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Title: Pneumothorax: a rare entity during pregnancy

Short title: Pneumothorax and pregnancy

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Abstract

Pneumothorax is a rarely seen condition during pregnancy, when changes in the respiratory physiology can sensitize the mother and fetus to the signs of hypoxia. Symptoms of pneumothorax, such as dyspnea, tachypnea and chest pain, can also be attributed to the pregnancy and complications with the pregnancy, and this can lead to misdiagnoses. The limitations in the use of such diagnostic tests as chest X-ray and computed tomography makes treatment more difficult. Herein, we report on two cases admitted to our hospital due to spontaneous pneumothorax during pregnancy. The diagnosis of pneumothorax were made based on a thorax ultrasonography in both patients, while a chest X-ray was used in the follow-up period, without the need for a thorax tomography. While one of the patient was treated via a tube thoracostomy, the other was treated via video-assisted thoracoscopic surgery.

Keywords: Pneumothorax, pregnancy, thoracic surgery

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Introduction

The occurrence of spontaneous pneumothorax (SP) with pregnancy is rare, although it can lead to serious problems for both the mother and fetus [1,2]. Most of the studies in literature are presented as case reports, and number fewer than 100 [1,2]. Alterations in the respiratory physiology and the limitations on the use of such tests as chest X-rays and computed tomography (CT) during pregnancy make the treatment of these patients more difficult.

Herein, we report on two cases admitted to our hospital with SP during pregnancy to highlight the importance of the use of alternative radiological imaging modalities and treatment options for pneumothorax.

Case Presentation

Case 1

A-30-year-old woman in the fifth gestational week (Gravida 2/Parity 1) was admitted with a complaint of chest pain. *The patient had a five pack/year smoking history in addition to a tube thoracostomy due to SP six months previously in her medical history. A physical examination revealed decreased respiratory sounds in the right hemithorax. Her blood pressure was 110/68 mm/Hg, heart rate was 78/min and respiratory rate was 18/min. Blood oxygen saturation was obtained as 98%. Biochemical test results were within normal limits and the β -hCG was 33562 mIU/ml (consistent with gestational week). The patient was further evaluated with a transvaginal ultrasonography (USG) by the obstetrician and gynecologist, the findings of which were consistent with the gestational week. A thoracic USG produced findings that were compatible with a right-sided pneumothorax. The patient*

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was decided to be followed up with nasal oxygen therapy. On Day 3 of follow-up, the patient complained of increased chest pain, and a physical examination revealed decreased respiratory sounds from the right hemithorax. The patient was subsequently evaluated with a chest X-ray with lead shield protection (Figure 1). Upon detection of the progression of pneumothorax, video-assisted thoracoscopic surgery (VATS) was recommended to the patient. The patient refused the surgery, however, and a right tube thoracoscopy was performed. The patient experienced no additional problems during follow-up and the thoracic drainage tube was removed on Day 5. The patient was discharged from the hospital without event. During follow-up, the pregnancy was terminated upon her own request and no recurrent pneumothorax developed during one year of follow-up.

Case 2

A 28-year-old woman in her 22nd gestational week (Gravida 2) was admitted with a complaint of sudden-onset chest pain on the left side. Her past medical history showed no smoking history or lung disease. Upon physical examination, respiratory sounds were found to be decreased in the left hemithorax. The blood pressure of the patient was 126/88 mm/Hg, pulse rate: 68/min and respiratory rate was 16/min. Her blood oxygen saturation was obtained as 97%. Biochemical examinations revealed no pathology other than mild anemia (hemoglobin: 11.9 mg/dl). The findings of a thoracic USG were compatible with a left-sided pneumothorax. The patient was evaluated with a transvaginal USG by the obstetrician and gynecologist, and the findings were found to be consistent with the gestational week. A left tube thoracostomy was performed without any additional diagnostic test. The patient experienced no additional problems during follow-up. The thoracic drainage tube was removed on Day 5 and the patient was discharged. One week later, the patient

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was re-admitted with a complaint of ipsilateral chest pain. Since the findings of thoracic USG were found to be compatible with pneumothorax, the patient was diagnosed with recurrent pneumothorax. A surgical treatment (*videothoracoscopic wedge resection*) decision was chosen for the patient, and she was evaluated with a chest X-ray before the operation (Figure 2). A total pneumothorax was detected and the patient underwent a problem-free videothoracoscopic wedge resection. The patient was re-evaluated by the obstetrician and gynecologist pre- and postoperatively, and no additional problems were observed in the patient or fetus. The thoracic drainage tube was removed on the postoperative fourth day and the patient was discharged without event. The patient gave birth to a male infant weighing 3,025 g in the 39th gestational week under spinal anesthesia. No recurrent pneumothorax was detected during the follow-up period of around one year period. Informed consent was obtained from the participants whose cases are included in the study.

Discussion

Spontaneous pneumothorax during pregnancy is an extremely rare clinical condition that warrants cautious management. The limitations on the use of tests such as chest X-rays and CT, as the standard diagnostic tools, and the changes in the respiratory physiology during pregnancy increase the importance of the condition.

The increase in the demand for oxygen during pregnancy is about 20%, increasing to 50% during delivery [2,4], and this demand is supplied by several complex physiological changes. Minute ventilation increases by a rate of 30–50% due to the direct stimulation of respiratory center by progesterone, and this increase is related primarily with the increase in tidal volume [2-4]. Although

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the diaphragm is pushed upwards by the enlarged uterus, the subcostal angle reaches to 103° from 68° by increasing at a rate of 50%, and an increase in the tidal volume is achieved [3]. An impairment in this complex physiological process causes easier hypoxia than in non-pregnant women, and this can have undesired effects on the fetus [3,4]. *The rapid treatment of pneumothorax detected during pregnancy is therefore of vital importance.*

The definite differential diagnosis in this special patient group is the initial challenge that must be overcome. Dyspnea and chest pain are the most common symptoms in patients with pneumothorax during pregnancy [1,2], and these symptoms can be misdiagnosed as pregnancy-related dyspnea – as a physiological event that affects 75% of pregnant women [1,3,4]. *In pregnancy, cardiac diseases may also cause diagnostic confusion due to their presentation with dyspnea and chest pain. Congenital anomalies such as undiagnosed heart valve failure and atrial septal defects may become symptomatic during pregnancy, and severe acute cardiac pathologies such as myocardial infarction and aortic dissection may also present with chest pain and shortness of breath [5,6]. Pulmonary embolisms, which may be encountered frequently during pregnancy and can cause severe maternal and fetal complications, is another disease that should be considered in a differential diagnosis [5,6]. In addition to these diseases, pneumonia, asthma attack and tuberculosis reactivation may also appear with dyspnea and chest pain [7]. The limited use of radiological tests complicates the condition, although a detailed medical history can be helpful at this stage.* The history of a recent pneumothorax in Case 1 was helpful in our diagnosis; however our second case had no previous lung disease, which complicated the diagnosis.

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As rapid neuronal development and migration take place during organogenesis (between gestational weeks 3 and 8) and the early fetal period (up until the 15th gestational week), the fetus is very sensitive to the teratogenic effects of radiation [8]. Despite this classical knowledge, a review of the literature revealed that chest X-rays were used for the diagnosis in the majority of cases [1,2,9]. *In our cases, we opted for a thoracic ultrasonography to circumvent the teratogenic effects of radiation as the initial diagnostic test. Ultrasonography is widely used in pregnancy as it has no maternal or fetal side effects, and is also common in invasive procedures such as amniocentesis and fetal blood transfusions, both in the detection of pregnancy and during the pregnancy [10]. The idea of using this harmless examination in pregnant patients with thoracic pathologies seems plausible. Literature contains studies reporting the use of ultrasonography in patients with pneumothorax with high sensitivity and specificity [11]. In line with this information, we opted to use ultrasound as much as possible in our patients. But as secondary etiologies such as the level of pneumothorax and parenchymal pathologies cannot be clearly determined via a thoracic ultrasonography, we also evaluated our patients with a chest X-ray in case an operation was considered. At this stage, magnetic resonance imaging (MRI), and the lack of associated fetal and maternal side effects, can be discussed. MRI is known to cause no side effects in the mother or fetus, and has been used in the treatment of lung disease during pregnancy [12]. In the present study, we opted for a chest X-ray due to the low cost, the immediate application and for practical reasons.*

There are different approaches to the treatment of pneumothorax during pregnancy. The British Thoracic Society states that recurrent pneumothorax is seen at an increased rate in pregnant women, and should be treated with conservative approaches with Grade C recommendations [13]. It has also been emphasized that VATS should be considered following pregnancy [13], although there

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have been several studies recommending surgical treatment for patients in whom prolonged air leak or recent recurrence is present during pregnancy [2,9]. Our first case had a history of pneumothorax, and conservative treatment including oxygen and observation was performed. *During the follow-up, the patient refused VATS, despite the progression of the pneumothorax, and so a tube thoracostomy was performed.* The second case was treated initially with a tube thoracostomy, although the condition recurred about one week later, *at which point VATS was performed. The patient was subsequently discharged without event. Prior to undergoing a cesarean section, the patient was examined and no finding related to pneumothorax was noted. Following the cesarean surgery, the patient was re-evaluated with a chest X-ray, and no radiopathological findings were observed.*

In conclusion, pneumothorax during pregnancy is a clinical condition that should be diagnosed and treated with the collaboration of specialists of chest disease, chest surgery, obstetrics and gynecology. In addition to this multidisciplinary approach, a detailed medical history and an ultrasonography performed by an experienced radiologist can be helpful in the differential diagnosis. Although following-up with conservative methods and a tube thoracostomy can provide satisfactory results, VATS should not be avoided *in the event of* prolonged air leak and recent recurrences. *A cesarean section under epidural anesthesia would appear to be a safe choice for delivery in this patient population.*

Informed Consent

Written informed consent was obtained from the all of the patients who participated in this study.

Declaration of conflict of interests

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The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the current version of the Helsinki Declaration.

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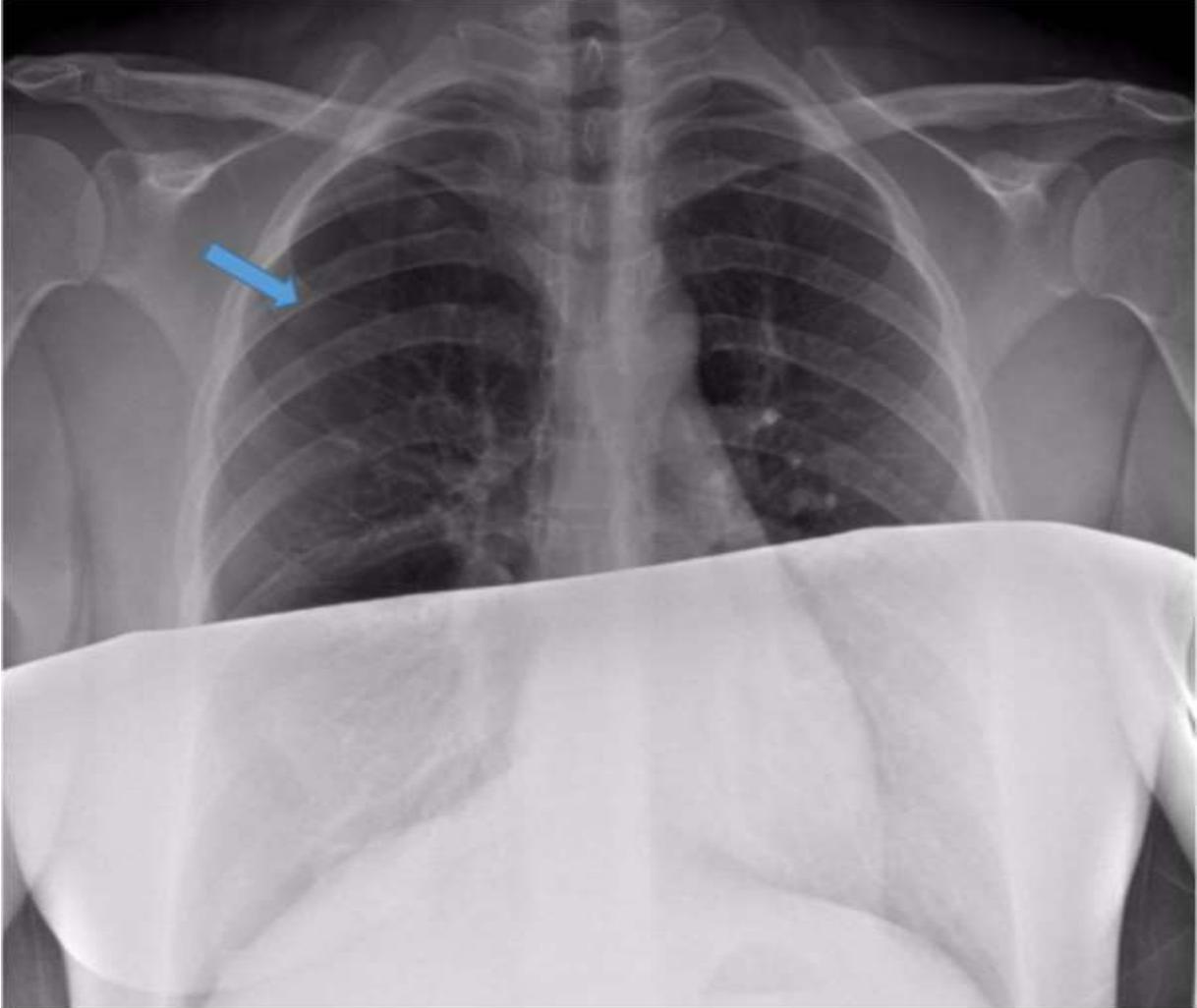
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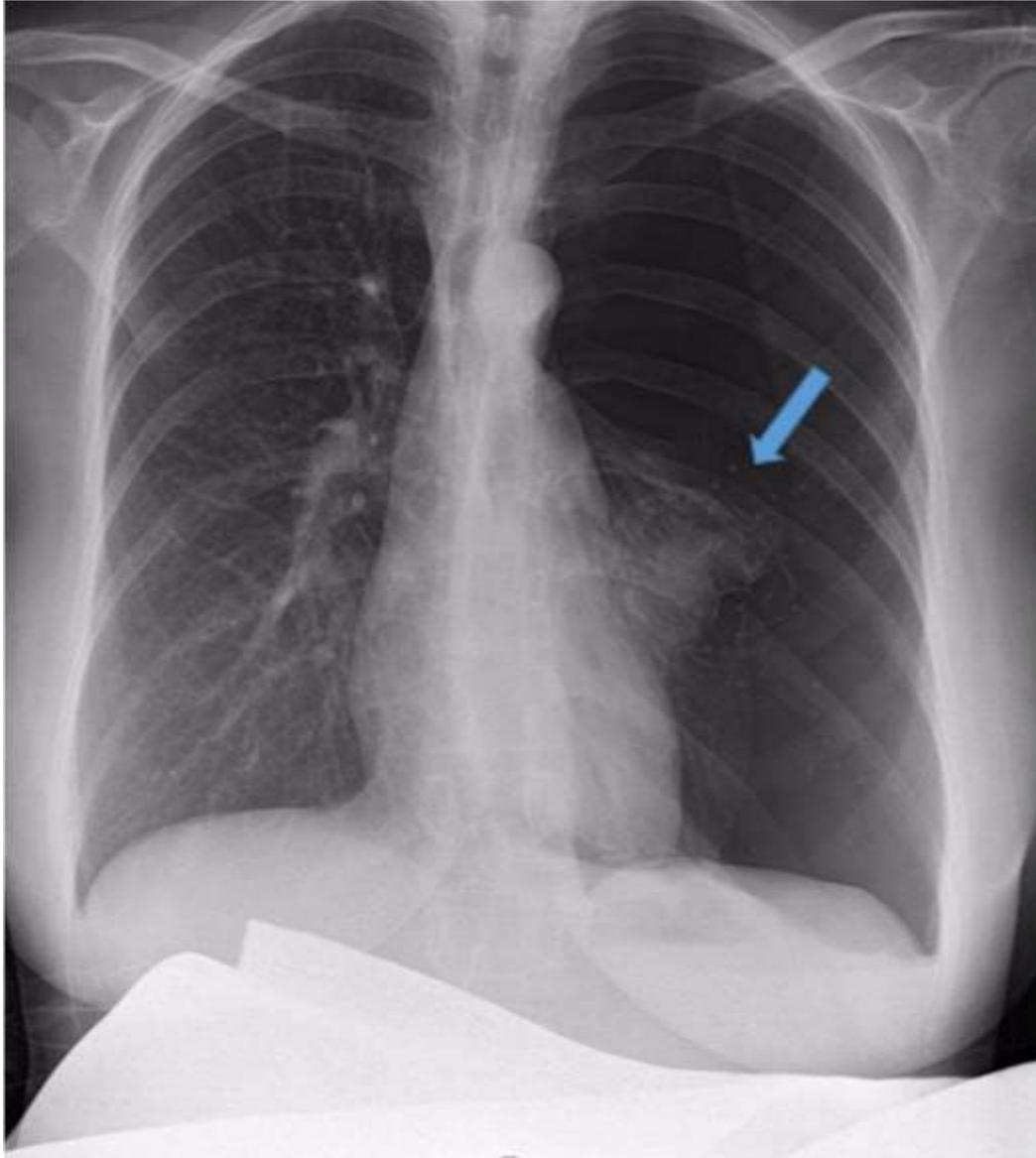
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Figure 1. Right subtotal pneumothorax line with protective material



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Figure 2. Left total pneumothorax with protective material



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