

Renal Replasman Tedavisi

George Coritsidis, MD and Saad Bhatti, MD
Çeviri: Uz. Dr. Fethi Gül, Prof. Dr. İsmail Cinel

ÖNEMLİ NOKTALAR

- 1 Renal Replasman Tedavisi (RRT): Yoğun bakım ünitelerinde en pahalı tedavi yöntemlerinden biridir. Kritik hastalarda RRT'nin planlanması karmaşık olup , yoğun bakım ve nefroloji uzmanı ortak kararıyla başlanmalıdır.
- 2 RRT Tipleri ; periton diyalizi , aralıklı hemodiyaliz , sürekli RRT ve düşük gradiyentli günlük diyalizdir.
- 3 RRT'de bu tedavi tipleri konveksiyon ve difüzyon mekanizmalarını kullanmaktadır. Bu kuvvetler ile solüd moleküllerin temizlenmesi ve plazma sıvı hacminin uzaklaştırılması; başka bir deyişle ultrafiltrasyon (UF) gerçekleşir.
- 4 RRT resüsitasyona yanıt vermeyen ve ağır hastalıkta , renal fonksiyonların hızlı düzelmesi beklenmeyen hastalarda erken başlanmalıdır: Çoklu organ yetmezliği, yüksek fraksiyonel 'sodyum' atılımı (FENa) , artmış azotemi (üre veya kreatin seviyelerine bakılmaksızın) oligüri, bulgularının hepsi Akut Tübüler Nekrozu (ATN) göstermektedir.
- 5 Günümüzde randomize çalışmalar ve metaanalizlere göre mortaliteyi düşürmede diyaliz tiplerinin birbirine üstünlüğü bulunmamaktadır. Fakat hemodinamik instabil ,akut koroner sendrom, artmış kafa içi basıncı , hipo/hipernatremi olgularında daha yavaş temizleme hızı tercih edilmelidir.

GİRİŞ

Yaklaşık 60 yıl önce KORE savaşında akut böbrek hasarı tedavisinde ilk kez RRT kullanılmıştır¹. Sonraki 25 yılda sürekli tedaviler Almanyada denenmiştir². RRT modaliteleri daha sonra yaygınlaşarak birçok hastanede kullanılmaya başlanmıştır. AKİ'de (Akut Böbrek Hasarı) önleyici ve destekleyici tedavilerin başarısızlığı , RRT kullanımını artırmıştır.

Son 10 yılda ciddi AKİ sıklığı iki katına çıkmıştır (Şekil 31-1).³ Buna paralel olarak 2012 yılında RRT ihtiyacı olan insan sayısı 200.000 kişiyi bulmuştur³. Günümüzde RRT gereken AKİ hastalarının sayısı Son Dönem Böbrek Yetmezliği (ESRD) hasta sayısını geçmiştir⁴. Bununla birlikte RRT gereksinimi

olan AKİ hastalarında mortalite ve morbidite hastaneye yatış süresine göre değişmektedir³⁻⁵.

Yoğun bakımda RRT ihtiyacı üç farklı klinik durumda ortaya çıkar: AKİ, kritik ESRD hastaları⁶ ve ilaç yada toksin aşırı dozu. AKİ'de RRT ihtiyacı düşünüldüğünden daha azdır. Yoğun bakımda AKİ sıklığı % 6 -19 arasında olmakla birlikte hasta popülasyonu, risk, hasar, kayıp ve son dönem böbrek yetmezliği kriterlerine (RIFLE) göre daha da artabilir⁷⁻⁸. AKİ'de RRT ihtiyacı %5'leri bulmakla birlikte, mortalite hergün artmaya devam ederek %25- 50'yi bulmaktadır³⁻⁸⁻¹⁰. AKİ'ye bağlı olarak kısa ve uzun dönem mortalite sıklığı özellikle RRT ihtiyacı

REFERANSLAR

- Smith LH, Post RS, Teschan PE, et al. Post-traumatic renal insufficiency in military casualties. II. Management, use of artificial kidney, prognosis. *Am J Med.* 1955;18:187-198.
- Kramer P, Wigger W, Reiger J, Matthaei D, Scheler F. Arteriovenous haemofiltration: a new and simple method for treatment of over hydrated patients resistant to diuretics. *Klin Wochenschr.* 1977;55:1121-1122.
- Hsu RK, McCulloch CE, Dudley RA, Lo LJ, Hsu CY. Temporal changes in incidence of dialysis-requiring AKI. *J Am Soc Nephrol.* 2013;24(1):37-42.
- Collins AJ, Foley RN, Chavers B, et al. United States Renal Data System 2011 Annual Data Report: atlas of chronic kidney disease and end-stage renal disease in the United States. *Am J Kidney Dis.* 2012;59(suppl 1):A7, e1-e420.
- Liangos O, Wald R, O'Bell JW, et al. Epidemiology and outcomes of acute renal failure in hospitalized patients: a national survey. *Clin J Am Soc Nephrol.* 2006;1:43-51.
- Strijack B, Mojica J, Sood M, et al. Outcomes of chronic dialysis patients admitted to the intensive care unit. *J Am Soc Nephrol.* 2009;20:2441-2447.
- Coritsidis G, Guru K, Ward L, Bashir R, Feinfeld DA, Carvounis CP. Differences in prediction of acute renal failure in medical and surgical intensive care patients. *Ren Fail.* 2000;22:235-244.
- Uchino S, Kellum JA, Bellomo R, et al. Acute renal failure in critically patients: a multinational, multicenter study. *JAMA.* 2005;294:813-818.
- Pannu N, Klarenbach S, Wiebe N, et al. For the Alberta kidney disease network. Renal replacement therapy in patients with acute renal failure: a systematic review. *JAMA.* 2008;299(7):793-805.
- Ympa YP, Sakr Y, Reinhart K, et al. Has mortality from acute renal failure decreased? A systemic review of the literature. *Am J Med.* 2005;118:827-832.
- Van Berendoncks AM, Elseviers MM, Lins RL; SHARF Study Group. Long-term follow-up. *Clin J Am Soc Nephrol.* 2010;5:1755-1762.
- Mehta RL, McDonald B, Gabbai F, et al. Nephrology consultation in acute renal failure: does timing matter? *Am J Med.* 2002;113:456-461.
- Palevsky PM, Zhang JH, O'Connor TZ, et al. Intensity of renal support in critically ill patients with acute kidney injury. *N Engl J Med.* 2008;359:7-20.
- Ricci Z, Ronco C. Dose and efficiency of renal replacement therapy: continuous renal replacement therapy versus intermittent hemodialysis versus slow extended daily dialysis. *Crit Care Med.* 2008;36(suppl 4):S229-S237.
- Daugirdas JT, Van Stone JC. Physiologic principles and urea kinetic modeling. In: Daugirdas JT, Blake PG, Ing TS, eds. *Handbook of Dialysis.* 3rd ed. Philadelphia, PA: Lippincott, Williams & Wilkins; 2001:15-45.
- Meyer TW, Hostetter TH. Uremia. *N Engl J Med.* 2007;357:1316-1325.
- Hutchison CA, Crowe AV, Stevens PE, Harrison DA, Lipkin GW. Case mix, outcome and activity for patients admitted to intensive care units requiring chronic renal dialysis: a secondary analysis of the ICNARC Case Mix Programme Database. *Crit Care.* 2007;11:R50.
- Bellomo R, Wan L, Langenberg C, Ishikawa K, May CN. Septic acute kidney injury: the glomerular arterioles. *Contrib Nephrol.* 2011;174:98-107.
- Coca SG, Peixoto AJ, Garg AX, Krumholz HM, Parikh CR. The prognostic importance of a small acute decrement in kidney function in hospitalized patients: a systematic review and meta-analysis. *Am J Kidney Dis.* 2007;50:712-720.
- Thakar CV, Rousseau J, Leonard AC. Timing of dialysis initiation in AKI in ICU: international survey. *Crit Care.* 2012;16:R237.
- Faubel S. Have we reached the limit of mortality benefit with our approach to renal replacement therapy in acute kidney injury? *Am J Kidney Dis.* 2013;62:1030-1033.
- Karvellas CJ, Farhat MR, Sajjad I, et al. A comparison of early versus late initiation of renal replacement therapy in critically ill patients with acute kidney injury: a systematic review and meta-analysis. *Crit Care.* 2011;15:R72.
- Gaudry S, Hajage D, Schortgen F, Martin-Lefevre L, Pons B, Boulet E, Boyer A, Chevrel G, Lerolle N, Carpentier D, et al. Initiation strategies for renal-replacement therapy in the intensive care unit. *N Engl J Med.* 2016;375(2):122-33.
- Zarbock A, Kellum JA, Schmidt C, Van Aken H, Wempe C, Pavenstadt H, Boanta A, Gerss J, Meersch M. Effect of early vs delayed initiation of renal replacement therapy on mortality in critically ill patients with acute kidney injury: the ELAIN randomized clinical trial. *JAMA.* 2016;315(20):2190-9.
- Bagshaw SM, Uchino S, Kellum JA, et al. Association between renal replacement therapy in critically ill patients with severe acute kidney injury and mortality. *J Crit Care.* 2013;28:1011-1018.

26. Waikar SS, Bonventre J. Can we rely on blood urea nitrogen as a biomarker to determine when to initiate dialysis? *Clin J Am Soc Nephrol*. 2006;1:903-904.
27. Liu KD, Himmelfarb J, Paganini E, et al. Timing of initiation of dialysis in critically ill patients with acute kidney injury. *Clin J Am Soc Nephrol*. 2006;1:915-919.
28. Bagshaw SM, Uchino S, Bellomo R, et al. Timing of renal replacement therapy and clinical outcomes in critically ill patients with severe acute kidney injury. *J Crit Care*. 2009;24:129-140.
29. RENAL Replacement Therapy Study Investigators, Bellomo R, Cass A. Intensity of continuous renal-replacement therapy in critically ill patients. *N Engl J Med*. 2009;361:1627-1638.
30. Hakim RM, Wingard RL, Parker RA. Effect of the dialysis membrane in the treatment of patients with acute renal failure. *N Engl J Med*. 1994;17:1338-1342.
31. Bouchard J, Soroko SB, Chertow GM, et al. Fluid accumulation, survival and recovery of kidney function in critically ill patients with acute kidney injury. *Kidney Int*. 2009;76:422-427.
32. Payen D, de Pont AC, Sakr Y, et al. A positive fluid balance is associated with a worse outcome in patients with acute renal failure. *Crit Care*. 2008;12:R74.
33. Sutherland SM, Zappitelli M, Alexander SR, et al. Fluid overload and mortality in children receiving continuous renal replacement therapy: the prospective pediatric continuous renal replacement therapy registry. *Am J Kidney Dis*. 2010;55:316-325.
34. Vaara ST, Korhonen AM, Kaukonen KM, et al. Fluid overload is associated with an increased risk for 90-day mortality in critically ill patients with renal replacement therapy: data from the prospective FINNAKI study. *Crit Care*. 2012;16:R197.
35. Vanholder R, Baurmeister U, Brunet P, Cohen G, Glorieux G, Jankowski J; European Uremic Toxin Work Group. A bench to bedside view of uremic toxins. *J Am Soc Nephrol*. 2008;19:863-870.
36. Siddiqui NF, Coca SG, Devereaux PJ, et al. Secular trends in acute dialysis after elective major surgery—1995 to 2009. *CMAJ*. 2012;184(11):1237-1245.
37. Ponce D, Berbel MN, Regina de Goes C, et al. High volume peritoneal dialysis in acute kidney injury: indications and limitations. *Clin J Am Soc Nephrol*. 2012;7:887-894.
38. Davenport A. Practical guidance for dialyzing a hemodialysis patient following acute brain injury. *Hemodial Int*. 2008;12:307-312.
39. Schortgen F, Soubrier N, Delclaux C, et al. Hemodynamic tolerance of intermittent hemodialysis in critically ill patients: usefulness of practice guidelines. *Am J Respir Crit Care Med*. 2000;162:197-202.
40. Overberger P, Pesacreta M, Palevsky PM; VA/NIH Acute Renal Failure Trial Network. Management of renal replacement therapy in acute kidney injury: a survey of practitioner prescribing practices. *Clin J Am Soc Nephrol*. 2007;2:623-630.
41. Yagi N, Leblanc M, Sakai K, et al. Cooling effect of continuous renal replacement therapy in critically ill patients. *Am J Kidney Dis*. 1998;32:1023-1030.
42. Barenbrock M, Hausberg M, Matzkies F, de la Motte S, Schaefer RM. Effects of bicarbonate- and lactate-buffered replacement fluids on cardiovascular outcome in CVVH patients. *Kidney Int*. 2000;58(4):1751-1757.
43. Uchino S, Fealy N, Baldwin I, Morimatsu H, Bellomo R. Pre-dilution vs. post-dilution during continuous veno-venous hemofiltration: impact on filter life and azotemic control. *Nephron Clin Pract*. 2003;94(4):c94-c98.
44. Friedrich JO, Wald R, Bagshaw SM, Burns KE, Adhikari NK. Hemofiltration compared to hemodialysis for acute kidney injury: systematic review and meta-analysis. *Crit Care*. 2012;16:R146.
45. Steinfeldt T, Rolfes C. Heparin induced thrombocytopenia and anticoagulation in renal replacement therapy. *Anesthesiol Intensivmed Notfallmed Schmerzther*. 2008;43(4):304-310; quiz 312.
46. Reddy BV, Grossman EJ, Trevino SA, Hursting MJ, Murray PT. Argatroban anticoagulation in patients with heparin-induced thrombocytopenia requiring renal replacement therapy. *Ann Pharmacother*. 2005;39(10):1601-1605.
47. Joannidis M, Oudemans-van Straaten HM. Clinical review: patency of the circuit in continuous renal replacement therapy. *Crit Care*. 2007;11(4):218.
48. Zhang Z, Hongying N. Efficacy and safety of regional citrate anticoagulation in critically ill patients undergoing continuous renal replacement therapy. *Intensive Care Med*. 2012;38(1):20-28.
49. Fliser D, Kielstein JT. Technology insight: treatment of renal failure in the intensive care unit with extended dialysis. *Nat Clin Pract Nephrol*. 2006;2:32-39.
50. Schwenger V, Weigand MA, Hoffman O, et al. Sustained low efficiency dialysis using single batch system in acute kidney injury—a randomized interventional trial: the RENal Replacement Therapy in Intensive Care Unit PatiEnts. *Crit Care*. 2012;16:R140.

51. Costanzo MR, Guglin ME, Saltzberg MT, et al; UNLOAD Trial Investigators. Ultrafiltration versus intravenous diuretics for patients hospitalized for acute decompensated heart failure. *J Am Coll Cardiol*. 2007;49:675-683.
52. Adams KF, Lindenfield J, Arnold JMO, et al. Executive summary: HFSA 2006 comprehensive heart failure practice guideline. *J Card Fail*. 2006;12:29-32.
53. Ricci Z, Ronco C, D'amico G, et al. Practice patterns in the management of acute renal failure in the critically ill patient: an international survey. *Nephrol Dial Transplant*. 2006;21:690-696.
54. KDIGO Clinical Practice Guideline for Acute Kidney Injury. *Kidney International Supplements* (2012) 2, 1; doi:10.1038/kisup.2012.1
55. Seyler L, Cotton F, Taccone FS, et al. Recommended beta-lactam regimens are inadequate in septic patients treated with continuous renal replacement therapy. *Crit Care*. 2011;15:R137.
56. Bogard KN, Peterson NT, Plumb TJ, et al. Antibiotic dosing during sustained low-efficiency dialysis: special considerations in adult critically ill patients. *Crit Care Med*. 2011;39:560-570.
57. Coritsidis GN, Dharmeshkumar S, Gupta G, et al. Does timing of dialysis in ESRD patients with acute myocardial infarcts affect morbidity or mortality? *Clin J Am Soc Nephrol*. 2009;4:1302-1311.
58. Pertosa G, Grandaliano G, Loreto G, et al. Clinical relevance of cytokine production in hemodialysis. *Kidney Int*. 2000;58(suppl 76):S104-S111.
59. Payen D, Mateo J, Cavaillon JM, et al. Impact of continuous venovenous hemofiltration on organ failure during the early phase of severe sepsis: a randomized controlled trial. *Crit Care Med*. 2009;37:803-810.
60. Wald R, Quinn RR, Luo J, et al. Chronic dialysis and death among survivors of acute kidney injury requiring dialysis. *JAMA*. 2009;302:1179-1185.
61. Schneider AG, Bellomo R, Bagshaw SM, Glassford NJ, Lo S, Jun M, Cass A, Gallagher M. Choice of renal replacement therapy modality and dialysis dependence after acute kidney injury: a systematic review and meta-analysis. *Intensive Care Med*. 2013 Jun;39(6):987-97
62. Parikh A, Shaw A. The economics of renal failure and kidney disease in critically ill patients. *Crit Care Clin*. 2012;28:99-111.
63. Rahamati MA, Homel P, Hoenich NA, et al. The role of improved water quality on inflammatory markers in patients undergoing regular dialysis. *Int J Artif Organs*. 2004;27:723-727.
64. Udy AA, Roberts JA, Shorr A, et al. Augmented renal clearance in septic and traumatized patients with normal plasma creatinine concentrations: identifying at-risk patients. *Nat Rev Nephrol*. 2011;7:539-543.
65. Palevsky PM, Molitoris BA, Okusa MD, et al. Design of clinical trials in acute kidney injury: report from an NIDDK workshop on trial methodology. *Clin J Am Soc Nephrol*. 2012;7:844-850.