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Chest Intercostal Drainage for Neonatal Spontaneous Pneumothorax: A Rare Case Report

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Authors' contributions

This work was carried out in collaboration among all authors. Author SA designed the study, performed the statistical analysis, and wrote the protocol. Author MB wrote the first draft of the manuscript and managed the analyses of the study. Author GCH managed the literature searches. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Background: Spontaneous Pneumothorax (SP) is only 0.05% to 0.1% of all live births with symptomatic pneumothorax and rarely occurs in term (1-2%) with the healthy condition after birth. The management of SP depends on the symptoms. If there is a sign of symptomatic pneumothorax, an intercostal catheter is needed.
Case presentation: A 2,535-gram and 48-cm-length female neonate was born by Caesarean Section from G2P1A0 37 weeks of pregnancy with severe preeclampsia. At birth, the baby did not cry immediately, with an Apgar Score of 5-7-8. After 2 hours of observation, the baby experienced rapid and deep breaths. Thorax X-Ray showed a right pneumothorax causing right pulmonary collapse and pushing the mediastinum toward the left, with normal cor configuration. The patient fell into a respiratory failure condition. It was decided to conduct a chest intercostal drainage in the right 4th intercostal space (ICS) anterior axillary line. After the chest intercostal drainage insertion, a thorax x-ray for evaluation was performed. Thorax X-Ray showed a chest tube inserted in the right 4th ICS anterior axillary line, neonatal pneumonia, normal cardiothoracic ratio, and no appearance of right pneumothorax. Four days after the chest intercostal drainage insertion, it was removed.

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Five days after the onset of pneumothorax, a thorax contrast CT scan was performed to investigate if there were any pulmonary abnormalities. Contrast CT scan showed no pneumothorax, or atelectasis, with normal cardiothoracic ratio. Eight days after the onset of pneumothorax, the patient was discharged with a stable condition.

Conclusion: Symptomatic spontaneous pneumothorax in a healthy neonate after birth is rare, but appropriate and adequate treatment is required. Knowing the risk factors, pathomechanism, and monitoring neonates at risk can help provide the best care for the patient. Further investigation of the risk factors for SP is needed for better monitoring, management, and outcome.

Keywords: Chest intercostal drainage; spontaneous pneumothorax; neonates.

1. INTRODUCTION

Spontaneous Pneumothorax (SP) occurs when air fills the pleural space spontaneously in patients with no certain precipitating factor [1]. It is only 0.05% to 0.1% of all live births with symptomatic pneumothorax [2] and rarely occurs in term (1-2%) with the healthy condition after birth [3]. Males are 3.7 to 4.2 times more likely to develop SP than females [4]. Respiratory distress syndrome is the most common comorbidity in SP patients [5]. Meconium aspiration syndrome, cleft palate, congenital thoracic deformity, and cardiac failure can also be found in SP patients [5]. The management of SP depends on the symptoms. If there is a sign of symptomatic pneumothorax, an intercostal catheter is needed [3].

2. CASE REPORT

A 2,535-gram and 48-cm-length female neonate was born by Caesarean Section from G2P1A0 37 weeks of pregnancy with severe preeclampsia. At birth, the baby did not cry immediately, with an Apgar Score of 5-7-8. After 2 hours of observation, the baby experienced rapid and deep breaths. Physical examination showed that the general condition looked weak, heart rate of 166 beats per minute, respiratory rate of 68 breaths per minute, the temperature of 37.3^0C, and oxygen saturation of 90-92% with oxygen 10 Litre per minute. Nostril breathe, right chest wall retraction, decreased breath sounds in the right hemithorax, and hypersonic percussion in the right hemithorax was found. Hb yielded 16.5 g/dL. The result from the blood gas analysis was respiratory acidosis. Anti-SARS COVID-19 obtained non-reactive IgM and IgG antibodies. Thorax X-Ray (Fig. 1) showed a right pneumothorax with a visible pleural line, causing right pulmonary collapse and pushing the mediastinum toward the left, with a normal cardiothoracic ratio (<58%). The patient fell into a respiratory failure condition. It was decided to conduct a chest intercostal drainage in the right 4^{th} intercostal space (ICS) anterior axillary line.

In preparation for the chest tube insertion, the patient was in a half-sitting position. The operating field was cleaned with povidone-iodine and covered with a sterile drape with a hole. Infiltration anesthesia was performed with lidocaine over the 4^{th} costa, right axillary anterior line. A 2 cm incision over the 4^{th} costa in the right axillary anterior line to the mark of the rib was done to split m. intercostalis to parietal pleura. From the digital examination of the pleural cavity, there were no adhesions and no mass. The horizontal mattress suture was done with nonabsorbable multifilament suture number 1.

The 12 fr chest tube was inserted into the pleural cavity, connected with NGT no. 18, and water sealed drainage bottle with initial bubble, swinging, and no blood. The chest tube was fixated with a slip knot.

After the chest intercostal drainage insertion, a thorax x-ray for evaluation was performed. Thorax X-Ray (Fig. 2) showed a chest tube inserted in the right 4^{th} ICS anterior axillary line, neonatal pneumonia, normal cardiothoracic ratio (<58%), and no appearance of right pneumothorax. Four days after, there was no sign of pneumothorax, the clinical condition improved, no air bubbling in the water sealed bottle, and the chest tube was removed. Five days after the onset of pneumothorax, a thorax contrast CT scan (Fig. 3) was performed to investigate if there were any pulmonary abnormalities. Contrast CT scan showed no pneumothorax, or atelectasis, with normal cardiothoracic ratio, normal shape and location of the heart. Eight days after the onset of pneumothorax, the patient was discharged with a stable condition.

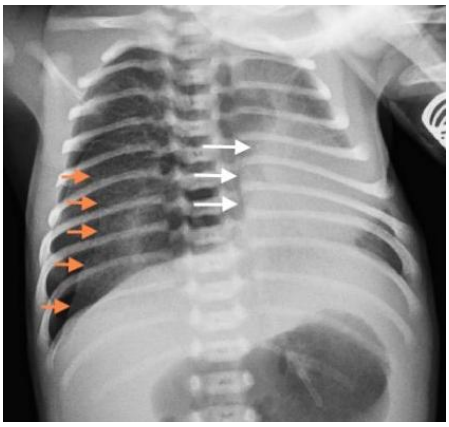

Fig. 1. Anteroposterior projection of thorax x-ray pre-chest intercostal drainage
Orange arrows showing a right pleural line (border between avascular radiolucent and the lung parenchyma); White arrows showing mediastinal shift

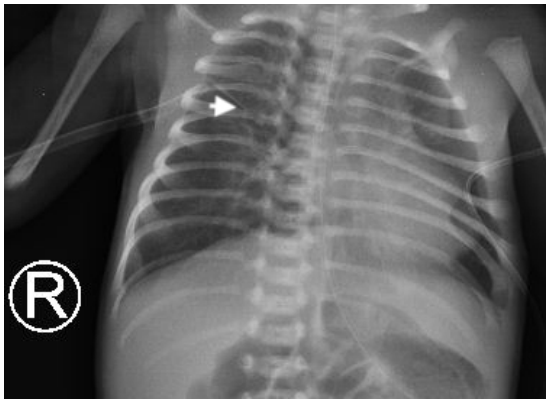

Fig. 2. Thorax x-ray post-chest intercostal drainage
There is no right pneumothorax. The tip of the intercostal drainage is in the right 4th intercostal space

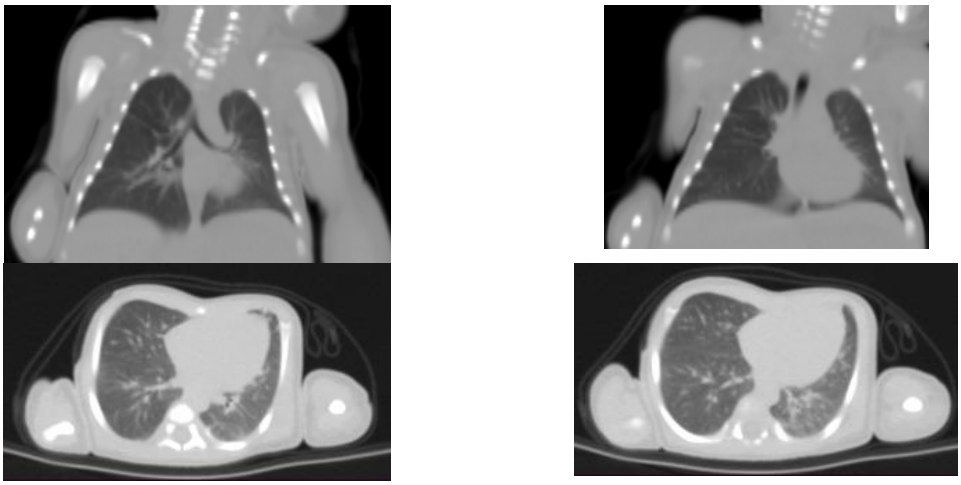

Fig. 3. Thorax contrast CT scan post removal of the chest intercostal drainage
There are no visible features of atelectasis, pneumothorax, or pneumomediastinum on CT, no visible mediastinal, hilar, or tracheobronchial lymphadenopathy. There is no visible picture of obstruction, narrowing, or dilation in the tracheobronchial system; The shape and size of the cor are normal

3. DISCUSSION

Pneumothorax is more frequently observed in neonates (1 – 2%) than in older children (1.2 – 28 per 100 000) [5]. The occurrence of spontaneous pneumothorax in a healthy newborn is a rare entity [6]. Most neonatal pneumothorax occurs as a result of birth injury, shoulder dystonia, prematurity, pneumonia, meconium aspiration syndrome, pulmonary hypoplasia, or assisted ventilation [7].

In this case, SP occurred < 48 hours in a female neonatal patient born at term without any sign such as meconium aspiration, respiratory distress, prematurity, birth injury, or pneumonia. In our literature search, Choi et al. [8] reported the perinatal characteristics of the term neonate pneumothorax. These were meconium aspiration in 21% of patients, premature rupture of membranes (PROM) in 21%, oligohydramnios in 17%, preeclampsia in 13%, and perinatal asphyxia in 56%. In the present study, meconium staining (28.6%), perinatal asphyxia (11.4%), PROM (5.7%), and fetal distress (5.7%) occurred in the term neonate pneumothorax. Pneumothorax may develop in the term newborns without pulmonary pathology or positive pressure ventilation. It is most probably due to high transpulmonary pressure generated with the onset of breathing [9]. In this case, severe preeclampsia could be the risk factor. In preeclampsia, the balance between pro and antiangiogenic factors is disrupted, resulting in an antiangiogenic state [10]. This state can lead to abnormal development of the lung vascular and alveolar structure [10]. However, the pathomechanism of pneumothorax with preeclampsia remains unclear.

In spontaneous vaginal delivery of the term, the baby passes through the vagina. There are potential chances of his thoracic cage being over-compressed during the delivery [7]. Under such circumstances, the pressure gradient between the alveolar and the perivascular space can increase abnormally for a transient period that may lead to the rupture of the alveoli[7]. In this case, the patient was born by a c-section, avoiding the risk of alveolar rupture due to over-compression.

Pneumothorax is often a respiratory emergency and requires a rapid initiation of therapeutic intervention. Transillumination, chest x-ray, lung ultrasonography, and CT scan (the diagnostic gold standard for pneumothorax) can be used to detect neonatal pneumothorax. There is some difference in the sensitivity and specificity among those examinations. According to Cattarossi's study [11], sensitivity and specificity in diagnosing pneumothorax were therefore 1 for lung ultrasonography, 0.87 and 0.96 for chest transillumination, and 0.96 and 1 for chest x-ray. Transillumination is less accurate than chest x-ray and ultrasonography, because of the possibility of false-positive (infants with chest wall edema, subcutaneous chest wall air, pneumomediastinum, or severe pulmonary interstitial emphysema) or false-negative (thick chest wall, darkly pigmented skin, or inadequate light conditions) [11]. In this case, clinical examination and chest x-ray were clear to diagnose pneumothorax.

High-quality evidence for the management of newborn pneumothorax is lacking [3]. There are several strategies for treating newborn pneumothorax. A careful observation-only, needle thoracocentesis or intercostal catheter insertion can be the options. At RPA Newborn Care, an asymptomatic infant with minimal respiratory support can be conservatively managed with careful observation [3]. Meanwhile, an infant with a large symptomatic pneumothorax or a tension pneumothorax should have an intercostal catheter placed [3]. If there is insufficient time to place an intercostal catheter in an acutely compromised infant, needle thoracocentesis should be performed, followed by consideration of the placement of an intercostal catheter [3]. If more than 20% of the lung field on one side is affected and/or if the patient's clinical condition is deteriorating and causing respiratory insufficiency, underwater drainage is mandatory 3]. In this case, the patient had respiratory failure, which indicated an intercostal catheter.

4. CONCLUSION

Symptomatic spontaneous pneumothorax in a healthy neonate after birth is rare, but appropriate and adequate treatment is required. Knowing the risk factors, pathomechanism, and monitoring neonates at risk can help provide the best care for the patient. Further investigation of the risk factors for SP is needed for better monitoring, management, and outcome.

CONSENT

As per international standards, parental written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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