respiratory distress and from the initial chest x-ray, there was multiple lucent areas in the hemithorax which prompted further radiological examinations. Chest USG and CT Scan showed the presence of multi-loculated empyema and there were no multiple cysts supporting the diagnosis of CPAM. This report showed that the presence of thoracic empyema in neonatal period is possible and the diagnosis should be carefully made by proper radiological examinations to help differentiate it with other differential diagnoses.

Conclusion

Thoracic empyema is presence of pus in the pleural cavity and may be loculated in some cases. Its occurrence is relatively common in children, but not in neonates. This case report showed the rare presence of multiple loculated empyema in neonate which resembled CPAM during initial radiology examination. A thorough radiological examinations helped differentiating 2 diagnoses resulting in appropriate treatment and better patient outcome.

Patient consent

Written informed consent was obtained for this case report.

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