Spontaneous pneumothorax in children

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Abstract

Question A 15-year-old boy in my practice returned for follow-up after having a spontaneous pneumothorax. He spent 6 hours in the emergency department and received oxygen. How common is this condition, and what needs to be considered regarding management and recurrence?

Answer Primary spontaneous pneumothorax—penetration of air in the pleural space between the lung and the chest wall—in children is common, and the incidence seems to be on the rise. Emphysematous bleb, asthma, and tobacco use were the most common findings associated with the condition, and in young children pneumothorax might be associated with underlying congenital anomalies. Auscultation and observation of the chest with imaging are used to diagnose the condition, and recurrence in adolescents is common. Treatment includes supportive therapy (mostly rest and oxygen) for small pneumothorax or placing a chest tube or definitive surgical treatment for larger pneumothorax.

Pneumothorax—the penetration of air in the pleural space between the lung and the chest wall—is a common finding in otherwise healthy adolescents. Since René T.H. Laënnec, the father of the stethoscope, became the first physician to reliably distinguish between pneumothorax and other lung pathologies in 1813,[1] spontaneous pneumothorax has been documented frequently.

Primary spontaneous pneumothorax occurs without any precipitating traumatic or iatrogenic mechanism, and secondary pneumothorax is considered when a cause is known. The incidence of spontaneous pneumothorax is estimated to be 3.4 to 18 cases per 100000 in men and 1.2 to 6 per 100000 in women,[2-4] and a recent age-stratified longitudinal study using data from the National Health Research Institutes of Taiwan reported an increased incidence over time.[5] In a large retrospective analysis from the United States (1997 to 2006), spontaneous pneumothorax increased from 2.68 to 3.41 per 100000 over a 10-year period.[6] The age group at highest risk is those 13 to 22 years of age, with incidence rates of higher than 10 per 100000 adolescents and young adults who were hospitalized.[5,6]

Emphysematous bleb (21%), asthma (10%), and tobacco use (4%) were the most common associated findings in the early 21st century.[6] Asthma (with or without exacerbation) is known to be associated with spontaneous pneumothorax, and the increase in recognition of asthma among adolescents in the Western world has also been associated with a substantial increase in the incidence of spontaneous pneumothorax.[6-8] In younger children, underlying congenital anomalies might also serve as a predisposing factor.[9]

It is commonly thought that young males with Marfan syndrome, the most common inherited disorder of connective tissue, are prone to spontaneous pneumothorax. In one retrospective cohort study from the Mayo Clinic, with patients 13 years of age or older and adults, 5% had experienced spontaneous pneumothorax, and 2 of 8 patients had had more than 1 episode. Apical blebs or bullae were identified on radiologic imaging in about 10% of patients.[10]

Clinical diagnosis and imaging

The presentation of pneumothorax usually includes acute onset of pain at rest or during mild physical activity and, depending on the extent of the pneumothorax, might include dyspnea and cough.[11] Auscultation of the chest might reveal differences in air entry to the lungs. However, for small pneumothorax, unequal breath sounds, hyperresonance with percussion, and asymmetric wall movements might be difficult to detect.

An x-ray scan of the chest can support the diagnosis, on which small amounts of intrapleural air can be seen, with air in the pleural space that outlines the visceral pleura. Reduced or a complete lack of markings on the affected side can be seen because of air. Atelectasis might also be seen on the affected side owing to compression by pleural air. A shift of the mediastinum and trachea pushed away from the affected lung has been documented in moderate to severe pneumothorax.

Current availability of ultrasound at the bedside has enhanced its use to detect pneumothorax. A recent meta-analysis of 17 studies with adult patients assessing ultrasound for pneumothorax compared with chest tomography, with or without an x-ray scan, suggested that the diagnostic accuracy of chest ultrasonography was very high, with an area under the curve of 0.979.[12] A meta-analysis in children found higher sensitivity and similar specificity for ultrasonography compared with chest x-ray scans, with a pooled sensitivity of 0.88 and specificity of 0.99 with ultrasonography, compared with a sensitivity of 0.52 and specificity of 1.00 for x-ray scans.[13] Computed tomography scans should be

reserved for individuals with Marfan syndrome, with the prospect of identifying blebs and to ensure risk stratification for pneumothorax.[10]

Choosing therapy

Treatment depends on the size of the pneumothorax. Most children and adolescents with pneumothorax, especially when minimal symptoms exist, can be managed conservatively. Bed rest might be all that is needed for previously healthy children with a small (5% to 15%) pneumothorax. Oxygenation in an emergency department might be needed if shortness of breath or chest pain are apparent, as oxygen has a role in faster reabsorption of air in the pleural cavity.[14] High concentrations of oxygen should be avoided to prevent toxicity. Among children with secondary spontaneous pneumothorax, longer observation and admission might be needed.

In children with larger symptomatic pneumothorax, chest tube placement might be needed. In a small retrospective study from Boston, Mass, children with pneumothorax had safer and more effective outcomes with pigtail catheters compared with large-bore chest tubes, but only 16 patients were included.[15]

Recurrence

Recurrent pneumothorax is the most common complication after an initial episode and was documented in about 50% of children.[16] Primary spontaneous pneumothorax recurrence rates were highest (22.4% to 36.8%) in children 13 to 18 years of age.[5] In a retrospective study of conservative treatment for 114 Korean children with primary spontaneous pneumothorax, almost half developed ipsilateral recurrence and 14% developed contralateral recurrence.[17] Blebs or bullae seen on high-resolution computed tomography or chest x-ray scans after an initial episode of pneumothorax were associated with ipsilateral recurrence. This information might be of benefit for a decision to embark on early video-assisted thoracoscopic surgery for those at high risk of recurrence.[17] In a small series from Israel, morbidity was comparable for those needing a chest tube or surgery, and the recurrence rate was statistically significantly lower following surgical intervention compared with other therapies.[16] In a retrospective series from Canada with 31 children with a 60% recurrence rate, video-assisted thoracic surgery resulted in less pain and shorter hospital stays compared with thoracostomy tubes, and was suggested (including prophylactic, contralateral treatment) as a preferred method.[18]

Conclusion

Primary spontaneous pneumothorax in children is common and incidence has increased over time. Auscultation and observation of the chest, with either x-ray or ultrasound scans, are used to diagnose the condition. Treatment for small pneumothorax is supportive, and for moderate and large pneumothorax it includes placing a chest tube or definitive treatment with surgery.

Competing interests
None declared

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References

1. Vatanoğlu-Lutz EE, Ataman AD. Medicine in philately: Rene T. H. Laënnec, the father of stethoscope. *Anatol J Cardiol* 2016;16(2):146-7.
2. Melton LJ 3rd, Hepper NGG, Offord KP. Incidence of spontaneous pneumothorax in Olmsted county, Minnesota: 1950 to 1974. *Am Rev Respir Dis* 1979;120(6):1379-82.
3. Bense L, Eklund G, Wiman LG. Smoking and the increased risk of contracting spontaneous pneumothorax. *Chest* 1987;92(6):1009-12.
4. Lopez ME, Fallon SC, Lee TC, Rodriguez JR, Brandt ML, Mazziotti MV. Management of the pediatric spontaneous pneumothorax: is primary surgery the treatment of choice? *Am J Surg* 2014;208(4):571-6. Epub 2014 Jul 24.
5. Huang YH, Chang PY, Wong KS, Chang CJ, Lai JY, Chen JC. An age-stratified longitudinal study of primary spontaneous pneumothorax. *J Adolesc Health* 2017;61(4):527-32. Epub 2017 Jul 14.
6. Dotson K, Timm N, Gittelman M. Is spontaneous pneumothorax really a pediatric problem? A national perspective. *Pediatr Emerg Care* 2012;28(4):340-4.
7. Poenaru D, Yazbeck S, Murphy S. Primary spontaneous pneumothorax in children. *J Pediatr Surg* 1994;29(9):1183-5.
8. Davis AM, Wensley DF, Phelan PD. Spontaneous pneumothorax in paediatric patients. *Respir Med* 1993;87(7):531-4.
9. Kaslow J, Bickel S, Wiesenauer C, Eid N, Morton R. Pediatric spontaneous pneumothorax: our experience and a review of the literature. *Pediatr Allergy Immunol Pulmonol* 2018;31(4):208-14. Epub 2018 Dec 12.
10. Karpman C, Aughenbaugh GL, Ryu JH. Pneumothorax and bullae in Marfan syndrome. *Respiration* 2011;82(3):219-24. Epub 2011 Jan 22.
11. Robinson PD, Blackburn C, Babl FE, Gamage L, Schutz J, Nogajski R, et al. Management of paediatric spontaneous pneumothorax: a multicentre retrospective case series. *Arch Dis Child* 2015;100(10):918-23. Epub 2015 Feb 10.
12. Ding W, Shen Y, Yang J, He X, Zhang M. Diagnosis of pneumothorax by radiography and ultrasonography: a meta-analysis. *Chest* 2011;140(4):859-66. Epub 2011 May 5.
13. Staub LJ, Biscaro RRM, Kaszubowski E, Maurici R. Chest ultrasonography for the emergency diagnosis of traumatic pneumothorax and haemothorax: a systematic review and meta-analysis. *Injury* 2018;49(3):457-66. Epub 2018 Feb 8.
14. Park CB, Moon MH, Jeon HW, Cho DG, Song SW, Won YD, et al. Does oxygen therapy increase the resolution rate of primary spontaneous pneumothorax? *J Thorac Dis* 2017;9(12):5239-43.
15. Dull KE, Fleisher GR. Pigtail catheters versus large-bore chest tubes for pneumothoraces in children treated in the emergency department. *Pediatr Emerg Care* 2002;18(4):265-7.
16. Seguier-Lipszyc E, Elizur A, Klin B, Lotan G. Management of primary spontaneous pneumothorax in children. *Clin Pediatr* (Phila) 2011;50(9):797-802. Epub 2011 Apr 11.
17. Choi SY, Park CB, Song SW, Kim YH, Jeong SC, Kim KS, et al. What factors predict recurrence after an initial episode of primary spontaneous pneumothorax in children? *Ann Thorac Cardiovasc Surg* 2014;20(6):961-7. Epub 2013 Nov 27.
18. Butterworth SA, Blair GK, LeBlanc JG, Skarsgard ED. An open and shut case for early VATS treatment of primary spontaneous pneumothorax in children. *Can J Surg* 2007;50(3):71-4.

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