

## Kritik Travma Hastalarında Tromboembolinin Yönetimi

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Majör travma, dünya çapında 40 yaşın altındaki kişilerde önde gelen mortalite ve morbidite nedenlerinden biridir. Her yıl, travmatik yaralanmalar dünya çapında yaklaşık 6 milyon ölüme neden olmaktadır (1). Şiddetli travma hastalarında hemoraji ve buna bağlı hiperkoagülasyon ile gelişen primer fibrinolitik hiperaktivite, klinisyenler için büyük bir zorluk oluşturur. Travma hastaları için güvenli bir antikoagülan tedavi sağlamak çok önemlidir, ancak önce bir dizi klinik sorunun yanıtlanması gerekir: Travmatik venöz tromboembolizm için risk faktörleri nelerdir? Hastaların koagülasyon disfonksiyonu durumu nasıl değerlendirilir? Venöz tromboembolizm için farmakolojik profilaksi başlatmak için en uygun zaman ne zaman? Ne tür profilaktik ajanlar kullanılmalıdır? Antikoagülasyona bağlı kanama nasıl yönetilir ve kemoprofilaksinin yeniden başlatılmasının optimal zamanlaması nasıl belirlenir? (2).

### Travma Sonrası VTE İnsidansı

Travma sonrası VTE insidansı, travmatik olmayan hastalardan 13 kat daha fazla olabilir vaka sayısına, travma tiplerine, tanı yöntemlerine ve travma tedavisi sırasında VTE önleme araçlarına bağlı olarak, travma sonrası VTE insidansı farklı çalışma tasarımları arasında büyük farklılıklar gösterir (%0.27-%65) (3). Hastalar travmatik yaralanmadan hemen sonra hiperkoagülasyon riski altındadır, ancak en yüksek risk travmadan bir hafta sonra ortaya çıkar.

İlk birkaç gün içinde çok sayıda (Pulmoner tromboemboli) PTE teşhis edilir ve yaralanmadan sonraki ilk 24 saat gibi erken bir zamanda önemli sayıda PTE bulunur; ve hiperkoagülasyon durumu hasta taburcu edildikten sonra bile devam edebilir (4,5).

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cığı boyutunu küçültür; özünde, gaz hacmini, beyin ödemi azaltır ve kandaki çözülmüş oksijenin kısmi basıncını artırır. Yaygın olarak tedavi için altın standart olarak kabul edilmektedir (71).

## Sonuçlar

- VAE, intravenöz infüzyonlar, tanı prosedürleri, laparoskopik ve özel ameliyatlar dahil olmak üzere tıbbi prosedürlerin iyi belgelenmiş ancak yeterince tespit edilmeyen bir komplikasyonudur.
- İntravasküler sisteme yerleştirilen herhangi bir iğne veya kateter, VAE riski taşır.
- VAE komplikasyonlarını tedavi etmenin morbiditesi, potansiyel mortalitesi ve yüksek maliyeti, önlemeyi kritik hale getirir.
- Özel cihazlar ve protokoller hastanede yatan hastalarda VAE riskini azaltır; ayakta tedavi ortamına bakım geçişleri olarak benzer önlemler uygulanmalıdır.
- VAE ciddi nörolojik morbidite ve hatta ölüme neden olabilir ve bu da haksız fiil iddialarını çözmek için büyük ödemelerle (ortalama 325.000 \$) sonuçlanır.

VAE'nin önlenmesi, klinisyenin uyanıklığına ve VAE'yi önleme, saptama ve tedavi etme stratejilerinin geliştirilmesine dayanır (72).

## Kaynaklar

1. Department of Violence and Injury Prevention and Disability; World Health Organization. Injuries and Violence: The Facts. Available online: [http://whqlibdoc.who.int/publications/2010/9789241599375\\_eng.pdf](http://whqlibdoc.who.int/publications/2010/9789241599375_eng.pdf) (accessed on 22 February 2020).
2. Yu-Hong Mi, Ming-Ying Xu *Chin J Traumatol.*2022 Mar;25(2):67-76.
3. Hamada S.R., Espina C., Guedj T., et al. High level of venous thromboembolism in critically ill trauma patients despite early and well-driven thromboprophylaxis protocol. *Ann Intensive Care.*2017;7:97.
4. Coleman JJ, Zarzaur BL, Katona CW, et al. Factors associated with pulmonary embolism within 72 hours of admission after trauma: a multicenter study. Y.-H. Mi and M.-Y. Xu *Chinese Journal of Traumatology* 25 (2022) 67e76
5. Kazemi Darabadi F., Jafari Zare M.A., Torabi Go-darzi Z., et al. Prevalence and main determinants of early post-traumatic thromboembolism in patients requiring ICU admission. *Eur J Trauma Emerg Surg.*2018;44:133–136.
6. Fröhlich M., Mutschler M., Caspers M., et al. Trauma-induced coagulopathy upon emergency room arrival: still a significant problem despite increased awareness and management? *Eur J Trauma Emerg Surg.*2019;45:115–124.
7. Paffrath T, Wafaisade A, Lefering R, et al. Venous thromboembolism after severe trauma: incidence, risk factors and outcome. *Injury.* 2010;41:97e101
8. Stannard JP, Singhania AK, Lopez-Ben RR, et al. Deep-vein thrombosis in high-energy skeletal trauma despite thromboprophylaxis. *J Bone Joint Surg Br.*2005;87:965e968.
9. Godzik J, McAndrew CM, Morshed S, et al. Multiple lower-extremity and pelvic fractures increase pulmonary embolus risk. *Orthopedics.* 2014;37
10. Valle EJ, Van Haren RM, Allen CJ, et al. Does traumatic brain injury increase the risk for venous thromboembolism in polytrauma patients. *J Trauma Acute Care Surg.* 2014;77:243e250.
11. Park SJ, Kim CK, Park YS, et al. Incidence and factors predicting venous thromboembolism after surgical treatment of fractures below the hip. *J Orthop Trauma.* 2015;29:e349ee354.
12. Karcutskie C.A., Meizoso J.P., Ray J.J., et al. Association of mechanism of injury with risk for venous thromboembolism after trauma. *JAMA Surg.*2017;152:35–40. doi:10.1001/jamasurg.2016.3116
13. Maegele M., Gu Z.T., Huang Q.B., et al. Updated concepts on the pathophysiology and the clinical management of trauma hemorrhage and coagulopathy. *Chin J Traumatol.*2017;20:125–132. doi:10.1016/j.cjtee.2017.03.004.
14. Upadhyaya G.K., Iyengar K.P., Jain V.K., et al. Evolving concepts and strategies in the management of polytrauma patients. *J Clin Orthop Trauma.*2021;12:58–65
15. Dobson G.P., Letson H.L., Sharma R., et al. Mechanisms of early trauma-induced coagulopathy: the clot thickens or not? *J Trauma Acute Care Surg.*2015;79:301–309
16. Simmons J.W., Powell M.F. Acute traumatic coagulopathy: pathophysiology and resuscitation. *Br J Anaesth.*2016;117:
17. Maegele M. The diagnosis and treatment of acute traumatic bleeding and coagulopathy. *Dtsch Arztebl Int.*2019;116:799–806. doi:10.3238/arztebl.2019.0799.
18. Bagot C.N., Arya R. Virchow and his triad: a question of attribution. *Br J Haematol.*2008;143:180–190.
19. Park M.S., Perkins S.E., Spears G.M., et al. Risk factors for venous thromboembolism after acute trauma: a population-based case-cohort study. *Thromb Res. Thromb Res.*2016;144:40–45. doi:10.1016/j.thromres.2016.03.026.

20. Strandvik G., El-Menyar A., Asim M., et al. Clinical characteristics, management practices, and in-hospital outcomes among trauma patients with venous thromboembolism. *JEmergencies, Trauma, Shock*.2020;13:124–130
21. Spinella P.C., Carroll C.L., Staff I., et al. Duration of red blood cell storage is associated with increased incidence of deep vein thrombosis and in hospital mortality in patients with traumatic injuries. *Crit Care*.2009;13:R151.
22. Hagemo JS. Prehospital detection of traumatic coagulopathy. *Transfusion*. 2013;53:48Se51S.
23. Brill J.B., Badiee J., Zander A.L., et al. The rate of deep vein thrombosis doubles in trauma patients with hypercoagulable thromboelastography. *JTrauma Acute Care Surg*.2017;83:413–419..
24. Konstantinides S.V., Meyer G., Becattini C., et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS): the task force for the diagnosis and management of acute pulmonary embolism of the European Society of Cardiology (ESC) *Eur Respir J*. 2019;54
25. Smythe M.A., Priziola J., Dobesh P.P., et al. Guidance for the practical management of the heparin anticoagulants in the treatment of venous thromboembolism. *JThromb Thrombolysis*.2016;41:165–186. doi:10.1007/s11239-015-1315-2
26. Gould MK, Garcia DA, Wren SM, et al. Prevention of VTE in nonorthopedic surgical patients: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest*. 2012;141:e227Se277S.
27. Kakkos SK, Caprini JA, Geroulakos G, et al. Combined intermittent pneumatic leg compression and pharmacological prophylaxis for prevention of venous thromboembolism. *Cochrane Database Syst Rev*. 2016;9:CD005258. [https:// doi.org/10.1002/14651858.CD005258.pub3](https://doi.org/10.1002/14651858.CD005258.pub3).
28. Spano PJ, Shaikh S, Boneva D, et al. Anticoagulant chemoprophylaxis in patients with traumatic brain injuries: a systematic review. *J Trauma Acute Care Surg*. 2020;88:454e460.
29. Joseph B, Friese RS, Sadoun M, et al. The big (brain injury guidelines) project: defining the management of traumatic brain injury by acute care surgeons. *J Trauma Acute Care Surg*. 2014;76:965e969
30. Gould MK, Garcia DA, Wren SM, et al. Prevention of VTE in Nonorthopedic surgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest* 2012;141:e227Se277S.
31. Hannan EL, Zhong Y, Lahey SJ, et al. 30-day readmissions after coronary artery bypass graft surgery in New York State. *JACC Cardiovasc Interv* 2011;4:569-76
32. Lindblad B, Eriksson A. Autopsy verified PTE in surgical department: analysis if PTE from 1951 to 1968. *Br J Surg* 1991;78:849-52.
33. Cohen AT, Tapson VF, Bergmann J, for the ENDORSE Investigators. Venous thromboembolism risk and prophylaxis in the acute hospital care setting (ENDORSE study): a multinational cross-sectional study. *Lancet* 2008;371:387-94.
34. David F, Francisco F, Rafael C. M Cerebral and pulmonary fat embolism after unilateral total knee arthroplasty, *Arthroplasty Today*, 2019-12-01, Volume 5, Issue 4, Pages 431-434,
35. Duran L, Kayhan S, Kati C, Akdemir HU, Balci K, Yavuz Y. Cerebral fat embolism syndrome after long bone fracture due to gunshot injury. *Indian J Crit Care Med* 2014;18(3):167-9.
36. Shkrum MJ, Ramsay DA, editors. The forensic pathology of trauma: Common problems for the pathologist. Chapter 8: Blunt Trauma. Totowa – New Jersey. Humana Press, 2007:450-1.
37. Talbot M, Schemitsch EH. Fat embolism syndrome: history, definition, epidemiology. *Injury*. 2006;37(Suppl 4):S3–S7
38. Stein PD, Yaekoub AY, Matta F, et al. Fat embolism syndrome. *Am J Med Sci* 2008;336(6):472–7.
39. Thomas JE, Ayyar DR. Systemic fat embolism. A diagnostic profile in 24 patients. *Arch Neurol* 1972;26(6):517–23.
40. Gurd AR, Wilson RI. The fat embolism syndrome. *The Journal of Bone and Joint Surgery* 1974;56B(3):408–16.
41. Lindeque BGP, Schoeman HS, Dommissie GF, Boeyens MC, Vlok AL. Fat embolism and the fat embolism syndrome. A double-blind therapeutic study. *The Journal of Bone and Joint Surgery* 1987;69(1):128–31
42. Rothberg DL, Makarewich CA. Fat embolism and fat embolism syndrome. *J Am Acad Orthop Surg* 2019;27:e346–55
43. Peltier LF. Fat embolism. A perspective. *Clin Orthop Relat Res* 1988;(232): 263–70.
44. Findlay JM, DeMajo W. Cerebral fat embolism. *Can Med Assoc J* 1984;131(7): 755–7.
45. Taviloglu K, Yanar H. Fat embolism syndrome. *Surg Today* 2007;37(1):5–8
46. Jacobson DM, Terrence CF, Reinmuth OM. The neurologic manifestations of fat embolism. *Neurology* 1986;36(6):847–51.
47. Krebs J, Ferguson SJ, Nuss K, et al. Sildenafil prevents cardiovascular changes after bone marrow fat embolization in sheep. *Anesthesiology* 2007;107(1): 75–81
48. Aebli N, Schwenke D, Davis G, et al. Polymethylmethacrylate causes prolonged pulmonary hypertension during fat embolism: a study in sheep. *Acta Orthop* 2005;76(6):904–11.
49. Murphy P, Edelist G, Byrick RJ, et al. Relationship of fat embolism to haemodynamic and echocardiographic changes during cemented arthroplasty. *Can J Anaesth* 1997;44(12):1293–300
50. Gossling HR, Pellegrini VD Jr. Fat embolism syndrome: a review of the pathophysiology and physiological basis of treatment. *Clin Orthop Relat Res* 1982;(165):68–82.

51. Chan KM, Tham KT, Chiu HS, et al. Post-traumatic fat embolism—its clinical and subclinical presentations. *J Trauma* 1984;24(1):45–9.
52. Mimoz O, Edouard A, Beydon L, et al. Contribution of bronchoalveolar lavage to the diagnosis of posttraumatic pulmonary fat embolism. *Intensive Care Med* 1995;21(12):973–80.
53. Greenberg HB. Roentgenographic signs of posttraumatic fat embolism. *JAMA* 1968;204(6):540–1.
54. Park HM, Ducret RP, Brindley DC. Pulmonary imaging in fat embolism syndrome. *Clin Nucl Med* 1986;11(7):521–2.
55. Meeke RI, Fitzpatrick GJ, Phelan DM. Cerebral oedema and the fat embolism syndrome. *Intensive Care Med* 1987;13(4):291–2.
56. Riska EB, Myllynen P. Fat embolism in patients with multiple injuries. *J Trauma* 1982;22(11):891–4. [ir](#)
57. Shier MR, Wilson RF, James RE, et al. Fat embolism prophylaxis: a study of four treatment modalities. *J Trauma* 1977;17(8):621–9.
58. Stoltenberg JJ, Gustilo RB. The use of methylprednisolone and hypertonic glucose in the prophylaxis of fat embolism syndrome. *Clin Orthop Relat Res* 1979;(143):211–21.
59. Vesely T.M. Air embolism during insertion of central venous catheters. *J. Vasc. Int. Radiol.* 2001;12:1291–1295. doi: 10.1016/S1051-0443(07)61554-1
60. Kapoor T, Gutierrez G. Air embolism as a cause of the systemic inflammatory response syndrome: a case report. *Crit Care* 2003;7(5):R98-10
61. Mirski M.A., Lele A.V., Fitzsimmons L., Toung T.J. Diagnosis and treatment of vascular air embolism. *Anesthesiology*. 2007;106:164–177.
62. Orliaguet GA, Martin J. Management of venous air embolism. *Cah Anesthesiol* 2000;48(4):251–60
63. Van Hulst RA, Klein J, Lachmann B. Gas embolism: pathophysiology and treatment. *Clin Physiol Funct Imaging* 2003;23(5):237–46.
64. Gottdiener JS, Papademetriou V, Notargiacomo A, Park WY, Cutler DJ. Incidence and cardiac effects of systemic venous air embolism. Echocardiographic evidence of arterial embolization via noncardiac shunt. *Arch Intern Med* 1988;148(4):795–800
65. Anselmino M, Matta M, Toso E, Ferraris F, Castagno D, Scaglione M, et al. Silent cerebral embolism during atrial fibrillation ablation: pathophysiology, prevention and management. *J Atr Fibrillation* 2013;6:796
66. Park DH, Chung YG, Kang SH, Park JY, Park YK, Lee HK. Arterial cerebral air embolism at the site of a spontaneous pontine hemorrhage in a patient receiving erroneous continuous positive pressure ventilation. *Clin Neurol Neurosurg* 2007;109: 803–5.
67. Gursoy S, Duger C, Kaygusuz K, Ozdemir Lol I, Gurelik B, Mimaroglu C. Cerebral arterial air embolism associated with mechanical ventilation and deep tracheal aspiration. *Case Rep Pulmonol* 2012;2012:41636
68. Durant T.M., Long J., Oppenheimer M.J. Pulmonary (venous) air embolism. *Am. Heart J.* 1947;33:269–281
69. Feil M. Preventing central line air embolism. *Am. J. Nurs.* 2015;115:64–69.
70. Shaikh N., Ummunisa F. Acute management of vascular air embolism. *J. Emerg. Trauma Shock.* 2009;2:180–185
71. Eoh E.J., Derrick B., Moon R. Cerebral arterial gas embolism during upper endoscopy. *A A Case Rep.* 2015;5:93–94.
72. Sorin J. Brull, Richard C. Prielipp *Journal of Critical Care*, 2017-12-01, Volume 42, Pages 255-263