

## PedsCases Podcast Scripts

This podcast can be accessed at [www.pedscases.com](http://www.pedscases.com), Apple Podcasting, Spotify, or your favourite podcasting app.

### **Approach to Pneumothorax**

Developed by Ryerson Seguin and Dr. Bryan Dicken for Pedscases.com  
February 22, 2022

### **Introduction**

Hey everyone, my name is Ryerson Seguin and I'm a third-year medical student at the University of Alberta. Today's episode was developed alongside Dr. Bryan Dicken, Pediatric Surgeon and Associate professor at the University of Alberta. Today we are going to be discussing pneumothorax.

### **Objectives**

By the end of this podcast, the listener will be able to:

1. Define pneumothorax and describe how it can occur
2. List a differential diagnosis for someone with a suspected pneumothorax
3. Identify the clinical signs/symptoms of someone presenting with a pneumothorax
4. Describe the management of a pneumothorax

To get started, let's begin with a case!

### **Clinical Case**

This is your 1<sup>st</sup> week on your Emergency Medicine rotation when a Max, a 16-year-old boy walks in presenting with increased difficulty of breathing and slight right-sided chest pain that began late last night after he got back from soccer practice (about 14 hours ago). He says the pain was pretty sharp initially but has dissipated slightly since it first began. You are asked to get a further history and report back to the attending physician where you will complete the physical exam together. You discover that there has been no history of trauma to the chest and no history of lung disease. Likewise, there is no family history of issues with the lung or heart. He has a slight cough that is associated with acute pain in the upper-right chest. He admits to smoking on occasion with his friends. Additionally, his mother tells you that he has undergone a "huge growth spurt" over the past year. When you look at his healthcare record you see that he has grown 5 inches in the past year and is now 6'2".

Developed by Ryerson Seguin and Bryan Dicken for Pedscases.com  
February 22, 2022

## **Pathophysiology/common methods of injury**

Alright, so keeping Max in mind, let's go over what exactly a pneumothorax is, and how it can occur. Simply put, a pneumothorax is an accumulation of air within the pleural space, or in other words, air between the chest wall and the lung tissue. There are two main categories of pneumothorax: The first is traumatic which includes both accidental and iatrogenic causes and the second is spontaneous. In today's episode, we will discuss both.

First, a traumatic pneumothorax: this occurs when there has been damage to the chest wall. This can either be from penetrating injuries, such as a knife wound or a gunshot, or blunt injuries—like the impact from an MVC. Additionally, as I mentioned earlier, there are iatrogenic causes. It is for this reason that it is especially important to be vigilant in your observation of a patient when they have recently undergone a procedure, including a pleural biopsy, subclavian needle stick, transthoracic needle aspiration, transbronchial biopsy, or a thoracentesis.

The second category is Spontaneous pneumothorax, which may be categorized into primary and secondary. Overall, a spontaneous pneumothorax is rare, occurring in only 2.6/100 000 children.

In general terms, a Primary pneumothorax occurs in individuals with otherwise healthy lungs while a secondary pneumothorax occurs in individuals with underlying lung conditions.

So let's break both of those down beginning with Primary Spontaneous pneumothorax

- **Primary Spontaneous pneumothorax**
  - This type of pneumothorax often presents after physical exertion but can also occur while the patient is at rest. It is more commonly found in tall, thin males. Additionally, the risk for occurrence (and recurrence) increases with tobacco use. In pediatric populations, it mainly occurs between ages 15-17. It can also occur in newborns, more often those who have a higher birth weight.
  - The underlying cause of primary spontaneous pneumothoraces isn't quite clear. It is thought typically to be associated with the rupture of superficial blebs (which are thinned areas of lung tissue typically smaller than 1 cm), however, in rare cases, it has also been shown to be associated with exposure to loud music and changes in atmospheric pressure. There is also evidence that there may be a genetic component, though it is still unclear at this time.

- o Patients may be asymptomatic or may come in presenting with unilateral chest pain that usually abates within 24 hours. This type of pneumothorax is often self-limiting. Pain is often exacerbated by deep breathing or coughing, resulting in sharp chest pain on the affected side.

Now onto

- **Secondary Spontaneous pneumothorax**

- o Remember, this is a pneumothorax occurring in someone with underlying lung conditions. The most common conditions to note for pediatric populations include obstructive conditions, such as Cystic Fibrosis or Asthma, infectious conditions, like measles or HIV, interstitial lung disease, or connective tissue diseases, such as Scleroderma or Marfan's syndrome.
- o Unlike Primary Spontaneous pneumothorax, this can be a life-threatening condition because the lungs are already impaired. This type of pneumothorax is more common in adult populations than pediatric populations.

## **History/Physical Exam/Differential diagnosis**

Now, anytime someone comes in presenting with chest pain there are a few things to rule out. This list includes a pulmonary embolism, myocardial infarction, esophageal rupture, tension pneumothorax, and MSK-type pain.

The best way to rule in a pneumothorax while simultaneously ruling out other diagnoses is first: a good History (which we will continue to get from Max throughout this section) and second your physical exam. However, it is important to note, that more often than not, the physical exam will be normal.

For History, you want to clarify what the patient means by "chest pain" – with a pneumothorax it will most often present as a sudden, sharp pain on the lateral side of the body, localizing to one side. You would want to ask the patient about feeling lightheaded, (resulting from hypotension). If the patient has a primary spontaneous pneumothorax, the pain would be most intense at the onset, but then dissipate within 24 hours. With a secondary, or traumatic pneumothorax, the symptoms will be more severe and do not go away without treatment. Additionally, they might complain of a cough or palpitations.

As we consider the possibility of pulmonary embolism on our differential of acute chest pain, you want to make sure and ask about a history of a DVT. This could include

symptoms of a swollen and/or tender leg as well as long periods of immobility. Max denies any of those symptoms when you ask him.

You also want to take this time to ask some questions to lower your suspicions of an esophageal rupture. This would include a history of extreme retrosternal chest pain or severe vomiting or retching. Luckily, Max denies any of these symptoms when you ask.

Myocardial infarction is extremely rare in pediatrics, but asking about nature of the pain, radiation and any chest pain with exertion would be valuable as well as asking about past history of any congenital or acquired heart conditions. Max has no past cardiac history.

You decide to then move onto your physical examination. Vital signs are always a great place to start. With a pneumothorax, you can expect to find the patient tachypneic and tachycardic. Additionally, on respiratory examination, you might find decreased/absent breath sounds on the side of the affected lung, transmitted breath sounds, or, as we mentioned earlier, the patient could present with no physical signs. Decreased motion of the chest with breathing, decreased tactile fremitus, an enlarged hemithorax (asymmetry of the chest wall) labored breathing, and hyperresonance on percussion of the affected side are all other possible signs. It is important to note that as the size of the pneumothorax increases, so does the extent of the corresponding signs/symptoms. Red flags to watch out for include signs that this has progressed to a tension pneumothorax including tracheal deviation (away from the affected side), a sudden difficulty with ventilation, and distended neck veins/elevated JVP.

For patients with a traumatic pneumothorax, complete exposure of the chest, both front and back are essential to identify the entry or exit wounds, as these may be associated with a sucking chest wound with worsening of the pneumothorax.

For infants, the signs are slightly different. Again, you should start with your vital signs. In addition, you are looking for cyanosis, decreased breath sounds, chest transillumination, nasal flaring, and tachypnea.

Lack of pain around the area with palpation will also help lower your suspicion of MSK-type pain.

## **Labs/Work-up**

It is important to know that a pneumothorax is can be diagnosed based on history and clinical findings. However, it is essential that a CXR be performed to confirm clinical

suspicious, as clinical findings are often subtle. The most common position is a standing PA view, with inspiration/expiration views.

As a side note, there aren't many laboratory tests to aid in your diagnosis of pneumothorax. That being said, with a longstanding pneumothorax, an Arterial Blood Gas may demonstrate hypoxemia, however, in acute cases, the ABG will be normal.

If you are unsure whether or not this could be cardiac in etiology, a normal result from an ECG is a quick and inexpensive way to make sure you aren't missing this diagnosis.

## Management

Now that we understand a bit more about what a pneumothorax is and how it presents, we need to talk about how to manage it. As you can imagine, the management differs depending on the type and severity of the pneumothorax.

For an asymptomatic patient who meets the following conditions including:

1. The patient has a small spontaneous pneumothorax (<3cm between the apex of the lung and the dome of the thoracic cavity)
- or
2. if the pneumothorax involves <20% of the hemithorax,

observation alone is a satisfactory treatment.

For other conditions including:

1. a large primary spontaneous pneumothorax
- or
2. a tension pneumothorax

patients are treated with a chest tube (otherwise known as a tube thoracostomy. This can be performed by landmarking between the 4<sup>th</sup> and 5<sup>th</sup> intercostal spaces at the anterior axillary line and then placing a tube into the chest, ensuring that it is inserted OVER TOP of the rib in order to avoid damaging the neurovascular bundle.

All patients, regardless of whether you are just observing the patient, or if you intervened, should have a repeat CXR the next day to ensure that the pneumothorax isn't progressing, and to make sure there are no worsening symptoms despite a chest tube.

Finally, for patients with a recurrent or bilateral pneumothorax or with a persistent air leak, a thoracotomy, or video-assisted thoracoscopic surgery may be necessary.

## Case Wrap-up and Key Learning Objectives

Developed by Ryerson Seguin and Bryan Dicken for PedsCases.com  
February 22, 2022

In conclusion, let's go back to Max. He's a 16-year-old, tall, thin male who occasionally smokes. Unfortunately, this puts him at high risk for a primary spontaneous pneumothorax. When you conduct your physical exam on him you don't appreciate any tracheal deviation, and other than being slightly tachycardic, his vital signs are normal. He has hyperresonance in his upper left chest wall when you percuss as well as decreased tactile fremitus and breath sounds in the same area. Based on our discussion today you think he has a Primary Spontaneous pneumothorax. Your attending Physician agrees with you and you send Max for an upright PA chest X-ray. When you look at the X-ray you notice a small apical pneumothorax measuring <2cm in the upper right chest. You recognize that this represents a low risk and can be treated with observation alone. You reassure Max and his mother about what is going on and educate them about any signs that could indicate that the pneumothorax is getting worse, including worsening chest pain or shortness of breath. You inform them they need to return to the Emergency department ASAP if any of those signs develop. You also tell them to follow up with their family doctor and ensure they get another CXR within 24 hours. Finally, you talk to them about the dangers of smoking and Max agrees to quit. Great work!

So now, that Max has been safely and carefully managed let's review our key learning objectives for today's episode:

1. Define pneumothorax and describe how it can occur
  - a. We learned that a pneumothorax is an accumulation of air in the pleural space. It can occur as the result of trauma to the chest, or it can be spontaneous – often occurring in tall, thin adolescent males.
2. List a differential diagnosis for someone with a suspected pneumothorax
  - a. We talked about some of the more serious things that can partially mimic or mask a pneumothorax including Pulmonary Embolism, Myocardial Infarction, Esophageal Rupture, Tension Pneumothorax, or MSK type pain.
3. Identify the clinical signs/symptoms of someone presenting with a pneumothorax
  - a. Remember, we are looking for someone who may or may not have obvious chest wounds, is tachycardic, has decreased/absent breath sounds in the affected area, hyperresonance upon percussion, and decreased tactile fremitus.
  - b. We can confirm our clinical suspicions with an X-ray.
4. Describe the management of a pneumothorax
  - a. For a stable patient meeting specific criteria we simply observe. However, symptomatic patients with moderate to large pneumothorax, or patients

who have undergone trauma often require a chest thoracostomy or undergo surgical procedures to fix the underlying issues.

And that concludes today's Pedscase episode on pneumothorax. Thanks for listening and stay tuned for more Podcasts coming your way.

## **References**

Macduff A, Arnold A, Harvey J. Management of Spontaneous Pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. Available from: <http://thorax.bmj.com/>

Tschopp JM, Rami-Porta R, Noppen M, Astoul P. Management of spontaneous pneumothorax: State of the art. *Eur Respir J*. 2006 Sep;28(3):637–50.

Sassoon CS, Light RW, O'Hara VS, Moritz TE. Iatrogenic pneumothorax: etiology and morbidity. Results of a Department of Veterans Affairs Cooperative Study. [\*Respiration\*. 1992;59\(4\):215-20](#)

Noppen M, De Keukeleire T. Pneumothorax. [\*Respiration\*. 2008;76\(2\):121-7](#)

Al Tawil K, Abu-Ekteish FM, Tamimi O, Al Hathal MM, Al Hathlol K, Abu Laimun B. Symptomatic Spontaneous Pneumothorax in Term Newborn Infants. *Pediatr Pulmonol* [Internet]. 2004 May 1 [cited 2021 Jun 9];37(5):443–6. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1002/ppul.10447>

Morrison PJ, Lowry RC, Nevin NC. Familial primary spontaneous pneumothorax consistent with true autosomal dominant inheritance. *Thorax* [Internet]. 1998 [cited 2021 Jun 9];53(2):151–152. Available from: <https://pubmed.ncbi.nlm.nih.gov/9624302/>

Teven S, Ahn AS, Ohn J, Effner EH. The New England Journal of Medicine SPONTANEOUS PNEUMOTHORAX. 2000.

Baumann MH, Strange C, Heffner JE, et al; AACP Pneumothorax Consensus Group. Management of spontaneous pneumothorax: an American College of Chest Physicians Delphi consensus statement. [\*Chest\*. 2001 Feb;119\(2\):590-602](#)

