



## TRAKEAL STENOZLAR

Efsun Gonca UĞUR CHOUSEIN<sup>1</sup>

### Giriş

Trakea, Yunanca “trakheia arteria” kelimelerinden köken alan, “wind-pipe” da denen, “içine hava üflenen kanal” olarak tanımlayabileceğimiz; yaşamsal olan solunum döngüsünde dış ortamdan alınan oksijenin akciğer parankimine kadar taşınmasına aracılık eden en önemli santral hava yolu bölümüdür.

Trakea, krikoid kıkırdak sonrası başlayıp ana karinada sonlanır ve ortalama uzunluğu 11,8 cm'dir (erkeklerde ortalama 10-13 cm; kadınlarda 1-2 cm daha kısadır). Trakea lümeni, ön ve yan duvarlarını oluşturan C-şeklinde 18-22 adet kıkırdaktan ve posteriorda bu kıkırdak parçalarını birbirine bağlayan membranöz bir duvardan oluşur. Trakeanın her santimetresinde yaklaşık iki kıkırdak halkası vardır ve her trakeal halkanın yüksekliği ortalama 4 mm'dir. Trakea duvarının kalınlığı ortalama 3 mm'dir ve ortalama dış çapı koronal ve sagittal boyutlarda sırasıyla 2.3 ve 1.8 cm'dir.

Trakea mukoza ve submukoza tabakalarını içerir. Mukoza tabakasındaki goblet hücreler mukus salgılayan siliyalı psödostratifiye kolumnar epitel hücrelerden oluşur ve submukozal tabaka ile aralarında bağlantı kanalları içerir. Yüzeydeki mukus ve siliyalar, hava yoluna giren partikülleri süpürerek dışarı atarlar (1).

Trakeal stenoz (darlık) ise trakea lümenin bu uzunlamasına devam eden yapısının ve açıklığının konjenital ya da edinsel, benign ya da malign nedenlerle %50'den fazla oranda obstrüksiyona uğramasıdır (2,3).

Trakeal stenoz akut bir tablo oluşturup acil müdahale gerektirebilecek kadar kritik öneme sahip olabilecek bir patoloji olduğundan toraks acilleri arasında önemli bir yer tutar.

1 Uzm. Dr. Efsun Gonca UĞUR CHOUSEIN, Sağlık Bilimleri Üniversitesi Yedikule Göğüs Hastalıkları ve Göğüs Cerrahisi Eğitim ve Araştırma Hastanesi, efsungoncachousein@yahoo.com

## KAYNAKLAR

1. Furlow PW, Mathisen DJ. Surgical anatomy of the trachea. *Ann Cardiothorac Surg.* 2018; 7(2): 255-260. Doi: 10.21037/acs.2018.03.01
2. Gelbard A, Francis DO, Sandulache VC, et al. Causes and Consequences of Adult Laryngotracheal Stenosis. *Laryngoscope.* 2015; 125(5): 1137-1143. Doi: 10.1002/lary.24956.
3. Murgu SD, Egressy K, Laxmanan B, et al. Central airway obstruction. Benign strictures, tracheobronchomalacia, and malignancy-related obstruction. *Chest.* 2016; 150:426-441. Doi: 10.1016/j.chest.2016.02.001.
4. Herrera P, Caldarone C, Forte V, et al. The current state of congenital tracheal stenosis. *Pediatr Surg Int.* 2007; 23(11):1033-44. Doi: 10.1007/s00383-007-1945-3.
5. Kim JH, Shin JH, Song HY, et al. Benign Tracheobronchial Strictures: Long-Term Results and Factors Affecting Airway Patency After Temporary Stent Placement. *AJR Am J Roentgenol* 2007; 188: 1033-1038. Doi: 10.2214/AJR.06.0888.
6. Oberg CL, Holden VK, Channick CL. Benign Central Airway Obstruction. *Semin Respir Crit Care Med.* 2018;39(6):731-746. Doi: 10.1055/s-0038-1676574.
7. Karakattu SM, Vijayan K, Haddad I, et al. Idiopathic Subglottic Tracheal Stenosis Misdiagnosed As Vocal Cord Dysfunction and Successfully Treated with Laser and Controlled Radial Expansion Balloon Dilation. *Cureus.* 2020; 12(4): e7702. Doi: 10.7759/cureus.7702.
8. Hirshoren N, Eliashar R. Wound-healing modulation in upper airway stenosis- Myths and facts. *Head Neck.* 2009; 31(1):111-26. Doi: 10.1002/hed.20925.
9. Songu M, Ozkul Y. Risk Factors for Adult Postintubation Tracheal Stenosis. *J Craniofac Surg.* 2019; 30(5): e447-e450. Doi: 10.1097/SCS.00000000000005513.
10. Koshkareva Y, Gaughan JP, Soliman AMS. Risk factors for adult laryngotracheal stenosis: a review of 74 cases. *Ann Otol Rhinol Laryngol.* 2007; 116(3):206-10. Doi: 10.1177/000348940711600308.
11. De S, De S. Post intubation tracheal stenosis. *Indian J Crit Care Med.* 2008; 12(4): 194-197. Doi: 10.4103/0972-5229.45081.
12. Shah SB, Kulkarni A. Thyroid cancer and post thyroidectomy tracheomalacia: algorithm for decoding a diagnostic dilemma! *Ain-Shams J Anesthesiol* 12, 10 (2020). Doi.org/10.1186/s42077-020-00061-2.
13. Pathak V, Shepherd R.W, Shojaee S. Tracheobronchial tuberculosis. *J. Thorac. Dis.* 2016; 8:3818-3825. Doi: 10.21037/jtd.2016.12.75.
14. Ruiz AC, Carrascosa MF, García-Rivero JL, et al. One not to miss: Tuberculous tracheal stenosis. *Respir Med Case Rep.* 2020; 30:101040. Doi: 10.1016/j.rmcr.2020.101040.
15. Marom EM, Goodman PC, McAdams HP. Focal Abnormalities of the Trachea and Main Bronchi. *AJR Am J Roentgenol.* 2001; 176:707-711. Doi: 10.2214/ajr.176.3.1760707.
16. Kadowaki T, Hamada H, Fujiwara A, et al. Bacterial tracheobronchitis. A rare cause of adult airway stenosis. *Respirology.* 2009; 14(8):1214-6. Doi: 10.1111/j.1440-1843.2009.01635.x.
17. Ashton-Sager A, Konia T. Tracheal Stenosis Due to Cytomegalovirus. *Arch Pathol Lab Med.* 2004; 128 (9): 1050-1051. Doi: 10.1043/1543-2165(2004)128.
18. Grenier PA, Beigelman-Aubry C, Brillet PY. Nonneoplastic tracheal and bronchial stenoses. *Radiol Clin North Am.* 2009; 47(2):243-60. Doi: 10.1016/j.rcl.2008.11.011.
19. Dablanca M, Maeso A, Méndez DD, et al. Laryngotracheal Stenosis of Autoimmu-

- ne Aetiology. *Acta Otorrinolaringol Esp.* 2017; 68(1):38-42. Doi: 10.1016/j.otorri.2016.01.002.
20. Scrobola JF, McClune JR, Harriott AJ, et al. Endobronchial Sarcoidosis. *J Bronchology Interv Pulmonol.* 2017; 24(4):303-306. Doi: 10.1097/LBR.0000000000000358.
  21. Ko JM, Jung JI, Park SH, et al. Benign tumors of the tracheobronchial tree: CT-Pathologic correlation. *AJR Am J Roentgenol.* 2006; 186(5):1304-13. Doi: 10.2214/AJR.04.1893.
  22. Madariaga MLL, Gaissert HA. Overview of malignant tracheal tumors. *Ann Cardiothorac Surg.* 2018 Mar; 7(2): 244–254. Doi: 10.21037/acs.2018.03.04.
  23. Mudambi L, Miller R, Eapen GA. Malignant central airway obstruction. *J Thorac Dis.* 2017; 9(10): 1087-1110. Doi: 10.21037/jtd.2017.07.27.
  24. Shepard JO, Flores EJ, Abbott GF. Imaging of the trachea. *Ann Cardiothorac Surg.* 2018; 7(2): 197-209. Doi: 10.21037/acs.2018.03.09.
  25. Madariaga ML, Gaissert HA. Secondary tracheal tumors: a systematic review. *Ann Cardiothorac Surg.* 2018; 7(2): 183-196. Doi: 10.21037/acs.2018.02.01.
  26. Freitas C, Martins N, Novais-Bastos H, et al. The role of interventional bronchoscopy in the management of post-intubation tracheal stenosis: A 20-year experience. *Pulmonology.* 2019;2531-0437(19)30222-3. Doi: 10.1016/j.pulmoe.2019.12.004.
  27. Monnier P, Dikkers FG, Eckel H, et al. Preoperative assessment and classification of benign laryngotracheal stenosis: a consensus paper of the European Laryngological Society. *Eur Arch Otorhinolaryngol.* 2015; 272(10):2885-96. Doi: 10.1007/s00405-015-3635-4.
  28. Fiz I, Philippe Monnier P, Koelmel JC, et al. Multicentric study applying the european laryngological society classification of benign laryngotracheal stenosis in adults treated by tracheal or cricotracheal resection and anastomosis. *Laryngoscope.* 2020; 130(7):1640-1645. Doi: 10.1002/lary.28274.
  29. Galluccio, G Lucantoni G, Battistoni P, et al. Interventional endoscopy in the management of benign tracheal stenoses: definitive treatment at long-term follow-up. *Eur J Cardiothorac Surg.* 2009;35(3):429-33; discussion 933-4. Doi: 10.1016/j.ejcts.2008.10.041.
  30. Freitag L, Ernst A, M. Unger M, et al. A proposed classification system of central airway stenosis. *Eur Respir J* 2007; 30: 7-12. Doi: 10.1183/09031936.00132804.
  31. Filauro M, Mazzola F, Missale F, et al. Endoscopic Preoperative Assessment, Classification of Stenosis, Decision-Making. *Front Pediatr.* 2020; 7:532. Doi: 10.3389/fped.2019.00532.
  32. McCaffrey TV. Classification of laryngotracheal stenosis. *Laryngoscope.*1992; 102(12 Pt 1):1335-40. Doi: 10.1288/00005537-199212000-00004.
  33. Broderick N, Staker T. (2019). Tracheal stenosis. Straker T, Rajan S (Eds.), *Anesthesiology: A Problem-Based Learning Approach* içinde (pp.325-333). Oxford: Oxford University Press.
  34. Cheng LP, Gu Y, Gui XW, et al. Diagnostic Value of Virtual Bronchoscopic Navigation in the Bronchial Tuberculosis Induced Central Airway Stenosis. *Infect Dis Ther.* 2020; 9:165-174. Doi: 10.1007/s40121-020-00283-9.
  35. Lin CT, Rowe S, Chu LC, et al. Cinematic rendering enhancements to virtual bronchoscopy: assessment of emergent tracheal pathology. *Emerg Radiol.* 2020. Doi: 10.1007/s10140-020-01816-y.
  36. Patel SJ, Reede DL, Katz DS, et al. Imaging the Pregnant Patient for Nonobstetric Conditions: Algorithms and Radiation Dose Considerations. *Radiographics.* 2007;

- 27(6):1705-22. Doi: 10.1148/rg.276075002.
37. Schweiger C, Cohen AP, Rutter MJ. Tracheal and bronchial stenoses and other obstructive conditions. *J Thorac Dis.* 2016 Nov; 8(11): 3369-3378. Doi: 10.21037/jtd.2016.11.74.
  38. Paradis TJ, Dixon J, Tieu BH. The role of bronchoscopy in the diagnosis of airway disease. *J Thorac Dis.* 2016; 8(12): 3826-3837. Doi: 10.21037/jtd.2016.12.68.
  39. Zhao X, Wen X, Wei W, et al. Clinical characteristics and prognoses of patients treated surgically for metastatic lung tumors. *Oncotarget.* 2017; 8(28):46491-46497. Doi: 10.18632/oncotarget.14822.
  40. Li XZ, Wang ZC, Qiu Y, et al. Bioinformatics analysis and verification of gene targets for benign tracheal stenosis. *Mol Genet Genomic Med.* 2020; 8(6): e1245. Doi: 10.1002/mgg3.1245.
  41. Theodore PR. Emergent management of malignancy-related acute airway obstruction. *Emerg Med Clin North Am.* 2009 May;27(2):231-41. Doi: 10.1016/j.emc.2009.01.009.
  42. Zarogoulidis P, Kontakiotis T, Tsakiridis K, et al. Difficult airway and difficult intubation in postintubation tracheal stenosis: a case report and literature review. *Ther Clin Risk Manag.* 2012; 8:279-86. Doi: 10.2147/TCRM.S31684.
  43. Ziapour B. Anterograde catheterization of severe tracheal stenosis as a difficult airway management option, followed by emergent tracheostomy (a case report). *J Cardiothorac Surg.* 2016; 11: 70. Doi: 10.1186/s13019-016-0471-6.
  44. Anwar-ul-huda, Qamar-ul-Hoda M, Awan S. Emergency airway management of a patient with tracheal stenosis. *J Pak Med Assoc.* 2010; 60(9):775-7.
  45. Bolliger CT, Beamis JF, Becker HD, et al. ERS/ATS statement on interventional pulmonology. *Eur Respir J* 2002; 19: 356-373. Doi: 10.1183/09031936.02.00204602.
  46. Hao ZR, Yao ZH, Zhao JQ, et al. Clinical efficacy of treatment for primary tracheal tumors by flexible bronchoscopy: Airway stenosis recanalization and quality of life. *Exp Ther Med.* 2020; 20(3):2099-2105. Doi:10.3892/etm.2020.8900.
  47. Sachdeva A, Pickering EM, Lee HJ. From electrocautery, balloon dilatation, neodymiumdoped:yttrium-aluminumgarnet (Nd:YAG) laser to argon plasma coagulation and cryotherapy. *J Thorac Dis* 2015; 7:363-79. Doi: 10.3978/j.issn.2072-1439.2015.12.12.
  48. Jin F, Li Q, Li S, et al. Interventional Bronchoscopy for the Treatment of Malignant Central Airway Stenosis: An Expert Recommendation for China. *Respiration.* 2019; 97(5): 484-494. Doi: 10.1159/000497213.
  49. Shrestha P, Madan K, Hadda V, et al. Therapeutic bronchoscopic interventions for nonmalignant central airway obstruction provide rapid and sustained improvement in symptoms and functional status. *Lung India.* 2020; 37(4): 295-299. Doi: 10.4103/lungindia.lungindia\_476\_19.
  50. Oh SK, Park KN, Lee SW. Long term results of endoscopic dilatation for tracheal and subglottic stenosis. *Clin Exp Otorhinolaryngol* 2014; 7:324-8.
  51. Chea C, Donga F, Wu X, et al. Argon gas knife combined with cryotherapy for amyloidosis leading to severe airway stenosis. *Respir Med Case Rep.* 2019; 14(28):100948. Doi: 10.1016/j.rmcr.2019.100948.
  52. Abdel-Aaty HE, Bakr RM, El-Mahallawy II, et al. Cryotherapy and electrocautery in the management of malignant endobronchial neoplasms. *Egypt J Chest Dis Tuberc.* 2019; 68(2):184-191.
  53. Wright CD, Li S, Geller AD, et al. Postintubation Tracheal Stenosis: Management

- and Results 1993 to 2017. *Ann Thorac Surg.* 2019; 108(5):1471-1477. doi: 10.1016/j.athoracsur.2019.05.050. Doi: 10.4103/ejcdt.ejcdt\_56\_18.
54. Benn BS, Krishna G. A novel multimodal approach to treating proximal tracheal obstructions with spray cryotherapy. *J Thorac Dis.* 2019; 11(2): 613-617. Doi: 10.21037/jtd.2018.11.134.
  55. Dutau H, Maldonado F, Laroumagne S, Astoul P. Silicone stents, the rigid bronchoscope, and the standard of care in central airway stenosis. *Curr Respir Care Rep* 2012; 1:46- 53.
  56. Ortiz-Comino RM, Morales A, López-Lisbona R, et al. Silicone stent versus fully covered metallic stent in malignant central airway stenosis. *Ann Thorac Surg.* 2020; S0003-4975(20)30963-2. Doi: 10.1016/j.athoracsur.2020.04.141.
  57. Guibert N, Saka H, Dutau H. Airway stenting: Technological advancements and its role in interventional pulmonology. *Respirology.* 2020; 25:953-962. Doi: 10.1111/resp.13801.
  58. McGrath EE, Warriner D, Anderson PB. Is stent insertion via flexible bronchoscopy a feasible alternative to surgery in inoperable thyroid related tracheobronchial stenosis? *J Thorac Dis.* 2013; 5(3): 302–305. Doi: 10.3978/j.issn.2072-1439.2013.04.01.
  59. Mathew R, Hibare K, Dalar L, et al. Tracheobronchial stent sizing and deployment practices airway stenting practices around the world: a survey study. *J Thorac Dis.* 2020; 12(10): 5495–5504. Doi: 10.21037/jtd-20-2080.
  60. Innabi A, McClelland S, Raman T, et al. No stent left behind: A review of stent removal and related complications. *EMJ Respir.* 2017; 5(1):78-84.
  61. Ayub A, Al-Ayoubi AM, Bhora FY. Stents for airway strictures: selection and results. *J Thorac Dis.* 2017; 9(2): 116–121. Doi: 10.21037/jtd.2017.01.56.
  62. Ozgul MA, Cetinkaya E, Seyhan EC, et al. Airway stents: a retrospective evaluation of indications, results and complications in our 10-year experience. *Tuberk Toraks* 2019;67(4):272-284. Doi • 10.5578/tt.68967.
  63. Lee HJ, Labaki W, Yu DH, et al. Airway stent complications: the role of follow-up bronchoscopy as a surveillance method *J Thorac Dis.* 2017; 9(11): 4651-4659. Doi: 10.21037/jtd.2017.09.139.
  64. Queiroga TLO, Cataneo DC, Martins RHG, et al. Mitomycin C in the Endoscopic Treatment of Laryngotracheal Stenosis: Systematic Review and Proportional Meta-Analysis. *Int Arch Otorhinolaryngol.* 2020; 24(1): e112-e124. doi: 10.1055/s-0039-1700582.
  65. Shadmehr MB, Abbasidezfouli A, Farzanegan R, Pejhan S, Daneshvar A, Sheikhy K, et al. The role of systemic steroids in postintubation tracheal stenosis: a randomized clinical trial. *Ann Thorac Surg* 2017; 103:246-53. Doi:10.1016/j.athoracsur.2016.05.063.
  66. Khan A, Hashim Z, Gupta M, et al. Rigid bronchoscopic interventions for central airway obstruction – An observational study. *Lung India.* 2020; 37(2): 114–119. Doi: 10.4103/lungindia.lungindia\_454\_19.
  67. Wang Z, Wang W, Wu, G. Clinical efficacy of argon plasma coagulation combined with cryotherapy for central airway stenosis caused by lung cancer. *J Cardiothorac Surg.* 2019; 14(1):155. Doi: 10.1186/s13019-019-0979-7.
  68. Luo F, Darwiche K, Singh S, et al. Performing bronchoscopy in times of the COVID-19 pandemic: Practice Statement from an International Expert Panel. *Respiration* 2020; 99:417-22. Doi: 10.1159/000507898