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Summer 7-28-2016

### Pneumothorax Resulting from Costal Osteochondroma

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# Pneumothorax Resulting from Costal Osteochondroma

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## Introduction

Pneumothorax is considered an urgent medical situation that should be treated quickly (Zarogoulidis et al., 2014). It is defined as the presence of air in the pleural space (Figure 1). In large pneumothoraces, breath sounds may be decreased or absent, and hypotension, tachypnea, tachycardia, and cyanosis can occur (Noppen, 2010). Typically pneumothorax is categorized as spontaneous or nonspontaneous (Noppen, 2010). A few cases have been studied in which a pneumothorax was caused by costal exostoses or osteochondroma.

An osteochondroma is the most common benign cartilage tumor (Vemula, Shah, & Willekes, 2012) in which a portion of the epiphyseal growth plate cartilage is separated from the main epiphysis (Kadu, Saindane, Goghate & Goghate, 2015). Osteochondroma begins in childhood and continue until skeletal maturity is reached (Jhunjhunwala & Dalal, 2016). The tumors can occur as a single exostosis or as multiple exostoses, which are noted in hereditary multiple exostoses (Marlowe, Arensman, & Price, 2011). The exostoses primarily are found in the metaphyseal portions of long bones, but can occur in the ribs (Imai et al., 2014). Most costal lesions are asymptomatic, but life threatening conditions such as pneumothorax secondary to osteochondroma have been reported in the literature (Vemula, Shah & Willekes, 2012). The pneumothoraces usually are due to mechanical injury from the exostosis to adjacent anatomical structures such as the pleura (Assefa, Murphy, Bergman & Atlas, 2011).

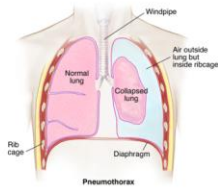


Figure 1. Diagram depicting physiologic mechanisms of pneumothorax. (Brigham and Women's Hospital, 2016)

## Case Study

A 16-year-old male reported to the hospital with complaints of right-side pleuritic chest pain with no recent history of trauma. His medical history included a diagnosis of multiple exostoses. This diagnosis also was present in other immediate family members.

A chest xray showed a right pneumothorax accompanied by a mass from the seventh and eighth ribs. Further examination by computed tomography (CT), indicated exostosis in the same ribs with a bony spur pointing inward toward the thoracic cavity.

Chest tube placement was performed to drain the pneumothorax. Costal resection surgery was performed by video-assisted thorascopic surgery. Thickening of the visceral pleura was noted near the eight rib. Resection of the rib containing the inward-projecting exostosis was performed. The pathological specimen revealed tissue consistent with exostosis but was non-malignant. (Imai et al., 2012).

For an example of CT imaging of costal exostosis and resulting pneumothorax see Figure 2 below.

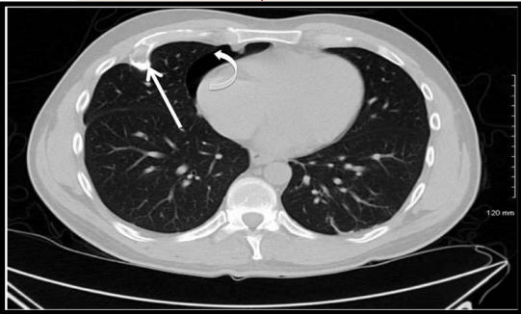


Figure 2. CT of chest without contrast showing lesion on posterior aspect of 4<sup>th</sup> rib (white arrow), and pneumothorax (curved white arrow). (Vemula, Shah & Willekes, 2012)

## Signs and Symptoms

### Costal Osteochondroma/exostoses

- Exostoses in many locations, especially metaphyseal region of long bones, trunk, scapula, ilium in addition to costal area (Figure 2)

- Typically the presence of EXT gene mutation (Kameda et al., 2016).

### Pneumothorax

- Shortness of Breath
- Chest Pain
- Diminished or absent breath sounds on affected side
- Dyspnea, tachypnea
- Tachycardia (ENA, 2014; Vemula et al., 2012)
- Hyper-resonant percussion of lungs (Noppen, 2010; ENA, 2014)

### Diagnosis

- Radiologic confirmation by XRAY, CT or MRI (Assefa et al., 2011)

## Underlying Pathophysiology

### Osteochondroma/exostosis

Costal osteochondromas, also known as exostoses, can be solitary events. This can include a sporadic event or can be secondary to trauma. This type of exostosis can occur in adults or children.

In addition, hereditary multiple exostoses (HME) can cause abnormal bone growth with resulting skeletal abnormalities in bones that have cartilagenous origins . (Figure 3) HME is an autosomal dominant disorder with an EXT family gene mutation. Exostoses resulting from HME typically occur before puberty (Marlowe et al., 2013; Assefa et al., 2011; Vemula et al., 2012).



Figure 3. Images depicting patients with EXT mutations and resulting osteochondromas, noted by the white arrows. (Cao et al., 2013)

### Pneumothorax Related to Osteochondroma

Pneumothorax occurs secondary to direct trauma to the lung from osteochondroma/exostosis (Chawla, Jackson & Munro, 2013). The sharp margins of the costal exostosis can cause a laceration to the pleura and pneumothorax (Imai et al., 2014). The exostosis can also mechanically interfere with the lung and pleura resulting in pneumothorax (Jhunjhunwala & Dalal, 2016). These physiologic mechanisms categorize the pneumothorax as traumatic (Zarogoulidis et al., 2014).

The damage to the chest wall and/or lung allows air from the atmosphere to enter the pleural space (Zarogoulidis, et al., 2014) , causing a subsequent loss of negative intrapleural pressure. The loss of the negative intrapleural pressure can cause partial or total lung collapse, also known as pneumothorax (Emergency Nurses Association [ENA], 2014). Figure 1 shows a diagram of pneumothorax physiology.

## Significance of Pathophysiology

While most costal tumors are asymptomatic, advanced practice nurses should be aware of the potentially fatal complications associated with these abnormal growths. Previously asymptomatic osteochondromas can undergo malignant transformation. One to two percent of solitary tumors become malignant, but that number rises to twenty five percent in HME. Therefore, close surveillance is of importance to ensure life-threatening pneumothorax, or other associated complications do not occur (Vemula et al., 2012). Prevention, diagnosis, and quick treatment of pneumothorax, secondary to a costal osteochondroma, should be the priority of the advanced practice nurse in at-risk patients.

## Implications for Nursing Care

The majority of patients presenting with costal osteochondromas are asymptomatic, and the tumors are typically seen as incidental findings on chest radiographs (Vemula et al., 2012; Assefa et al., 2011). However, in patients with HME, costal exostoses are more common and should be monitored (Assefa et al., 2011). Complications are still rare, but life threatening pneumothorax can occur with solitary osteochondromas or exostoses (Assefa et al., 2011; Imai et al., 2014).

Patients with suspicion for costal exostoses or osteochondroma should be examined with a CT scan to determine if involvement of the growth with intrathoracic organs (Kameda et al., 2016). Some studies propose only close follow-up as treatment, especially if the patient is asymptomatic (Chawla et al., 2013; Vemula et al., 2012). Others propose surgical treatment due to the possibility of lung trauma resulting in pneumothorax (Chawla et al., 2013; Kameda et al., 2016; Vemula et al., 2012; Jhunjhunwala & Dalal, 2016).

## Implications for Nursing Care Cont.

Advanced practice nurses should cautiously evaluate costal osteochondromas and exostoses due to their potential to cause lung and pleural injuries. This is especially true for pre-pubescent children with HME. If complications are associated with the tumor, surgical treatment should be explored that can include thorascopic surgery. In the case of immediate necessary treatment, needle decompression, chest tube insertion, or needle aspiration are potential options (Zarogoulidis et al., 2014).

## Conclusion

Osteochondromas are the most common neoplasm of the bone. Two percent of these tumors grow in the chest wall, and can cause severe complications such as pneumothorax. Costal exostoses can cause traumatic pneumothorax through puncture, laceration, or friction from chest wall movement during breathing (Kameda et al., 2016; Imai et al., 2014). The consequent change in intrapleural pressure and possible lung collapse is an urgent medical situation (ENA, 2014) that the advanced practice nurse should diagnose and treat quickly.

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