

## Bölüm 2

# PULMONER EMBOLİ

Feride MARIM<sup>2</sup>

### GİRİŞ

Pulmoner emboli (PE), pulmoner arterler ve dallarının trombus ile tıkanmasıyla oluşmaktadır. PE, çoğunlukla derin ven trombozuna (DVT) eşlik etmektedir. PE ve DVT'nin birlikte görülmesi venöz tromboembolizm (VTE) olarak adlandırılmaktır.

#### Epidemiyoloji

PE 3. en sık görülen kardiyovasküler hastalık olup, insidansı 100.000'de 100-200 arasındadır (1,2). 60 yaşından sonra insidansı belirgin olarak artmaktadır (3). Her iki cinste de görülmeye sıklığı benzerdir (3, 4). Kış aylarında daha sık görüldüğü bildirilmiştir ve bu durum fiziksel aktivitenin daha az olmasıyla ilişkilendirilebilir (4-6).

Nefes darlığı, plöretik göğüs ağrısı gibi karakteristik semptomlarla başvuranlar, asemptomatik seyredip rastlantısal tanı alanlar olabileceği gibi, şok ve ani ölümle de kendini gösterebilmektedir (2,7,8). Mortalite tedavi edilmeyen hastalarda yaklaşık %25-30'a kadar yükselmekte, tedavi edilenlerde ise %2-8'e gerilemektedir (9-13). Ölümcul seyredebilmesinin yanında, risk faktörü taşıyan kişiler iyi analiz edildiğinde önlenebilir de bir hastalıktır.

#### Risk Faktörleri

Endotel hasarı, hiperkoagülabilite ve staz Virchow triadını oluşturur ve bu faktörler damar içi pihtlaşmadan sorumludurlar. VTE olgularının büyük çoğunda bu faktörlerden birine neden olan edinsel ve/veya kalıtsal faktörler saptanmaktadır (4,14).

<sup>2</sup> Doktor Öğretim Üyesi, Kütahya Sağlık Bilimleri Üniversitesi Göğüs Hastalıkları Anabilim Dalı, feridemarim@hotmail.com

madde ile perfüzyon sintigrafisi çekilmesi tanıda oldukça güvenilirdir (84). Spiral BT anjiyografide anne meme dokusu yüksek doz radyasyona maruz kaldığı için mümkünse sintografi tercih edilmelidir (85). Tedavide UFH ya da kiloya göre DMAH kullanılmalıdır (86,87). Trombolitik tedavi hayat kurtarıcı bir tedavi olup, Alteplaz kullanılan 28 gebe kadının dahil edildiği bir çalışmada trombolitik tedaviye bağlı komplikasyon oranı gebe olmayan popülasyonla benzer bulunmuştur (88).

**Kanser:** Kanserli hastalarda VTE riski sağlıklı polpülasyona göre 4 kat, kemoterapi alanlarda ise 6 kat artmıştır (89). DMAH ile tedavi tercih edilmekte olup, nüks riski nedeniyle kanserin aktif olduğu dönem boyunca uzatılmış tedavi önerilmektedir (90,91).

Sonuç olarak PE, mortalitesi yüksek bir hastalık olup; hızlı tanı ve tedavisi önem arz etmektedir. Günümüzde klinik risk değerlendirmeleri ve tanı yöntemleri daha kolay uygulanabilmekte, tedavi seçenekleri ise giderek artmaktadır.

## KAYNAKLAR

1. Heit JA. The epidemiology of venous thromboembolism in the community. Arteriosclerosis, thrombosis, and vascular biology. 2008;28(3):370-2.
2. Cohen AT, Agnelli G, Anderson FA, et al. Venous thromboembolism (VTE) in Europe. Thrombosis and haemostasis. 2007;98(10):756-64.
3. Anderson FA Jr, Wheeler HB, Goldberg RJ, et al. A population-based perspective of the hospital incidence and case-fatality rates of deep vein thrombosis and pulmonary embolism. The Worcester DVT Study. Arch Intern Med. 1991;151(5):933-8.
4. White RH. The epidemiology of venous thromboembolism. Circulation. 2003;107(23 Suppl 1):I4-8.
5. Wroblewski BM, Siney P, White R. Seasonal variation in fatal pulmonary embolism after hip arthroplasty. Lancet. 1990;335(8680):56.
6. Gallerani M, Manfredini R, Ricci L, et al. Sudden death from pulmonary thromboembolism: chronobiological aspects. Eur Heart J. 1992;13(5):661-5.
7. Heit JA, Silverstein MD, Mohr DN, et al. Risk factors for deep vein thrombosis and pulmonary embolism: a population-based case-control study. Archives of internal medicine. 2000;160(6):809-15.
8. Stein PD, Henry JW. Prevalence of acute pulmonary embolism among patients in a general hospital and at autopsy. Chest. 1995;108(4):978-81.
9. Dalen JE, Alpert JS. Natural history of pulmonary embolism. Progress in cardiovascular diseases. 1975;17(4):259-70.
10. Barratt DW, Jordan SC. Clinical features of pulmonary embolism. Lancet. 1961;1(7180):729-32.
11. Carson JL, Kelley MA, Duff A, et al. The clinical course of pulmonary embolism. N Engl J Med. 1992;326(19):1240-5.
12. Douketis JD, Kearon C, Bates S, et al. Risk of fatal pulmonary embolism in patients with treated venous thromboembolism. Jama. 1998;279(6):458-62.
13. Nijkeuter M, Sohne M, Tick LW, et al. The natural course of hemodynamically stable pulmonary embolism: Clinical outcome and risk factors in a large prospective cohort study. Chest. 2007;131(2):517-23.

14. Tapson VF. Acute pulmonary embolism. *N Engl J Med.* 2008;358(10):1037-52.
15. Gussoni G, Frasson S, La Regina M, et al. investigators R. Three-month mortality rate and clinical predictors in patients with venous thromboembolism and cancer. Findings from the RIETE registry. *Thrombosis research.* 2013;131(1):24-30.
16. Başbuğ HS, Bitargil M, Tural K, et al. Trouseau Syndrome: Carcinoma-Associated Deep Venous Thrombosis: Cesa Report. *Turkish Journal of Vascular Surgery.*
17. Blom JW, Doggen CJ, Osanto S, et al. Malignancies, prothrombotic mutations, and the risk of venous thrombosis. *Jama.* 2005;293(6):715-22.
18. Timp JF, Braekkan SK, Versteeg HH, et al. Epidemiology of cancer-associated venous thrombosis. *Blood.* 2013;122(10):1712-23.
19. Pomp E, Lenselink A, Rosendaal F, et al. Pregnancy, the postpartum period and prothrombotic defects: risk of venous thrombosis in the MEGA study. *Journal of Thrombosis and Haemostasis.* 2008;6(4):632-7.
20. Sultan AA, West J, Tata LJ, et al. Risk of first venous thromboembolism in pregnant women in hospital: population based cohort study from England. *Bmj.* 2013;347:f6099.
21. Akgun M, Meral M, Onbas O, et al. Comparison of clinical characteristics and outcomes of patients with COPD exacerbation with or without venous thromboembolism. *Respiration.* 2006;73(4):428-33.
22. Ucar EY, Araz O, Akgun M, et al. Low-molecular-weight heparin use with thrombolysis: is it effective and safe? Ten years' clinical experience. *Respiration.* 2013;86(4):318-23.
23. Rali PM, Criner GJ. Submassive Pulmonary Embolism. *Am J Respir Crit Care Med.* 2018;198(5):588-98.
24. Arseven O, Ekim N, Müsellim B, ve ark. Türk Toraks Derneği Pulmoner Tromboembolizm Tanı ve Tedavi Uzlaşı Raporu. 2015.
25. McIntyre KM, Sasahara AA. The hemodynamic response to pulmonary embolism in patients without prior cardiopulmonary disease. *The American journal of cardiology.* 1971;28(3):288-94.
26. Elliott CG. Pulmonary physiology during pulmonary embolism. *Chest.* 1992;101(4):163S-71S.
27. Marcus JT, Gan CT-J, Zwanenburg JJ, et al. Interventricular mechanical asynchrony in pulmonary arterial hypertension: left-to-right delay in peak shortening is related to right ventricular overload and left ventricular underfilling. *Journal of the American College of Cardiology.* 2008;51(7):750-7.
28. Mauritz G-J, Marcus JT, Westerhof N, et al. Prolonged right ventricular post-systolic isovolumic period in pulmonary arterial hypertension is not a reflection of diastolic dysfunction. *Heart.* 2011;97(6):473-8.
29. Nadel JA, Murray JF, Mason R, et al. *Textbook of respiratory medicine:* Saunders; 2000.
30. Konstantinides SV, Torbicki A, Agnelli G, et al. 2014 ESC guidelines on the diagnosis and management of acute pulmonary embolism. *Eur Heart J.* 2014;35(43):3033-69, 69a-69k.
31. Tosun H. Akut pulmoner tromboemboli tanısı konulan hastalarda kronik tromboembolik pulmoner hipertansiyon gelişme insidansı ve ilişkili risk faktörleri/The incidence and related risk factors of chronic thromboembolic pulmonary hypertension in acute pulmonary embolism patients. 2017.
32. Obi M, Packer CD. Submassive Pulmonary Embolism: A Re-evaluation of Hemodynamic Instability. *Cureus.* 2019;11(5):e4644.
33. Kucher N, Rossi E, De Rosa M, et al. Prognostic role of echocardiography among patients with acute pulmonary embolism and a systolic arterial pressure of 90 mm Hg or higher. *Archives of internal medicine.* 2005;165(15):1777-81.
34. Miniati M, Prediletto R, Formichi B, et al. E. Accuracy of clinical assessment in the diagnosis of pulmonary embolism. *American journal of respiratory and critical care medicine.* 1999;159(3):864-71.

35. Pollack CV, Schreiber D, Goldhaber SZ, et al. Clinical characteristics, management, and outcomes of patients diagnosed with acute pulmonary embolism in the emergency department: initial report of EMPEROR (Multicenter Emergency Medicine Pulmonary Embolism in the Real World Registry). *Journal of the American College of Cardiology*. 2011;57(6):700-6.
36. Wells PS, Ginsberg JS, Anderson DR, et al. Use of a clinical model for safe management of patients with suspected pulmonary embolism. *Annals of internal medicine*. 1998;129(12):997-1005.
37. Stein PD, Henry JW. Clinical characteristics of patients with acute pulmonary embolism stratified according to their presenting syndromes. *Chest*. 1997;112(4):974-9.
38. Van Belle A, Buller HR, Huisman MV, et al. Effectiveness of managing suspected pulmonary embolism using an algorithm combining clinical probability, D-dimer testing, and computed tomography. *Jama*. 2006;295(2):172-9.
39. Wells PS, Anderson DR, Rodger M, et al. Derivation of a simple clinical model to categorize patients probability of pulmonary embolism: increasing the models utility with the SimpliRED D-dimer. *Thrombosis and haemostasis*. 2000;83(03):416-20.
40. Le Gal G, Righini M, Roy P-M, et al. Prediction of pulmonary embolism in the emergency department: the revised Geneva score. *Annals of internal medicine*. 2006;144(3):165-71.
41. Ceriani E, Combescure C, Le Gal G, et al. Clinical prediction rules for pulmonary embolism: a systematic review and meta-analysis. *Journal of thrombosis and haemostasis*. 2010;8(5):957-70.
42. Stein PD, Terrin ML, Hales CA, et al. Clinical, laboratory, roentgenographic, and electrocardiographic findings in patients with acute pulmonary embolism and no pre-existing cardiac or pulmonary disease. *Chest*. 1991;100(3):598-603.
43. Uresandi F, Blanquer J, Conget F, et al. Guidelines for the diagnosis, treatment, and follow-up of pulmonary embolism. *Arch Bronconeumol*. 2004;40(12):580-94.
44. Penalosa A, Roy PM, Kline J, et al. Performance of age-adjusted D-dimer cut-off to rule out pulmonary embolism. *Journal of Thrombosis and Haemostasis*. 2012;10(7):1291-6.
45. Schouten HJ, Geersing G, Koek H, et al. Diagnostic accuracy of conventional or age adjusted D-dimer cut-off values in older patients with suspected venous thromboembolism: systematic review and meta-analysis. *Bmj*. 2013;346:f2492.
46. Righini M, Van Es J, Den Exter PL, et al. Age-adjusted D-dimer cutoff levels to rule out pulmonary embolism: the ADJUST-PE study. *Jama*. 2014;311(11):1117-24.
47. Pruszczyk P, Bochowicz A, Torbicki A, et al. Cardiac troponin T monitoring identifies high-risk group of normotensive patients with acute pulmonary embolism. *Chest*. 2003;123(6):1947-52.
48. Kucher N, Printzen G, Doernhoefer T, et al. Low pro-brain natriuretic peptide levels predict benign clinical outcome in acute pulmonary embolism. *Circulation*. 2003;107(12):1576-8.
49. Powell T, Müller NL. Imaging of acute pulmonary thromboembolism: should spiral computed tomography replace the ventilation-perfusion scan? *Clinics in chest medicine*. 2003;24(1):29-38, v.
50. Geibel A, Zehender M, Kasper W, et al. Prognostic value of the ECG on admission in patients with acute major pulmonary embolism. *European respiratory journal*. 2005;25(5):843-8.
51. Kurzyna M, Torbicki A, Pruszczyk P, et al. Disturbed right ventricular ejection pattern as a new Doppler echocardiographic sign of acute pulmonary embolism. *The American journal of cardiology*. 2002;90(5):507-11.
52. Frémont B, Pacouret G, Jacobi D, et al. Prognostic value of echocardiographic right/left ventricular end-diastolic diameter ratio in patients with acute pulmonary embolism: results from a monocenter registry of 1,416 patients. *Chest*. 2008;133(2):358-62.
53. Pruszczyk P, Torbicki A, Kuch-Wocial A, et al. Diagnostic value of transoesophageal echocardiography in suspected haemodynamically significant pulmonary embolism. *Heart*. 2001;85(6):628-34.
54. Kucher N, Luder C, Dornhofer T, et al. Novel management strategy for patients with suspected pulmonary embolism. *European heart journal*. 2003;24(4):366-76.

55. Ghaye B, Szapiro D, Mastora I, et al. Peripheral pulmonary arteries: how far in the lung does multi-detector row spiral CT allow analysis? *Radiology*. 2001;219(3):629-36.
56. Patel S, Kazerooni EA, Cascade PN. Pulmonary embolism: optimization of small pulmonary artery visualization at multi-detector row CT. *Radiology*. 2003;227(2):455-60.
57. Remy-Jardin M, Remy J, Wattinne L, et al. Central pulmonary thromboembolism: diagnosis with spiral volumetric CT with the single-breath-hold technique--comparison with pulmonary angiography. *Radiology*. 1992;185(2):381-7.
58. Stein PD, Fowler SE, Goodman LR, et al. Multidetector computed tomography for acute pulmonary embolism. *New England Journal of Medicine*. 2006;354(22):2317-27.
59. Reid JH, Coche EE, Inoue T, et al. Is the lung scan alive and well? Facts and controversies in defining the role of lung scintigraphy for the diagnosis of pulmonary embolism in the era of MDCT. *European journal of nuclear medicine and molecular imaging*. 2009;36(3):505-21.
60. Hull RD, Hirsh J, Carter CJ, et al. Pulmonary angiography, ventilation lung scanning, and venography for clinically suspected pulmonary embolism with abnormal perfusion lung scan. *Annals of internal Medicine*. 1983;98(6):891-9.
61. Goodacre S, Sampson F, Thomas S, et al. Systematic review and meta-analysis of the diagnostic accuracy of ultrasonography for deep vein thrombosis. *BMC medical imaging*. 2005;5(1):6.
62. Van Beek E, Reekers J, Batchelor D, et al. Feasibility, safety and clinical utility of angiography in patients with suspected pulmonary embolism. *European radiology*. 1996;6(4):415-9.
63. Stein P, Athanasoulis C, Alavi A, et al. Complications and validity of pulmonary angiography in acute pulmonary embolism. *Circulation*. 1992;85(2):462-8.
64. Wan S, Quinlan DJ, Agnelli G, et al. Thrombolysis compared with heparin for the initial treatment of pulmonary embolism: a meta-analysis of the randomized controlled trials. *Circulation*. 2004;110(6):744-9.
65. Perrier A, Miron M-J, Desmarais S, et al. Using clinical evaluation and lung scan to rule out suspected pulmonary embolism: Is it a valid option in patients with normal results of lower-limb venous compression ultrasonography? *Archives of internal medicine*. 2000;160(4):512-6.
66. Value of the ventilation/perfusion scan in acute pulmonary embolism. Results of the prospective investigation of pulmonary embolism diagnosis (PIOPED). *Jama*. 1990;263(20):2753-9.
67. Roy P-M, Colombet I, Durieux P, et al. Systematic review and meta-analysis of strategies for the diagnosis of suspected pulmonary embolism. *Bmj*. 2005;331(7511):259.
68. Chan CM, Woods C, Shorr AF, et al. The validation and reproducibility of the pulmonary embolism severity index. *Journal of Thrombosis and Haemostasis*. 2010;8(7):1509-14.
69. Vanni S, Nazerian P, Pepe G, et al. Comparison of two prognostic models for acute pulmonary embolism: clinical vs. right ventricular dysfunction-guided approach. *Journal of Thrombosis and Haemostasis*. 2011;9(10):1916-23.
70. Donzé J, Le Gal G, Fine MJ. Prospective validation of the pulmonary embolism severity index. *Thrombosis and haemostasis*. 2008;100(05):943-8.
71. Jiménez D, Yusen RD, Otero R, et al. Prognostic models for selecting patients with acute pulmonary embolism for initial outpatient therapy. *Chest*. 2007;132(1):24-30.
72. Aujesky D, Roy P-M, Verschuren F, et al. Outpatient versus inpatient treatment for patients with acute pulmonary embolism: an international, open-label, randomised, non-inferiority trial. *The Lancet*. 2011;378(9785):41-8.
73. Puls M, Dellas C, Lankeit M, et al. Heart-type fatty acid-binding protein permits early risk stratification of pulmonary embolism. *European heart journal*. 2006;28(2):224-9.
74. Raschke RA, Gollihare B, Peirce JC, et al. The effectiveness of implementing the weight-based heparin nomogram as a practice guideline. *Archives of internal medicine*. 1996;156(15):1645-9.
75. Hull RD, Raskob GE, Hirsh J, et al. Continuous intravenous heparin compared with intermittent subcutaneous heparin in the initial treatment of proximal-vein thrombosis. *New England Journal of Medicine*. 1986;315(18):1109-14.

76. Merli G, Spiro TE, Olsson C-G. Subcutaneous enoxaparin once or twice daily compared with intravenous unfractionated heparin for treatment of venous thromboembolic disease. *Annals of internal medicine.* 2001;134(3):191-202.
77. Middeldorp S. How I treat pregnancy-related venous thromboembolism. *Blood.* 2011;118(20):5394-400.
78. Van der Hulle T, Kooiman J, Den Exter P, et al. Effectiveness and safety of novel oral anticoagulants as compared with vitamin K antagonists in the treatment of acute symptomatic venous thromboembolism: a systematic review and meta-analysis. *Journal of Thrombosis and Haemostasis.* 2014;12(3):320-8.
79. Ucar EY. Update on Thrombolytic Therapy in Acute Pulmonary Thromboembolism. *Eurasian J Med.* 2019;51(2):186-90.
80. Becattini C, Agnelli G, Salvi A, et al. Bolus tenecteplase for right ventricle dysfunction in hemodynamically stable patients with pulmonary embolism. *Thrombosis research.* 2010;125(3):e82-e6.
81. Group BTSSoCCPEGD. British Thoracic Society guidelines for the management of suspected acute pulmonary embolism. *Thorax.* 2003;58(6):470.
82. Sullivan EA, Ford JB, Chambers G, et al. Maternal mortality in Australia, 1973–1996. *Australian and New Zealand journal of obstetrics and gynaecology.* 2004;44(5):452-7.
83. Ercan Ş, Özkan S, Yücel N, et al. Establishing reference intervals for D-dimer to trimesters. *The Journal of Maternal-Fetal & Neonatal Medicine.* 2015;28(8):983-7.
84. Scarsbrook AF, Bradley KM, Gleeson FV. Perfusion scintigraphy: diagnostic utility in pregnant women with suspected pulmonary embolic disease. *European radiology.* 2007;17(10):2554-60.
85. Valentin J. International commission on radiation protection. Managing patient dose in multi-detector computed tomography (MDCT). *2007:1-79.*
86. Bates SM, Greer IA, Middeldorp S, et al. VTE, thrombophilia, antithrombotic therapy, and pregnancy: antithrombotic therapy and prevention of thrombosis: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest.* 2012;141(2):e691S-e736S.
87. Segal JB, Streiff MB, Hofmann LV, et al. Management of venous thromboembolism: a systematic review for a practice guideline. *Annals of internal medicine.* 2007;146(3):211-22.
88. Leonhardt G, Gaul C, Nietsch HH, et al. Thrombolytic therapy in pregnancy. *Journal of thrombosis and thrombolysis.* 2006;21(3):271-6.
89. Heit JA, Silverstein MD, Mohr DN, et al. Risk factors for deep vein thrombosis and pulmonary embolism: a population-based case-control study. *Archives of internal medicine.* 2000;160(6):809-15.
90. Goldhaber SZ, Bounameaux H. Pulmonary embolism and deep vein thrombosis. *The Lancet.* 2012;379(9828):1835-46.
91. Wharin C, Tagalakis V. Management of venous thromboembolism in cancer patients and the role of the new oral anticoagulants. *Blood reviews.* 2014;28(1):1-8.