



BÖLÜM 9

Büyük Havayolu Hastalıkları

Serap GENÇER¹

GİRİŞ

Havayolu hastalıkları trakeayı, bronşları ve bronşioelleri tutan hastalıklardır ve etkilenen havayolunun boyutuna bağlı büyük ve küçük havayolu hastalıkları olarak ikiye ayrılabilir. Bu bölümde büyük havayolu hastalıklarından bahsedilecektir.

Büyük havayolları, üst veya alt havayolları olarak sınıflandırılır. Üst bölümü nazal kaviteden başlayan ve torasik inlete kadar servikal trakeayı kapsayan hava pasajıdır. Alt bölümü ise torasik inlet seviyesinin altında başlar, torasik trakea ve bronşları içerir. Trakea ve bronşların duvarlarında kıkırdak bulunur.

Yüksek çözünürlüklü bilgisayarlı tomografi (“*high-resolution computed tomography*”- *HRCT*), havayolu hastalığı şüphesi olan hastaların araştırılmasında kullanılan en önemli görüntüleme yöntemidir. Ekspiratuar *HRCT* gerekli durumlarda kullanılabilir. Zorlu ekspirasyonda tamamlayıcı bilgisayarlı tomografi (*BT*) çekimi sıklıkla tavsiye edilir ve özellikle trakeobronşial kollapsı ve ekspiratuar hava hapsini değerlendirmek için yararlıdır (1). Pron pozisyonda çekilen *HRCT* ile erken ve gizli interstisyel akciğer hastalıkları tespit edilebilir (2). İnce kesitli aksiyel görüntüler trakeadan başlayarak *BT*'de görülebilen en küçük periferik bronşiole kadar havayollarının kolayca takip edilmesini sağlar. Minimum ve maksimum yoğunluk (“*intensity*”) projeksiyonlarının kullanıldığı multiplanar reformatlar, havayolu anormalliklerinin görüntülenmesinde yardımcı olabilir.

¹ Uzm. Dr., Ankara Atatürk Sanatoryum Eğitim ve Araştırma Hastanesi, Radyoloji Kliniği, serapkirli@yahoo.com, ORCID iD: 0000-0002-8648-6536

KAYNAKLAR

1. Grenier PA, Kanne JP. Current Approach to Acute and Chronic Airway Disease. 2019 [cited 2023 May 17];57–64. Available from: <https://pubmed.ncbi.nlm.nih.gov/32096939/>
2. Griffin CB, Primack SL. High-resolution CT: normal anatomy, techniques, and pitfalls. Radiol Clin North Am [Internet]. 2001 [cited 2023 May 17];39(6):1073–90. Available from: <https://pubmed.ncbi.nlm.nih.gov/11699662/>
3. Boiselle PM. Imaging of the large airways. Clin Chest Med [Internet]. 2008 Mar [cited 2023 May 17];29(1):181–93. Available from: <https://pubmed.ncbi.nlm.nih.gov/18267191/>
4. Ngo AVH, Walker CM, Chung JH, Takasugi JE, Stern EJ, Kanne JP, et al. Tumors and tumor-like conditions of the large airways. AJR Am J Roentgenol [Internet]. 2013 Aug [cited 2023 May 17];201(2):301–13. Available from: <https://pubmed.ncbi.nlm.nih.gov/23883210/>
5. Hyde DM, Hamid Q, Irvin CG. Anatomy, pathology, and physiology of the tracheobronchial tree: emphasis on the distal airways. J Allergy Clin Immunol [Internet]. 2009 [cited 2023 May 17];124(6 Suppl). Available from: <https://pubmed.ncbi.nlm.nih.gov/19962039/>
6. Shepard JAO, Flores EJ, Abbott GF. Imaging of the trachea. Ann Cardiothorac Surg [Internet]. 2018 Mar 1 [cited 2023 May 17];7(2):197–209. Available from: <https://pubmed.ncbi.nlm.nih.gov/29707497/>
7. Stern EJ, Graham CM, Webb WR, Gamsu G. Normal trachea during forced expiration: dynamic CT measurements. Radiology [Internet]. 1993 [cited 2023 May 17];187(1):27–31. Available from: <https://pubmed.ncbi.nlm.nih.gov/8451427/>
8. Michael Holbert J, Strollo DC. Imaging of the normal trachea. J Thorac Imaging [Internet]. 1995 [cited 2023 May 17];10(3):171–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/7674430/>
9. Ghaye B, Szapiro D, Fanchamps JM, Dondelinger RF. Congenital Bronchial Abnormalities Revisited1. <https://doi.org/10.1148/radiographics211.g01ja06105> [Internet]. 2001 Jan 1 [cited 2023 May 17];21(1):105–19. Available from: <https://pubs.rsna.org/doi/10.1148/radiographics.21.1.g01ja06105>
10. TORAKS DERGİSİ AĞUSTOS 2006 • CİLT 7 • SAYI 2.
11. Spittle N, McCluskey A. Lesson of the week: tracheal stenosis after intubation. BMJ [Internet]. 2000 Oct 21 [cited 2023 May 17];321(7267):1000–2. Available from: <https://pubmed.ncbi.nlm.nih.gov/11039970/>
12. Wain JC. Postintubation tracheal stenosis. Semin Thorac Cardiovasc Surg [Internet]. 2009 Sep [cited 2023 May 17];21(3):284–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/19942129/>
13. Prince JS, Duhamel DR, Levin DL, Harrell JH, Friedman PJ. Nonneoplastic lesions of the tracheobronchial wall: radiologic findings with bronchoscopic correlation. Radiographics [Internet]. 2002 [cited 2023 May 17];22 Spec No(SPEC. ISS). Available from: <https://pubmed.ncbi.nlm.nih.gov/12376612/>
14. Lee KS, Boiselle PM. Update on multidetector computed tomography imaging of the airways. J Thorac Imaging [Internet]. 2010 May [cited 2023 May 17];25(2):112–24. Available from: <https://pubmed.ncbi.nlm.nih.gov/20463531/>
15. Webb EM, Elicker BM, Webb WR. Using CT to diagnose nonneoplastic tracheal abnormalities: appearance of the tracheal wall. AJR Am J Roentgenol [Internet]. 2000 [cited 2023 May 17];174(5):1315–21. Available from: <https://pubmed.ncbi.nlm.nih.gov/10789785/>
16. Huang HJ, Fang HY, Chen HC, Wu CY, Cheng CY, Chang CL. Three-dimensional computed tomography for detection of tracheobronchial foreign body aspiration in children. Pediatr Surg Int [Internet]. 2008 Feb [cited 2023 May 17];24(2):157–60. Available from: <https://pubmed.ncbi.nlm.nih.gov/18040695/>

17. Zissin R, Shapiro-Feinberg M, Rozenman J, Apter S, Smorjik J, Hertz M. CT findings of the chest in adults with aspirated foreign bodies. *Eur Radiol* [Internet]. 2001 [cited 2023 May 17];11(4):606–11. Available from: <https://pubmed.ncbi.nlm.nih.gov/11354755/>
18. Adaletli I, Kurugoglu S, Ulus S, Ozer H, Elicevik M, Kantarci F, et al. Utilization of low-dose multidetector CT and virtual bronchoscopy in children with suspected foreign body aspiration. *Pediatr Radiol* [Internet]. 2007 Jan [cited 2023 May 17];37(1):33–40. Available from: <https://pubmed.ncbi.nlm.nih.gov/17033800/>
19. Haliloglu M, Ciftci AO, Oto A, Gumus B, Tanyel FC, Senocak ME, et al. CT virtual bronchoscopy in the evaluation of children with suspected foreign body aspiration. *Eur J Radiol* [Internet]. 2003 Nov [cited 2023 May 17];48(2):188–92. Available from: <https://pubmed.ncbi.nlm.nih.gov/14680912/>
20. Carden KA, Boiselle PM, Waltz DA, Ernst A. Tracheomalacia and tracheobronchomalacia in children and adults: an in-depth review. *Chest* [Internet]. 2005 [cited 2023 May 17];127(3):984–1005. Available from: <https://pubmed.ncbi.nlm.nih.gov/15764786/>
21. Jung Hee Lee, Sung Soo Park, Dong Hoo Lee, Dong Ho Shin, Suck Chul Yang, Byeong Moo Yoo. Endobronchial tuberculosis. Clinical and bronchoscopic features in 121 cases. *Chest* [Internet]. 1992 [cited 2023 May 17];102(4):990–4. Available from: <https://pubmed.ncbi.nlm.nih.gov/1395814/>
22. Grenier PA, Beigelman-Aubry C, Brillet PY. Nonneoplastic tracheal and bronchial stenoses. *Radiol Clin North Am* [Internet]. 2009 Mar [cited 2023 May 17];47(2):243–60. Available from: <https://pubmed.ncbi.nlm.nih.gov/19249454/>
23. Kang EY. Large airway diseases. *J Thorac Imaging* [Internet]. 2011 Nov [cited 2023 May 17];26(4):249–62. Available from: <https://pubmed.ncbi.nlm.nih.gov/22009079/>
24. REYNOLDS JH, KOLAWOLE R. Imaging of large and small airway disease. <http://dx.doi.org/101259/imaging20100062> [Internet]. 2013 Jul 29 [cited 2023 May 17];22(1):20100062. Available from: <https://www.birpublications.org/doi/10.1259/imaging.20100062>
25. Moon WK, Im JG, Yeon KM, Han MC. Tuberculosis of the central airways: CT findings of active and fibrotic disease. *AJR Am J Roentgenol* [Internet]. 1997 [cited 2023 May 17];169(3):649–53. Available from: <https://pubmed.ncbi.nlm.nih.gov/9275870/>
26. Franquet T, Serrano F, Giménez A, Rodriguez-Arias JM, Puzo C. Necrotizing Aspergillosis of large airways: CT findings in eight patients. *J Comput Assist Tomogr* [Internet]. 2002 [cited 2023 May 17];26(3):342–5. Available from: <https://pubmed.ncbi.nlm.nih.gov/12016359/>
27. Franquet T, Müller NL, Oikonomou A, Flint JD. Aspergillus infection of the airways: computed tomography and pathologic findings. *J Comput Assist Tomogr* [Internet]. 2004 [cited 2023 May 17];28(1):10–6. Available from: <https://pubmed.ncbi.nlm.nih.gov/14716226/>
28. Park CM, Goo JM, Lee HJ, Kim MA, Lee CH, Kang MJ. Tumors in the tracheobronchial tree: CT and FDG PET features. *Radiographics* [Internet]. 2009 Jan [cited 2023 May 17];29(1):55–71. Available from: <https://pubmed.ncbi.nlm.nih.gov/19168836/>
29. Jeong MK, Jung IJ, Seog HP, Kyo YL, Myung HC, Myeong IA, et al. Benign tumors of the tracheobronchial tree: CT-pathologic correlation. *AJR Am J Roentgenol* [Internet]. 2006 May [cited 2023 May 17];186(5):1304–13. Available from: <https://pubmed.ncbi.nlm.nih.gov/16632723/>
30. Urdaneta AI, Yu JB, Wilson LD. Population based cancer registry analysis of primary tracheal carcinoma. *Am J Clin Oncol* [Internet]. 2011 Feb [cited 2023 May 17];34(1):32–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/20087156/>
31. Heidinger BH, Occhipinti M, Eisenberg RL, Bankier AA. Imaging of Large Airways Disorders. *AJR Am J Roentgenol* [Internet]. 2015 Jul 1 [cited 2023 May 17];205(1):41–56. Available from: <https://pubmed.ncbi.nlm.nih.gov/26102379/>
32. Chong S, Lee KS, Chung MJ, Han J, Jung Kwon O, Kim TS. Neuroendocrine tumors of the lung: clinical, pathologic, and imaging findings. *Radiographics* [Internet]. 2006 Jan [cited 2023 May 17];26(1):41–58. Available from: <https://pubmed.ncbi.nlm.nih.gov/16418242/>

33. Polychronopoulos VS, Prakash UBS, Golbin JM, Edell ES, Specks U. Airway involvement in Wegener's granulomatosis. *Rheum Dis Clin North Am* [Internet]. 2007 Nov [cited 2023 May 18];33(4):755–75. Available from: <https://pubmed.ncbi.nlm.nih.gov/18037115/>
34. Behar J V., Choi YW, Hartman TA, Allen NB, McAdams HP. Relapsing polychondritis affecting the lower respiratory tract. *AJR Am J Roentgenol* [Internet]. 2002 [cited 2023 May 18];178(1):173–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/11756115/>
35. Tillie-Leblond I, Wallaert B, Leblond D, Salez F, Perez T, Remy-Jardin M, et al. Respiratory involvement in relapsing polychondritis. Clinical, functional, endoscopic, and radiographic evaluations. *Medicine* [Internet]. 1998 [cited 2023 May 18];77(3):168–76. Available from: <https://pubmed.ncbi.nlm.nih.gov/9653428/>
36. Kim HY, Im JG, Song KS, Lee KS, Kim SJ, Kim JS, et al. Localized amyloidosis of the respiratory system: CT features. *J Comput Assist Tomogr* [Internet]. 1999 [cited 2023 May 18];23(4):627–31. Available from: <https://pubmed.ncbi.nlm.nih.gov/10433298/>
37. O'Regan A, Fenlon HM, Beamis JE, Steele MP, Skinner M, Berk JL. Tracheobronchial amyloidosis. The Boston University experience from 1984 to 1999. *Medicine* [Internet]. 2000 Mar [cited 2023 May 18];79(2):69–79. Available from: <https://pubmed.ncbi.nlm.nih.gov/10771705/>
38. Ahmed KA, Thompson JW, Joyner RE, Stocks RMS. Airway obstruction secondary to tracheobronchial involvement of asymptomatic undiagnosed Crohn's disease in a pediatric patient. *Int J Pediatr Otorhinolaryngol* [Internet]. 2005 Jul [cited 2023 May 18];69(7):1003–5. Available from: <https://pubmed.ncbi.nlm.nih.gov/15911023/>
39. Henry MT, Davidson LA, Cooke NJ. Tracheobronchial involvement with Crohn's disease. *Eur J Gastroenterol Hepatol* [Internet]. 2001 [cited 2023 May 18];13(12):1495–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/11742200/>
40. Abu-Hijleh M, Lee D, Braman SS. Tracheobronchopathia osteochondroplastica: a rare large airway disorder. *Lung* [Internet]. 2008 Dec [cited 2023 May 22];186(6):353–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/18787900/>
41. Little BP, Duong PAT. Imaging of Diseases of the Large Airways. *Radiol Clin North Am* [Internet]. 2016 Nov 1 [cited 2023 May 22];54(6):1183–203. Available from: <https://pubmed.ncbi.nlm.nih.gov/27719983/>
42. Krustins E, Kravale Z, Buls A. Mounier-Kuhn syndrome or congenital tracheobronchomegaly: a literature review. *Respir Med* [Internet]. 2013 Dec [cited 2023 May 22];107(12):1822–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/24070565/>
43. Aslam A, Cardenas JDL, Morrison RJ, Lagisetty KH, Litmanovich D, Sella EC, et al. Tracheobronchomalacia and Excessive Dynamic Airway Collapse: Current Concepts and Future Directions. *Radiographics* [Internet]. 2022 Jul 1 [cited 2023 May 22];42(4):1012–27. Available from: <https://pubmed.ncbi.nlm.nih.gov/35522576/>
44. Ridge CA, O'Donnell CR, Lee EY, Majid A, Boiselle PM. Tracheobronchomalacia: current concepts and controversies. *J Thorac Imaging* [Internet]. 2011 Nov [cited 2023 May 22];26(4):278–89. Available from: <https://pubmed.ncbi.nlm.nih.gov/22009081/>
45. Lee EY, Litmanovich D, Boiselle PM. Multidetector CT evaluation of tracheobronchomalacia. *Radiol Clin North Am* [Internet]. 2009 Mar [cited 2023 May 22];47(2):261–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/19249455/>
46. Boiselle PM, O'Donnell CR, Bankier AA, Ernst A, Millet ME, Potemkin A, et al. Tracheal collapsibility in healthy volunteers during forced expiration: assessment with multidetector CT. *Radiology* [Internet]. 2009 Jul [cited 2023 May 22];252(1):255–62. Available from: <https://pubmed.ncbi.nlm.nih.gov/19420322/>
47. Litmanovich D, O'Donnell CR, Bankier AA, Ernst A, Millett ME, Loring SH, et al. Bronchial collapsibility at forced expiration in healthy volunteers: assessment with multidetector CT. *Radiology* [Internet]. 2010 Nov [cited 2023 May 22];257(2):560–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/20829540/>

48. Boiselle PM, Ernst A. Tracheal morphology in patients with tracheomalacia: prevalence of inspiratory lunate and expiratory “frown” shapes. *J Thorac Imaging* [Internet]. 2006 Aug [cited 2023 May 22];21(3):190–6. Available from: <https://pubmed.ncbi.nlm.nih.gov/16915063/>
49. Pakzad A, Jacob J. Radiology of Bronchiectasis. *Clin Chest Med* [Internet]. 2022 Mar 1 [cited 2023 May 22];43(1):47–60. Available from: <https://pubmed.ncbi.nlm.nih.gov/35236560/>
50. Hansell DM, Bankier AA, MacMahon H, McLoud TC, Müller NL, Remy J. Fleischner Society: glossary of terms for thoracic imaging. *Radiology* [Internet]. 2008 Mar [cited 2023 May 22];246(3):697–722. Available from: <https://pubmed.ncbi.nlm.nih.gov/18195376/>
51. Quint JK, Millett ERC, Joshi M, Navaratnam V, Thomas SL, Hurst JR, et al. Changes in the incidence, prevalence and mortality of bronchiectasis in the UK from 2004 to 2013: a population-based cohort study. *Eur Respir J* [Internet]. 2016 Jan 1 [cited 2023 May 22];47(1):186–93. Available from: <https://pubmed.ncbi.nlm.nih.gov/26541539/>
52. Ringshausen FC, de Roux A, Pletz MW, Hämäläinen N, Welte T, Rademacher J. Bronchiectasis-associated hospitalizations in Germany, 2005-2011: a population-based study of disease burden and trends. *PLoS One* [Internet]. 2013 Aug 1 [cited 2023 May 22];8(8). Available from: <https://pubmed.ncbi.nlm.nih.gov/23936489/>
53. Grenier PA, Kanne JP. Current Approach to Acute and Chronic Airway Disease. 2019 Feb 20 [cited 2023 May 17];57–64. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK553866/>
54. Javidan-Nejad C, Bhalla S. Bronchiectasis. *Radiol Clin North Am* [Internet]. 2009 Mar [cited 2023 May 22];47(2):289–306. Available from: <https://pubmed.ncbi.nlm.nih.gov/19249457/>
55. Feldman C. Bronchiectasis: new approaches to diagnosis and management. *Clin Chest Med* [Internet]. 2011 Sep [cited 2023 May 22];32(3):535–46. Available from: <https://pubmed.ncbi.nlm.nih.gov/21867821/>
56. Dalal PU, Hansell DM. High-resolution computed tomography of the lungs: the borderlands of normality. *Eur Radiol* [Internet]. 2006 Apr [cited 2023 May 22];16(4):771–80. Available from: <https://pubmed.ncbi.nlm.nih.gov/16362421/>
57. Polverino E, Goeminne PC, McDonnell MJ, Aliberti S, Marshall SE, Loebinger MR, et al. European Respiratory Society guidelines for the management of adult bronchiectasis. *Eur Respir J* [Internet]. 2017 Sep 1 [cited 2023 May 22];50(3). Available from: <https://pubmed.ncbi.nlm.nih.gov/28889110/>
58. Anwar GA, McDonnell MJ, Worthy SA, Bourke SC, Afolabi G, Lordan J, et al. Phenotyping adults with non-cystic fibrosis bronchiectasis: a prospective observational cohort study. *Respir Med* [Internet]. 2013 Jul [cited 2023 May 22];107(7):1001–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/23672995/>
59. Lonni S, Chalmers JD, Goeminne PC, McDonnell MJ, Dimakou K, De Soyza A, et al. Etiology of Non-Cystic Fibrosis Bronchiectasis in Adults and Its Correlation to Disease Severity. *Ann Am Thorac Soc* [Internet]. 2015 Dec 1 [cited 2023 May 22];12(12):1764–70. Available from: <https://pubmed.ncbi.nlm.nih.gov/26431397/>
60. Milliron B, Henry TS, Veeraraghavan S, Little BP. Bronchiectasis: Mechanisms and Imaging Clues of Associated Common and Uncommon Diseases. *Radiographics* [Internet]. 2015 Jul 1 [cited 2023 May 22];35(4):1011–30. Available from: <https://pubmed.ncbi.nlm.nih.gov/26024063/>
61. Nemeč SF, Bankier AA, Eisenberg RL. Upper lobe-predominant diseases of the lung. *AJR Am J Roentgenol* [Internet]. 2013 Mar [cited 2023 May 22];200(3). Available from: <https://pubmed.ncbi.nlm.nih.gov/23436867/>
62. Davis PB, Drumm M, Konstan MW. Cystic fibrosis. *Am J Respir Crit Care Med* [Internet]. 1996 [cited 2023 May 22];154(5):1229–56. Available from: <https://pubmed.ncbi.nlm.nih.gov/8912731/>
63. Farrell PM. Improving the health of patients with cystic fibrosis through newborn screening. Wisconsin Cystic Fibrosis Neonatal Screening Study Group. *Adv Pediatr* [Internet]. 2000 [cited 2023 May 22];47:79–115. Available from: <https://pubmed.ncbi.nlm.nih.gov/10959441/>

64. Nunes H, Uzunhan Y, Gille T, Lamberto C, Valeyre D, Brillet PY. Imaging of sarcoidosis of the airways and lung parenchyma and correlation with lung function. *Eur Respir J* [Internet]. 2012 Sep 1 [cited 2023 May 22];40(3):750–65. Available from: <https://pubmed.ncbi.nlm.nih.gov/22790910/>
65. Goo JM, Im JG. CT of tuberculosis and nontuberculous mycobacterial infections. *Radiol Clin North Am* [Internet]. 2002 [cited 2023 May 22];40(1):73–87. Available from: <https://pubmed.ncbi.nlm.nih.gov/11813821/>
66. King PT. The pathophysiology of bronchiectasis. *Int J Chron Obstruct Pulmon Dis* [Internet]. 2009 [cited 2023 May 22];4:411–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/20037680/>
67. Ward S, Heyneman L, Lee MJ, Leung AN, Hansell DM, Müller NL. Accuracy of CT in the diagnosis of allergic bronchopulmonary aspergillosis in asthmatic patients. *AJR Am J Roentgenol* [Internet]. 1999 [cited 2023 May 22];173(4):937–42. Available from: <https://pubmed.ncbi.nlm.nih.gov/10511153/>
68. Koh WJ, Kyung SL, Jung Kwon OJK, Yeon JJ, Kwak SH, Tae SK. Bilateral bronchiectasis and bronchiolitis at thin-section CT: diagnostic implications in nontuberculous mycobacterial pulmonary infection. *Radiology* [Internet]. 2005 Apr [cited 2023 May 22];235(1):282–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/15703315/>
69. Lucas JS, Burgess A, Mitchison HM, Moya E, Williamson M, Hogg C. Diagnosis and management of primary ciliary dyskinesia. *Arch Dis Child* [Internet]. 2014 [cited 2023 May 22];99(9):850–6. Available from: <https://pubmed.ncbi.nlm.nih.gov/24771309/>
70. Kuehni CE, Lucas JS. Diagnosis of primary ciliary dyskinesia: summary of the ERS Task Force report. *Breathe (Sheff)* [Internet]. 2017 Sep 1 [cited 2023 May 22];13(3):166–78. Available from: <https://pubmed.ncbi.nlm.nih.gov/28894478/>
71. Noone PG, Leigh MW, Sannuti A, Minnix SL, Carson JL, Hazucha M, et al. Primary ciliary dyskinesia: diagnostic and phenotypic features. *Am J Respir Crit Care Med* [Internet]. 2004 Feb 15 [cited 2023 May 22];169(4):459–67. Available from: <https://pubmed.ncbi.nlm.nih.gov/14656747/>
72. Vanaken GJ, Bassinet L, Boon M, Mani R, Honoré I, Papon JF, et al. Infertility in an adult cohort with primary ciliary dyskinesia: phenotype-gene association. *Eur Respir J* [Internet]. 2017 Nov 1 [cited 2023 May 22];50(5). Available from: <https://pubmed.ncbi.nlm.nih.gov/29122913/>
73. Kennedy MP, Noone PG, Leigh MW, Zariwala MA, Minnix SL, Knowles MR, et al. High-resolution CT of patients with primary ciliary dyskinesia. *AJR Am J Roentgenol* [Internet]. 2007 May [cited 2023 May 22];188(5):1232–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/17449765/>
74. Bernard GR, Artigas A, Brigham KL, Carlet J, Falke K, Hudson L, et al. The American-European Consensus Conference on ARDS. Definitions, mechanisms, relevant outcomes, and clinical trial coordination. *Am J Respir Crit Care Med* [Internet]. 1994 [cited 2023 May 22];149(3 Pt 1):818–24. Available from: <https://pubmed.ncbi.nlm.nih.gov/7509706/>
75. Treggiari MM, Romand JA, Martin JB, Suter PM. Air cysts and bronchiectasis prevail in nondependent areas in severe acute respiratory distress syndrome: a computed tomographic study of ventilator-associated changes. *Crit Care Med* [Internet]. 2002 [cited 2023 May 22];30(8):1747–52. Available from: <https://pubmed.ncbi.nlm.nih.gov/12163787/>
76. Desai SR. Acute respiratory distress syndrome: Imaging of the injured lung. *Clin Radiol* [Internet]. 2002 [cited 2023 May 22];57(1):8–17. Available from: <https://pubmed.ncbi.nlm.nih.gov/11798197/>
77. Matsuse T, Oka T, Kida K, Fukuchi Y. Importance of diffuse aspiration bronchiolitis caused by chronic occult aspiration in the elderly. *Chest* [Internet]. 1996 [cited 2023 May 22];110(5):1289–93. Available from: <https://pubmed.ncbi.nlm.nih.gov/8915236/>

78. Semple T, Calder A, Owens CM, Padley S. Current and future approaches to large airways imaging in adults and children. *Clin Radiol* [Internet]. 2017 May 1 [cited 2023 May 22];72(5):356–74. Available from: <https://pubmed.ncbi.nlm.nih.gov/28258742/>
79. Touw CML, Van De Ven AA, De Jong PA, Terheggen-Lagro S, Beek E, Sanders EAM, et al. Detection of pulmonary complications in common variable immunodeficiency. *Pediatr Allergy Immunol* [Internet]. 2010 Aug [cited 2023 May 22];21(5):793–805. Available from: <https://pubmed.ncbi.nlm.nih.gov/19912551/>
80. Lynch DA, Travis WD, Müller NL, Galvin JR, Hansell DM, Grenier PA, et al. Idiopathic interstitial pneumonias: CT features. *Radiology* [Internet]. 2005 Jul [cited 2023 May 22];236(1):10–21. Available from: <https://pubmed.ncbi.nlm.nih.gov/15987960/>
81. Bouros D, Hatzakis K, Labrakis H, Zeibecoglou K. Association of malignancy with diseases causing interstitial pulmonary changes. *Chest* [Internet]. 2002 [cited 2023 May 22];121(4):1278–89. Available from: <https://pubmed.ncbi.nlm.nih.gov/11948064/>
82. King MA, Stone JA, Diaz PT, Mueller CF, Becker WJ, Gadek JE. Alpha 1-antitrypsin deficiency: evaluation of bronchiectasis with CT. *Radiology* [Internet]. 1996 [cited 2023 May 22];199(1):137–41. Available from: <https://pubmed.ncbi.nlm.nih.gov/8633137/>
83. Parr DG, Guest PG, Reynolds JH, Dowson LJ, Stockley RA. Prevalence and impact of bronchiectasis in alpha1-antitrypsin deficiency. *Am J Respir Crit Care Med* [Internet]. 2007 Dec 15 [cited 2023 May 22];176(12):1215–21. Available from: <https://pubmed.ncbi.nlm.nih.gov/17872489/>
84. Cihanbeylerden M, Kurt B. Young's syndrome, a rare syndrome that can cause infertility and mimics cystic fibrosis and immotile-cilia syndrome: a case report. *Eur Rev Med Pharmacol Sci* [Internet]. 2022 [cited 2023 May 22];26(18):6569–71. Available from: <https://pubmed.ncbi.nlm.nih.gov/36196705/>
85. Maldonado F, Tazelaar HD, Wang CW, Ryu JH. Yellow nail syndrome: analysis of 41 consecutive patients. *Chest* [Internet]. 2008 [cited 2023 May 22];134(2):375–81. Available from: <https://pubmed.ncbi.nlm.nih.gov/18403655/>
86. Noriega Aldave AP, William Saliski DO. The clinical manifestations, diagnosis and management of williams-campbell syndrome. *N Am J Med Sci* [Internet]. 2014 Sep 1 [cited 2023 May 22];6(9):429–32. Available from: <https://pubmed.ncbi.nlm.nih.gov/25317385/>
87. Konoglou M, Porpodis K, Zarogoulidis P, Loridas N, Katsikogiannis N, Mitrakas A, et al. Williams-Campbell syndrome: a case report. *Int J Gen Med* [Internet]. 2012 [cited 2023 May 22];5:41–4. Available from: <https://pubmed.ncbi.nlm.nih.gov/22287845/>
88. Pipavath SNJ, Stern EJ. Imaging of Small Airway Disease (SAD). *Radiol Clin North Am* [Internet]. 2009 Mar [cited 2023 May 22];47(2):307–16. Available from: <https://pubmed.ncbi.nlm.nih.gov/19249458/>
89. Wasilewska E, Lee EY, Eisenberg RL. Unilateral hyperlucent lung in children. *AJR Am J Roentgenol* [Internet]. 2012 May [cited 2023 May 22];198(5). Available from: <https://pubmed.ncbi.nlm.nih.gov/22528920/>
90. Thompson BR, Hodgson YM, Kotsimbos T, Liakakos P, Ellis MJ, Snell GI, et al. Bronchiolitis obliterans syndrome leads to a functional deterioration of the acinus post lung transplant. *Thorax* [Internet]. 2014 [cited 2023 May 22];69(5):487–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/24212890/>
91. Reichenspurner H, Girgis RE, Robbins RC, Yun KL, Nitschke M, Berry GJ, et al. Stanford experience with obliterative bronchiolitis after lung and heart-lung transplantation. *Ann Thorac Surg* [Internet]. 1996 [cited 2023 May 22];62(5):1467–73. Available from: <https://pubmed.ncbi.nlm.nih.gov/8893585/>

92. Bankier AA, Van Muylem A, Knoop C, Estenne M, Gevenois PA. Bronchiolitis obliterans syndrome in heart-lung transplant recipients: diagnosis with expiratory CT. *Radiology* [Internet]. 2001 [cited 2023 May 22];218(2):533–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/11161175/>
93. Kim TS, Han J, Koh WJ, Choi JC, Chung MJ, Lee KS, et al. Endobronchial actinomycosis associated with broncholithiasis: CT findings for nine patients. *AJR Am J Roentgenol* [Internet]. 2005 [cited 2023 May 22];185(2):347–53. Available from: <https://pubmed.ncbi.nlm.nih.gov/16037504/>
94. Seo BJ, Song KS, Jin SL, Jin MG, Hye YK, Song JW, et al. Broncholithiasis: review of the causes with radiologic-pathologic correlation. *Radiographics* [Internet]. 2002 [cited 2023 May 22];22 Spec No(SPEC. ISS). Available from: <https://pubmed.ncbi.nlm.nih.gov/12376611/>
95. Gupta A, Shah A. Bronchial anthracofibrosis: an emerging pulmonary disease due to biomass fuel exposure. *Int J Tuberc Lung Dis* [Internet]. 2011 May [cited 2023 May 22];15(5):602–12. Available from: <https://pubmed.ncbi.nlm.nih.gov/21418734/>
96. Kim HY, Im JG, Goo JM, Kim JY, Han SK, Lee JK, et al. Bronchial anthracofibrosis (inflammatory bronchial stenosis with anthracotic pigmentation): CT findings. *AJR Am J Roentgenol* [Internet]. 2000 [cited 2023 May 22];174(2):523–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/10658734/>