

POST KARDİYAK ARREST BAKIM

**37.
BÖLÜM**

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1.Giriş

Kardiyak arrest gelişen hastalarda uygulanan kardiyo pulmoner resusitasyon (KPR)'nun temel amacı, spontan dolaşım geri dönüşümü (SDGD)'nü sağlamaktır. Resüsítasyondaki çeşitli ilerlemelere rağmen SDGD alındıktan sonra taburcu edilen hastaların oranı oldukça düşüktür (1). SDGD, kardiyak arrestten sonra derlenmenin ilk aşamasıdır. Kardiyak arrest sonrası; post-kardiyak arrest sendromu, miyokard disfonksiyonu, beyin hasarı ve sistemik iskemi / reperfüzyon yanıtına bağlı hasar resüsítasyondan sonraki dönemi karmaşık hale getirmektedir (2). Bakım dönemi boyunca post-kardiyak arrest sendromunun şiddeti ve arrestin nedenine bağlı olarak pek çok hastada organlara yönelik destek tedavisi gerekebilmektedir. Böylece nörolojik iyileşme ve sağkalım oranı hakkında fikir edinilmiş olur (3-9). Post kardiyak arrest sendromunun azaltılması ve sağ kalım oranını artırmak için çeşitli stratejiler geliştirilmiştir (10). Kardiyak arrest nedeninin belirlenmesi ve tedavisi, hemodinami takibi, hava yolu ve havalandırma yönetimi, sedasyon, nöbet takibi, kan glukoz takibi, sıcaklık yönetimi, прогноз ve rehabilitasyon takibi bu stratejilerdendir (1).

2.Kardiyak arrest nedeninin tanımlanması

SDGD sağlandıktan sonra, kardiyak arreste yol açan nedenler tespit edilip erken tedavi edilmelidir. Dikkatli, detaylı ve titiz bir fizik muayene, bu nedenlerin hızla belirlenmesine yardımcı olacaktır. Bu nedenlerden bazıları geri döndürülebilir nedenler olup erkenden tedavi edilmelidir. Bunlar kısaca 5H (hipovolemi, hipoksi, hipotermi, hipo/hiper kalemi, hidrojen) ve 5T (toksin, tromboz kardiyak, tromboz pulmoner, tamponad, tansiyon pnemotoraks) şeklinde pratikleştirilmiştir (1).

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KAYNAKÇA

1. Pothiawala, S. Post-resuscitation care. *Singapore medical journal*, 2017 ; 58(7), 404. DOI: 10.11622/smedj.2017060
2. Nolan JP, Neumar RW, Adrie C, et al. Post-cardiac arrest syndrome: epidemiology, pathophysiology, treatment, and prognostication. A Scientific Statement from the International Liaison Committee on Resuscitation; the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesia; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Cardiology; the Council on Stroke. *Resuscitation* 2008; 79:350-79.
3. Spaite DW, Bobrow BJ, Stoltz U, et al. Statewide regionalization of postarrest care for out-of-hospital cardiac arrest: association with survival and neurologic outcome. *Ann Emerg Med* 2014; 64:496–506
4. Soholm H, Wachtell K, Nielsen SL, et al. Tertiary centres have improved survival compared to other hospitals in the Copenhagen area after out-of-hospital cardiac arrest. *Resuscitation* 2013;84:162–7.doi: 10.1016/j.resuscitation.2012.06.029. Epub 2012 Jul 13.
5. Sunde K, Pytte M, Jacobsen D, et al. Implementation of a standardised treatment protocol for post resuscitation care after out-of-hospital cardiac arrest. *Resuscitation* 2007;73:29–39.DOI: 10.1016 / j. Resüsitusasyon.2006.08.016
6. Gaieski DF, Band RA, Abella BS, et al. Early goal-directed hemodynamic optimization combined with therapeutic hypothermia in comatose survivors of out-of-hospital cardiac arrest. *Resuscitation* 2009;80:418–24.DOI: 10.1016 / j. Resüsitusasyon.2008.12.015
7. Carr BG, Goyal M, Band RA, et al. A national analysis of the relationship between hospital factors and post-cardiac arrest mortality. *Intensive Care Med* 2009;35:505–11.DOI: 10.1007 / s00134-008-1335-x
8. Oddo M, Schaller MD, Feihl F, et al. From evidence to clinical practice: effective implementation of therapeutic hypothermia to improve patient outcome after cardiac arrest. *Crit Care Med*2006 ;34:1865–73. DOI: 10.1097 / 01.CCM.0000221922.08878.49
9. Knafelj R, Radsel P, Ploj T, et al. Primary percutaneous coronary intervention and mild induced hypothermia in comatose survivors of ventricular fibrillation with ST-elevation acute myocardial infarction. *Resuscitation* 2007;74:227–34. DOI: 10.1016 / j. Resüsitusasyon.2007.01.016
10. Sandroni C, D'Arrigo S. Management of oxygen and carbon dioxide pressure after cardiac arrest. *Minerva Anestesiologica* 2014;80(10):1105- 14.
11. Mongardon N, Dumas F, Ricome S, et al. Postcardiac arrest syndrome: from immediate resuscitation to long-term outcome. *Ann Intensive Care* 2011;1:45.DOI: 10.1186 / 2110-5820-1-45
12. Stub D, Bernard S, Duffy SJ, et al. Post cardiac arrest syndrome: a review of therapeutic strategies. *Circulation* 2011;123:1428–35. DOI: 10.1161 / CIRCULATIONA-HA.110.988725
13. Nielsen N, Wetterslev J, Cronberg T, et al. Targeted temperature management at 33 degrees C versus 36 degrees C after cardiac arrest. *N Engl J Med* 2013;369:2197–206.DOI: 10.1056 / NEJMoa1310519
14. Dragancea I, Rundgren M, Englund E, et al. The influence of induced hypothermia and delayed prognostication on the mode of death after cardiac arrest. *Resuscitation* 2013;84:337–42. DOI: 10.1016/j.resuscitation.2012.09.015

15. I, Monchi M, Chiche JD, et al. Reversible myocardial dysfunction in survivors of out-of-hospital cardiac arrest. *J Am Coll Cardiol* 2002;40:2110–6. DOI: 10.1016 / s0735-1097 (02) 02594-9
16. Chalkias A, Xanthos T. Pathophysiology and pathogenesis of post-resuscitation myocardial stunning. *Heart Fail Rev* 2012;17:117–28. DOI: 10.1007 / s10741-011-9255-1
17. Adrie C, Monchi M, Laurent I, et al. Coagulopathy after successful cardiopulmonary resuscitation following cardiac arrest: implication of the protein C anticoagulant pathway. *J Am Coll Cardiol* 2005;46:21–8. DOI: 10.1016 / j.jacc.2005.03.046
18. Adrie C, Adib-Conquy M, Laurent I, et al. Successful cardiopulmonary resuscitation after cardiac arrest as a “sepsis-like” syndrome. *Circulation* 2002;106:562–8. DOI: 10.1161 / 01.cir.0000023891.80661.ad
19. Adrie C, Laurent I, Monchi M, et al. Postresuscitation disease after cardiac arrest: a sepsis-like syndrome? *Curr Opin Crit Care* 2004;10:208–12. DOI: 10.1097 / 01.ccx.0000126090.06275.fe
20. Huet O, Dupic L, Batteux F, et al. Postresuscitation syndrome: potential role of hydroxyl radical-induced endothelial cell damage. *Crit Care Med* 2011;39:1712–20. DOI: 10.1097 / CCM.0b013e3182186d42
21. Fink K, Schwarz M, Feldbrugge L, et al. Severe endothelial injury and subsequent repair in patients after successful cardiopulmonary resuscitation. *Crit Care* 2010;14:R104. DOI: 10.1186 / cc9050
22. van Genderen ME, Lima A, Akkerhuis M, et al. Persistent peripheral and microcirculatory perfusion alterations after out-of-hospital cardiac arrest are associated with poor survival. *Crit Care Med* 2012;40:2287–94. DOI: 10.1097 / CCM.0b013e31825333b2
23. Bro-Jeppesen J, Kjaergaard J, Wanscher M, et al. Systemic inflammatory response and potential prognostic implications after out-of-hospital cardiac arrest: a substudy of the target temperature management trial. *Crit Care Med* 2015;43:1223–32. DOI: 10.1097/CCM.0000000000000937
24. Sutherasan Y, Penuelas O, Muriel A, et al. Management and outcome of mechanically ventilated patients after cardiac arrest. *Crit Care* 2015;19:215. DOI: 10.1186 / s13054-015-0922-9
25. Mackenney J, Soar J. Cardiopulmonary Resuscitation And Post-Resuscitation Care. *Anaesth Intensive Care* 2013;14(1): 15–8
26. Balan IS, Fiskum G, Hazelton J, et al. Oximetry-guided reoxygenation improves neurological outcome after experimental cardiac arrest. *Stroke* 2006;37:3008–13. DOI: 10.1161 / 01.STR.0000248455.73785.b1
27. Kilgannon JH, Jones AE, Shapiro NI, et al. Association between arterial hyperoxia following resuscitation from cardiac arrest and in-hospital mortality. *JAMA* 2010;303:2165–71. DOI: 10.1001 / jama.2010.707
28. Pilcher J, Weatherall M, Shirtcliffe P, et al. The effect of hyperoxia following cardiac arrest – a systematic review and meta-analysis of animal trials. *Resuscitation* 2012;83:417–22. DOI: 10.1016/j.resuscitation.2011.12.021
29. Bouzat P, Suys T, Sala N, et al. Effect of moderate hyperventilation and induced hypertension on cerebral tissue oxygenation after cardiac arrest and therapeutic hypothermia. *Resuscitation* 2013;84:1540–5. DOI: 10.1016/j.resuscitation.2013.05.014
30. Buunk G, van der Hoeven JG, Meinders AE. Cerebrovascular reactivity in comatose patients resuscitated from a cardiac arrest. *Stroke* 1997;28:1569–73. DOI: 10.1161 /

- 01.str.28.8.1569
31. Buunk G, van der Hoeven JG, Meinders AE. A comparison of near-infrared spectroscopy and jugularbulb oximetry in comatose patients resuscitated from a cardiac arrest. *Anaesthesia* 1998;53:13–9. DOI: 10.1111/j.1365-2044.1998.00263.x
 32. Roberts BW, Kilgannon JH, Chansky ME, et al. Association between postresuscitation partial pressure of arterial carbon dioxide and neurological outcome in patients with postcardiacarrest syndrome. *Circulation* 2013;127:2107–13. DOI: 10.1161/CIRCULATIONAHA.112.000168
 33. Schneider AG, Eastwood GM, Bellomo R, et al. Arterial carbon dioxide tension and outcome in patients admitted to the intensive care unit after cardiac arrest. *Resuscitation* 2013;84:927–34. DOI: 10.1016/j.resuscitation.2013.02.014
 34. Bray JE, Bernard S, Cantwell K, et al. The association between systolic blood pressure on arrival at hospital and outcome in adults surviving from out-of-hospital cardiac arrests of presumed cardiac aetiology. *Resuscitation*. 2014;85:509–15
 35. Ruiz-Bailén M, Aguayo de Hoyos E, Ruiz-Navarro S, et al. Reversible myocardial dysfunction after cardiopulmonary resuscitation. *Resuscitation* 2005;66:175–81. DOI: 10.1016/j.resuscitation.2005.01.012
 36. Chang WT, Ma MH, Chien KL, et al. Postresuscitation myocardial dysfunction: correlated factors and prognostic implications. *Intensive Care Med* 2007;33:88–95 DOI: 10.1007/s00134-006-0442-9
 37. Nolan J P, Soar J, Cariou A, et al. European resuscitation council and European society of intensive care medicine 2015 guidelines for post-resuscitation care. *Intensive care medicine*, 41(12), 2039–2056. 38 Topjian AA, French B, Sutton RM, Conlon T, Nadkarni VM, Moler FW, et al. Early postresuscitation hypotension is associated with increased mortality following pediatric cardiac arrest. *Crit Care Med* 2014;42(6):1518–1523
 39. Larsen JM, Ravkilde J. Acute coronary angiography in patients resuscitated from out-of-hospital cardiac arrest – a systematic review and meta-analysis. *Resuscitation* 2012;83:1427–33. DOI: 10.1016/j.resus.2012.08.337
 40. Dumas F, Cariou A, Manzo-Silberman S, et al. Immediate percutaneous coronary intervention is associated with better survival after out-of-hospital cardiac arrest: insights from the PROCAT(Parisian Region Out of Hospital Cardiac ArresT) registry. *Circ Cardiovasc Interv.* 2010;3:200–7. DOI: 10.1161/CIRCINTERVENTIONS.109.913665
 41. Grasner JT, Meybohm P, Caliebe A, et al. Postresuscitation care with mild therapeutic hypothermia and coronary intervention after out-of-hospital cardiopulmonary resuscitation: a prospective registry analysis. *Crit Care* 2011;15:R61. DOI: 10.1186/cc10035
 42. Callaway CW, Schmicker RH, Brown SP, et al. Early coronary angiography and induced hypothermia are associated with survival and functional recovery after out-of-hospital cardiac arrest. *Resuscitation* 2014;85:657–63. DOI: 10.1016/j.resuscitation.2013.12.028
 43. Dumas F, White L, Stubbs BA, et al. Long-term prognosis following resuscitation from out of hospital cardiac arrest: role of percutaneous coronary intervention and therapeutic hypothermia. *J Am Coll Cardiol* 2012;60:21–7. DOI: 10.1016/j.jacc.2012.03.036
 44. Radsel P, Knafelj R, Kocjancic S, et al. Angiographic characteristics of coronary disease and postresuscitation electrocardiograms in patients with aborted cardi-

- ac arrest outside a hospital. Am J Cardiol 2011;108: 634–8.DOI: 10.1016 / j.amjcard.2011.04.008
45. Hollenbeck RD, McPherson JA, Mooney MR, et al. Early cardiac catheterization is associated with improved survival in comatose survivors of cardiac arrest without STEMI. Resuscitation 2014;85:88–95.DOI: 10.1016/j.resuscitation.2013.07.027
46. Redfors B, Ramunddal T, Angeras O, et al. Angiographic findings and survival in patients undergoing coronary angiography due to sudden cardiac arrest in Western Sweden. Resuscitation 2015;90:13–20.DOI: 10.1016/j.resuscitation.2014.11.034
47. Bro-Jeppesen J, Kjaergaard J, Wanscher M, et al. Emergency coronary angiography in comatose cardiac arrest patients: do real-life experiences support the guidelines? Eur Heart J Acute Cardiovasc Care 2012;1:291–301. DOI: 10.1177 / 2048872612465588
48. Dankiewicz J, Nielsen N, Annborn M, et al. Survival in patients without acute ST elevation after cardiac arrest and association with early coronary angiography: a post hoc analysis from the TTM trial. Intensive Care Med 2015;41:856–64. DOI: 10.1007 / s00134-015-3735-z
49. Nishizawa H, Kudoh I. Cerebral autoregulation is impaired in patients resuscitated after cardiac arrest. Acta Anaesthesiol Scand 1996;40: 1149–53.DOI: 10.1111 / j.1399-6576.1996.tb05579.x
50. Sundgreen C, Larsen FS, Herzog TM, et al. Autoregulation of cerebral blood flow in patients resuscitated from cardiac arrest. Stroke 2001;32:128–32. DOI: 10.1161 / 01.str.32.1.128
51. Deakin CD, Nolan JP, Soar J, et al. European Resuscitation Council Guidelines for Resuscitation 2010 Section 4. Adult advanced life support. Resuscitation 2010;81:1305–52. DOI: 10.1016/j.resuscitation.2010.08.017
52. Lee DS, Green LD, Liu PP, et al. Effectiveness of implantable defibrillators for preventing arrhythmic events and death: a meta-analysis. J Am Coll Cardiol 2003;41:1573–82.DOI: 10.1016 / s0735-1097 (03) 00253-5
53. Vardas PE, Auricchio A, Blanc JJ, et al. Guidelines for cardiac pacing and cardiac resynchronization therapy: the Task Force for Cardiac Pacing and Cardiac Resynchronization Therapy of the European Society of Cardiology. Developed in collaboration with the European Heart Rhythm Association. Eur Heart J 2007;28:2256–95.
54. Steg PG, James SK, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J 2012;33: 2569–619.DOI: 10.1093 / eurheartj / ehs215
55. Arnaout M, Mongardon N, Deye N, et al. Out-of-hospital cardiac arrest from brain cause: epidemiology, clinical features, and outcome in a multicenter cohort. Crit Care Med 2015;43:453–60.DOI: 10.1097 / CCM.0000000000000722
56. Chelly J, Mongardon N, Dumas F, et al. Benefit of an early and systematic imaging procedure after cardiac arrest: insights from the PROCAT (Parisian Region Out of Hospital Cardiac Arrest) registry. Resuscitation 2012;83: 1444–50.DOI: 10.1016/j.resuscitation.2012.08.321
57. Chamorro C, Borrallo J, Romera M, et al. Anesthesia and analgesia protocol during therapeutic hypothermia after cardiac arrest: a systematic review. Anesth Analg. 2010;110(5):1328-1335. DOI: 10.1213 / ANE.0b013e3181d8cacf
58. Salciccioli J, Cocchi M, Rittenberger J, et al. Continuous neuromuscular blockade is associated with decreased mortality in post-cardiac arrest patients. Resuscitation

- 2013;84(12):1728-1733. DOI: 10.1016/j.resuscitation.2013.06.008
- 59. Snyder BD, Hauser WA, Loewenson RB, et al. Neurologic prognosis after cardio-pulmonary arrest. III: Seizure activity. *Neurology* 1980;30:1292–7. DOI: 10.1212 / wnl.30.12.1292
 - 60. Bouwes A, van Poppel D, Koelman JH, et al. Acute posthypoxic myoclonus after cardiopulmonary resuscitation. *BMC Neurol* 2012;12:63. DOI: 10.1186 / 1471-2377-12-63
 - 61. Seder DB, Sunde K, Rubertsson S, et al. Neurologic outcomes and postresuscitation care of patients with myoclonus following cardiac arrest. *Crit Care Med* 2015;43:965–72. DOI: 10.1097 / CCM.0000000000000880
 - 62. Ingvar M. Cerebral blood flow and metabolic rate during seizures. Relationship to epileptic brain damage. *Ann N Y Acad Sci* 1986;462:194–206. DOI: 10.1111 / j.1749-6632.1986.tb51254.x
 - 63. Caviness JN, Brown P. Myoclonus: current concepts and recent advances. *Lancet Neurol* 2004;3:598–607. DOI: 10.1016 / S1474-4422 (04) 00880-4
 - 64. Padkin A. Glucose control after cardiac arrest. *Resuscitation* 2009;80(6):611-612. DOI: 10.1016/j.resuscitation.2009.04.019
 - 65. Ling Y, Li X, Gao X. Intensive versus conventional glucose control in critically ill patients: a meta-analysis of randomized controlled trials. *Eur J Intern Med* 2012;23(6):564-574. DOI: 10.1016 / j.ejim.2012.02.013
 - 66. Herlitz J, Castren M, Friberg H, et al. Post resuscitation care: what are the therapeutic alternatives and what do we know?. *Resuscitation* 2006;69(1):15-22. DOI: 10.1016/j. resuscitation.2005.08.006
 - 67. Hypothermia after Cardiac Arrest Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. *N Engl J Med* 2002;346:549-56. DOI: 10.1056 / NEJMoa012689
 - 68. Bro-Jeppesen J, Hassager C, Wanscher M, et al. Post-hypothermia fever is associated with increased mortality after out-of-hospital cardiac arrest. *Resuscitation* 2013;84(12):1734-1740. DOI: 10.1016/j.resuscitation.2013.07.023
 - 69. Wijdicks EFM, Huidra A, Young GB, Bassetti CL, et al. Practice Parameter: Prediction of outcome in comatose survivors after cardiopulmonary resuscitation (an evidence-based review) Report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology* 2006; 67(2):203-208
 - 70. Leary M, Grossstreuer A, Iannacone S, et al. Pyrexia and neurologic outcomes after therapeutic hypothermia for cardiac arrest. *Resuscitation* 2013;84(8):1056-61. DOI: 10.1016/j.resuscitation.2012.11.003
 - 71. Winters S, Wolf K, Kettinger S, et al. Assessment of risk factors for post-rewarming “rebound hyperthermia” in cardiac arrest patients undergoing therapeutic hypothermia. *Resuscitation* 2013;84(9):1245-1249. DOI: 10.1016/j.resuscitation.2013.03.027
 - 72. Laver S, Farrow C, Turner D, et al. Mode of death after admission to an intensive care unit following cardiac arrest. *Intensive Care Med*. 2004;30:2126–8. DOI: 10.1007 / s00134-004-2425-z
 - 73. Bernard SA, Gray TW, Buist MD, et al. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *N Engl J Med*. 2002;346:557–63. DOI: 10.1056 / NEJMoa003289
 - 74. Jarrah S, Dziodzio J, Lord C, et al. Surface cooling after cardiac arrest:effecti-

- veness, skin safety, and adverse events in routine clinical practice. *Neurocrit Care.* 2011;14:382–8. DOI: 10.1007 / s12028-011-9506-y
75. Kim F, Olsufka M, Carlbom D, et al. Pilot study of rapid infusion of 2 L of 4 degrees C normal saline for induction of mild hypothermia in hospitalized, comatose survivors of out-of-hospital cardiac arrest. *Circulation.* 2005;112:715–9.
 76. Castrén M, Nordberg P, Svensson L, et al. Intra-arrest transnasal evaporative cooling:a randomized, prehsptial, multicentre study (PRINCE:Pre-ROSC IntraNasal Cooling Effectiveness) *Circulation.* 2010;122:729–36.
 77. Al-Senani FM, Graffagnino C, Grotta JC, et al. A prospective multicenter pilot study to evaluate the feasibility and safety of using the CoolGard System and Icy catheter following cardiac arrest. *Resuscitation.* 2004;62:143–50. DOI: 10.1016/j.resuscitation.2004.02.016
 78. Hoedemaekers CW, Ezzahti M, Gerritsen A, et al. Comparison of cooling methods toinduce and maintain normo- and hypothermia in intensive care unit patients: a prospective interventionstudy. *Crit Care* 2007;11:R91. DOI: 10.1186/cc6104
 79. Gillies MA, Pratt R, Whiteley C, et al. Therapeutic hypothermia after cardiac arrest: a retrospective comparison of surface and endovascular cooling techniques. *Resuscitation* 2010;81:1117–22.DOI: 10.1016/j.resuscitation.2010.05.001
 80. Arrich J. Clinical application of mild therapeutic hypothermia after cardiac arrest. *Crit Care Med* 2007;35:1041–7. DOI: 10.1097 / 01.CCM.0000259383.48324.35
 81. Aribogün A, Akın Ş. Yoğun bakım hastalarında tedavi amacıyla hipotermi uygulaması. *Anestezi Dergisi* 2007;15(3):161.
 82. Abend NS, Mani R, Tschuda TN, et al. EEG Monitoring during Therapeutic Hypothermia in Neonates, Children, and Adults. *Am J Electroneurodiagnostic Technol* 2011;51(3):141-164.
 83. Storm C, Meyer T, Schroeder T, et al. Use of target temperature management after cardiac arrest in Germany - A nationwide survey including 951 intensive care units. *Resuscitation* 2014;85(8):1012-1017.
 84. Çertuğ A. Avrupa Resüsítasyon Konseyi 2010 Resüsítasyon Kılavuzu'ndaki Temel Değişiklikler. *Anestezi Dergisi* 2011;19(1): 1 – 14
 85. Buijs, E, Verboom E, Top A, et al. Early microcirculatory impairment during therapeutic hypothermia is associated with poor outcome in post-cardiac arrest children: a prospective observational cohort study. *Resuscitation* 2014;85(3):397-404.
 86. Lin J, Hsia S, Wang H, et al. Therapeutic Hypothermia Associated With Increased Survival After Resuscitation in Children.*Pediatr Neurol* 2013;48(4):285-290. DOI: 10.1016 / j.pediatrneurol.2012.12.021
 87. Kim J, Shin S, Ro YS, et al. Post-resuscitation care and outcomes of out-of-hospital cardiac arrest: a nationwide propensity score-matching analysis. *Resuscitation* 2013;84(8):1068-1077.
 88. Kupchik N. Development and implementation of a therapeutic hypothermia protocol. *Crit Care Med* 2009;37:S279-S284. DOI: 10.1097 / CCM.0b013e3181aa61c5
 89. Choi S, Youn C, Park K, et al. Therapeutic hypothermia in adult cardiac arrest because of drowning. *Acta Anaesthesiol Scand* 2012;56(1): 116-123 DOI: 10.1111 / j.1399-6576.2011.02562.x
 90. Geurts M, Macleod M, Kollmar R, et al. Therapeutic hypothermia and the risk of infection: a systematic review and meta-analysis. *Crit Care Med* 2014;42(2):231-42 DOI: 10.1097 / CCM.0b013e3182a276e8

91. Stiell IG, Nichol G, Leroux BG, et al. Early versus later rhythm analysis in patients with out-of-hospital cardiac arrest. *N Engl J Med* 2011;365:787–97DOI: 10.1056 / NEJMoa1010076
92. Samaniego EA, Mlynash M, Caulfield AF, et al. Sedation confounds outcome prediction in cardiac arrest survivors treated with hypothermia. *Resuscitation* 2011;15:113–9.DOI: 10.1007 / s12028-010-9412-8
93. Sharshar T, Citerio G, Andrews PJ, et al. Neurological examination of critically ill patients: a pragmatic approach. Report of an ESICM expert panel. *Intensive Care Med* 2014;40:484–95. DOI: 10.1007 / s00134-014-3214-y
94. Cronberg T, Lilja G, Horn J, et al. Neurologic function and health-related quality of life in patients following targeted temperature management at 33 degrees C vs 36 degrees C after out-of-hospital cardiac arrest: a randomized clinical trial. *JAMA Neurol* 2015.
95. Moulaert VRMP, Verbunt JA, van Heugten CM, et al. Cognitive impairments in survivors of out-of-hospital cardiac arrest: a systematic review. *Resuscitation* 2009;80:297–305.
96. Wilder Schaaf KP, Artman LK, Peberdy MA, et al. Anxiety, depression, and PTSD following cardiac arrest: a systematic review of the literature. *Resuscitation* 2013;84:873–7.
97. Wachelder EM, Moulaert VR, van Heugten C, et al. Life after survival: long-term daily functioning and quality of life after an out-of-hospital cardiac arrest. *Resuscitation* 2009;80:517–22.DOI: 10.1016/j.resuscitation.2009.01.020
98. Lundgren-Nilsson A, Rosen H, Hofgren C, et al. The first year after successful cardiac resuscitation: function, activity, participation and quality of life. *Resuscitation* 2005;66:285–9.
99. Moulaert VR, Wachelder EM, Verbunt JA, et al. Determinants of quality of life in survivors of cardiac arrest. *J Rehabil Med* 2010;42:553–8.DOI: 10.2340/16501977-0547