





CELAL BAYAR
ÜNİVERSİTESİ

Post-kardiyak Arrest Sendromu ve Post-resüsitatif Bakım

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Manisa



Tarihçe

1740 Fransız Bilimler Akademisi (The Paris Academy of Sciences) boğulma vakalarında ağızdan ağza solunumu önerdi.

1891 Dr. Friedrich Maass insanda ilk kez göğüs kompresyonu tarifledi.

1904 Dr. George Crile ABDde ilk kez kapalı göğüs masajı uyguladı.



Tarihçe

1954 James Elam ilk kez hastanın oksijenini idame ettirmeyi başardı.

1956 Peter Safar ve James Elam ağızdan ağza resusitasyonu icat ettiler.



Tarihçe

- 1960** Cardiopulmonary resuscitation (CPR) geliştirildi.
AHA, CPR'ı hekimlere tanıtmak için bir program kurdu.
- 1970** Dr. Vladimir Negovsky **post-resusitasyon hastalığı** tanımladı.
- 1992** International Liasion Committee on Resuscitation (ILCOR) kuruldu.
- 2008** ILCOR **post-kardiak arrest sendromu** tanımını önerdi.



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Abstract

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[Ann Surg.](#) 1953 May;137(5):731-44.

Some common denominators in 1200 cases of cardiac arrest.
[STEPHENSON HE Jr.](#), [REID LC](#), [HINTON JW](#).

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Student paramedic experience with prehospital cardiac arrest cases [Prehosp Emerg Care. 2009]

[Review](#) C.A.U.S.E.: Cardiac arrest ultra-sound exam--a better approach to [Resuscitation. 2008]

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[Anaesthesia](#). 2007 Dec;62(12):1207-16.

Outcome following admission to UK intensive care units after cardiac arrest: a secondary analysis of the ICNARC Case Mix Programme Database.

[Nolan JP](#)¹, [Laver SR](#), [Welch CA](#), [Harrison DA](#), [Gupta V](#), [Rowan K](#).

 **Author information**

Abstract

Using a retrospective analysis of the Intensive Care National Audit and Research Centre Case Mix Programme Database (ICNARC CMPD), we have summarised the characteristics and outcomes for mechanically ventilated patients admitted to UK intensive care units (ICUs) after cardiac arrest. Descriptive statistics on case mix, physiology, treatment, service delivery, outcome and activity were described separately for community cardiac arrest, in-hospital cardiac arrest (peri-operative) and in-hospital cardiac arrest (not peri-operative). The impact on outcome of several patient characteristics and physiological values were analysed using multivariable logistic regression. Mechanically ventilated survivors of cardiac arrest accounted for 24,132 (5.8%) of all admissions to the 174 ICUs in the ICNARC CMP. Of these, 10,347 (42.9%) survived to leave the ICU and 6778 (28.6%) survived to acute hospital discharge. The ICNARC model gives much better discrimination than APACHE II for predicting hospital mortality after admission to ICU following cardiac arrest: the predicted hospital mortality based on the APACHE II and ICNARC model was 41.9% and 79.7%, respectively.

PMID: 17991255 [PubMed - indexed for MEDLINE]

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Admission factors associated with hospital mortality in patients with haemal [Crit Care. 2009]

Case mix, outcome and activity for patients admitted to intensive care units [Crit Care. 2007]

Review Outcome prediction in critical care: the ICNARC model. [Curr Opin Crit Care. 2008]

Review Databases for assessing the outcomes of the treatment of patients [Cardiol Young. 2008]

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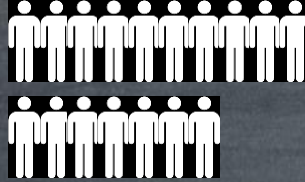
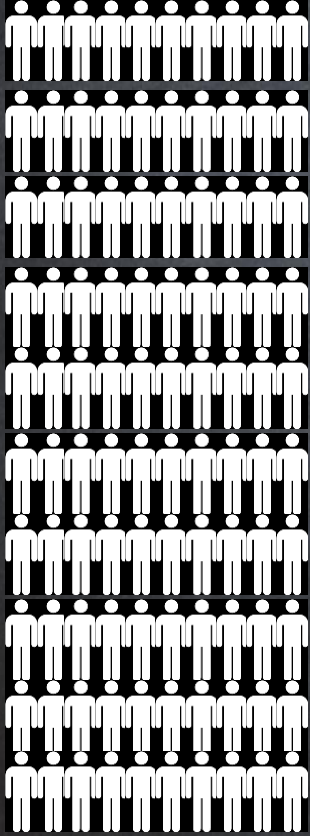
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Hastane dışı kardiyak arrest

Anaesthesia

Journal of the Association of Anaesthetists of
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Abstract

The following term was not found in PubMed: 2006;295.

JAMA. 2006 Jan 4;295(1):50-7.

First documented rhythm and clinical outcome from in-hospital cardiac arrest among children and adults.

Nadkarni VM¹, Larkin GL, Peberdy MA, Carey SM, Kaye W, Mancini ME, Nichol G, Lane-Truitt T, Potts J, Ornato JP, Berg RA; National Registry of Cardiopulmonary Resuscitation Investigators.

Author information

Abstract

CONTEXT: Cardiac arrests in adults are often due to ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT), which are associated with better outcomes than asystole or pulseless electrical activity (PEA). Cardiac arrests in children are typically asystole or PEA.

OBJECTIVE: To test the hypothesis that children have relatively fewer in-hospital cardiac arrests associated with VF or pulseless VT compared with adults and, therefore, worse survival outcomes.

DESIGN, SETTING, AND PATIENTS: A prospective observational study from a multicenter registry (National Registry of Cardiopulmonary Resuscitation) of cardiac arrests in 253 US and Canadian hospitals between January 1, 2000, and March 30, 2004. A total of 36,902 adults (> or =18 years) and 880 children (<18 years) with pulseless cardiac arrests requiring chest compressions, defibrillation, or both were assessed. Cardiac arrests occurring in the delivery department, neonatal intensive care unit, and in the out-of-hospital setting were excluded.

MAIN OUTCOME MEASURE: Survival to hospital discharge.

RESULTS: The rate of survival to hospital discharge following pulseless cardiac arrest was higher in children than adults (27% [236/880] vs 18% [6485/36,902]; adjusted odds ratio [OR], 2.29; 95% confidence interval [CI], 1.95-2.68). Of these survivors, 65% (154/236) of children and 73% (4737/6485) of adults had good neurological outcome. The prevalence of VF or pulseless VT as the first documented pulseless rhythm was 14% (120/880) in children and 23% (8361/36,902) in adults (OR, 0.54; 95% CI, 0.44-0.65; P<.001). The prevalence of asystole was 40% (350) in children and 35% (13,024) in adults (OR, 1.20; 95% CI, 1.10-1.40; P = .006), whereas the prevalence of PEA was 24% (213) in children and 32% (11,963) in adults (OR, 0.67; 95% CI, 0.57-0.78; P<.001). After adjustment for differences in preexisting conditions, interventions in place at time of arrest, witnessed and/or monitored status, time to defibrillation of VF or pulseless VT, intensive care unit location of arrest, and duration of cardiopulmonary resuscitation, only first documented pulseless arrest rhythm remained significantly associated with differential survival to discharge (24% [135/563] in children vs 11% [2719/24,987] in adults with asystole and PEA; adjusted OR, 2.73; 95% CI, 2.23-3.32).

CONCLUSIONS: In this multicenter registry of in-hospital cardiac arrest, the first documented pulseless arrest rhythm was typically asystole or PEA in both children and adults. Because of better survival after asystole and PEA, children had better outcomes than adults despite fewer cardiac arrests due to VF or pulseless VT.

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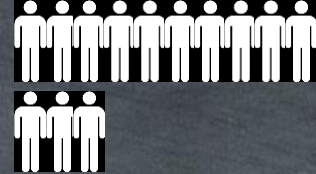
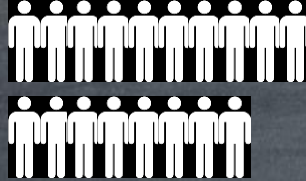
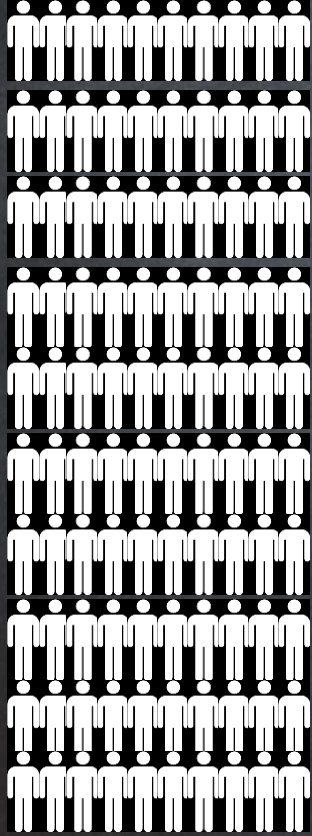
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- Rhythms and outcomes of adult in-hospital cardiac arrest. [Crit Care Med. 2010]
- Outcome from out-of-hospital cardiac arrest caused by nonventricular fibrillation in children. [Ann Emerg Med. 1998]
- Outcomes of in-hospital ventricular fibrillation in children. [N Engl J Med. 2006]
- [Review](#) Cardiopulmonary resuscitation in children. [Curr Opin Crit Care. 2009]
- [Review](#) Cardiopulmonary resuscitation (CPR) plus delay [Cochrane Database Syst Rev. 2014]

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Hastane içi kardiyak arrest



Phases of Post-Cardiac Arrest Syndrome

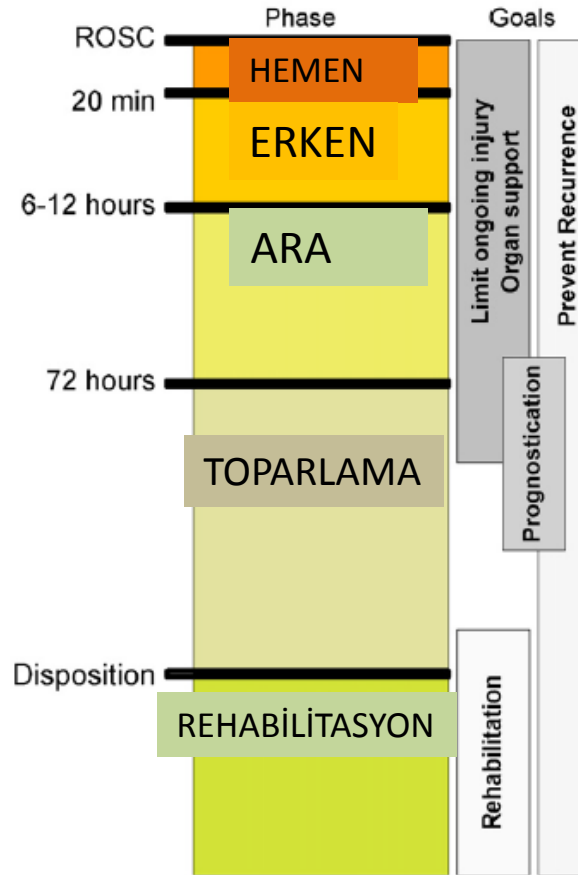
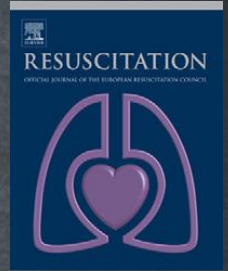


Figure 1 Phases of post cardiac arrest syndrome



Post-kardiyak Arrest Sendromu (PKAS)

1. Anoksik beyin hasarı

2. Miyokardiyal disfonksiyon

PKAS

3. Sistemik iskemi/reperfüzyon
cevabı

4. Persistan presipitan patoloji



Post-kardiyak Arrest Sendromu (PKAS)

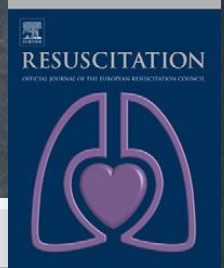


Table 1 Post-cardiac arrest syndrome: pathophysiology, clinical manifestations, and potential treatments.

Syndrome	Pathophysiology	Clinical manifestation	Potential treatments
Post-cardiac arrest brain injury	• Impaired cerebrovascular autoregulation • Cerebral oedema (limited) • Postischaemic neurodegeneration	• Coma • Seizures • Myoclonus • Cognitive dysfunction • Persistent vegetative state • Secondary Parkinsonism • Cortical stroke • Spinal stroke • Brain death	• Therapeutic hypothermia¹⁷⁷ • Early haemodynamic optimization • Airway protection and mechanical ventilation • Seizure control • Controlled reoxygenation (SaO₂ 94%-96%) • Supportive care



Post-kardiyak Arrest Sendromu (PKAS)

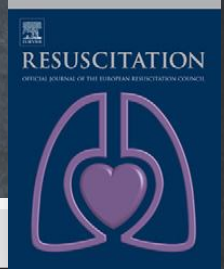


Table 1 Post-cardiac arrest syndrome: pathophysiology, clinical manifestations, and potential treatments.

Syndrome	Pathophysiology	Clinical manifestation	Potential treatments
Post-cardiac arrest myocardial dysfunction	• Global hypokinesis (myocardial stunning) • Reduced cardiac output • ACS	• Early revascularization of AMI^{171,373} • Hypotension • Dysrhythmias • Cardiovascular collapse	• Early haemodynamic optimization • Intravenous fluid⁹⁷ • Inotropes⁹⁷ • IABP^{13,160} • LVAD¹⁶¹ • ECMO³⁶¹



Post-kardiyak Arrest Sendromu (PKAS)

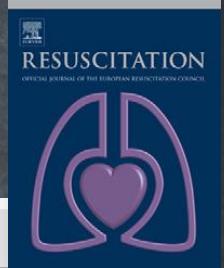


Table 1 Post-cardiac arrest syndrome: pathophysiology, clinical manifestations, and potential treatments.

Syndrome	Pathophysiology	Clinical manifestation	Potential treatments
Systemic ischaemia/ reperfusion response	• Systemic inflammatory response syndrome • Impaired vasoregulation • Increased coagulation • Adrenal suppression • Impaired tissue oxygen delivery and utilisation • Impaired resistance to infection	• Ongoing tissue hypoxia/ ischaemia • Hypotension • Cardiovascular collapse • Pyrexia (fever) • Hyperglycaemia • Multiorgan failure • Infection	• Early haemodynamic optimization • Intravenous fluid • Vasopressors • High-volume haemofiltration³⁷⁴ • Temperature control • Glucose control²²⁰ • Antibiotics for documented infection



Post-kardiyak Arrest Sendromu (PKAS)

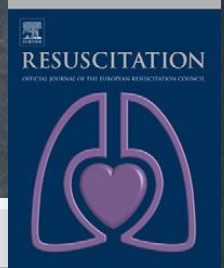


Table 1 Post-cardiac arrest syndrome: pathophysiology, clinical manifestations, and potential treatments.

Syndrome	Pathophysiology	Clinical manifestation	Potential treatments
Persistent precipitating pathology	• Cardiovascular disease (AMI/ACS, cardiomyopathy) • Pulmonary disease (COPD, asthma) • CNS disease (CVA) • Thromboembolic disease (PE) • Toxicologic (overdose, poisoning) • Infection (sepsis, pneumonia) • Hypovolaemia (haemorrhage, dehydration)	• Specific to aetiology, but complicated by concomitant PCAS	• Disease-specific interventions guided by patient condition concomitant PCAS



Post-resüsitatif Bakım

1- Monitörizasyon

Table 2 Post-cardiac arrest syndrome: monitoring options.

1. General intensive care monitoring
 - Arterial catheter
 - Oxygen saturation by pulse oximetry
 - Continuous ECG
 - CVP
 - ScvO₂
 - Temperature (bladder, esophagus)
 - Urine output
 - Arterial blood gases
 - Serum lactate
 - Blood glucose, electrolytes, CBC, and general blood sampling
 - Chest radiograph
2. More advanced haemodynamic monitoring
 - Echocardiography
 - Cardiac output monitoring (either non-invasive or PA catheter)
3. Cerebral monitoring
 - EEG (on indication/continuously): early seizure detection and treatment
 - CT/MRI

CVP indicates central venous pressure; ScvO₂, central venous oxygen saturation; CBC, complete blood count; PA, pulmonary artery; EEG, electroencephalogram; and CT/MRI, computed tomography/magnetic resonance imaging.



Post-resüsitatif Bakım

2-Hedefe Yönelik Tedavi (early goal-directed therapy)

- Santral venöz basınç (CVP) 8—12 mmHg,
- MAP 65-90 mmHg,
- ScvO₂ > %70,
- Hematocrit > %30 yada Hb>8g/dL,
- Laktat ≤2 mmol/L,
- İdrar çıkışı ≥0.5mL/kg-saat
- Oxygen delivery index > 600mL/dak/m²



Post-resüsitatif Bakım

3- Oksijenizasyon

- Arterial oksijen saturasyonu, $\text{SaO}_2 \geq \%94$
- Hiperoksijenizasyondan kaçın



Post-resüsitatif Bakım

4- Ventilasyon

- Solunum sayısı 10-12/dk
- Hedef: NORMOKAPNİ olmalı (PaCO₂: 40-45)
- Hiperventilasyon, serebral vazokonstriksiyona yol açar, Serebral iskemiye arttırır
- İntratorasik basınç artışı ile ilişkili kardiyak outputda düşme
- Düşük tidal volum: 6 ml/kg sağlanmalı. Biotravma, volütravma ve barotravmadan koru



Post-resüsitatif Bakım

5-Dolaşım desteği

- Disritmi, hipotansiyon ve düşük kardiyak indexe bağlı.
- Elektrolit bozukluklarını düzelt
- Proflaktik antiaritmik kullanımı önerilmiyor
- İntravenöz sıvı desteği (CVP hedefi 8-12 mmHg)
- İnotrop ve vasopressörler



Post-resüsitatif Bakım

6- Akut koroner sendromu yönetimi

- Hastane dışı kardiyak arrestin en sık nedeni
- Erken dönemde koroner anjiyografi
- Fibrinolitikler
- Hipotermi eşliğinde standart tedavi



Post-resüsitatif Bakım

7-Diğer devam eden presipite patolojiler

- PE, sepsis, elektrolit bozuklukları, tansiyon pntx,
- Kardiyak tamponad,
- Toksinler vb.



Post-resüsitatif Bakım

8- Terapötik hipotermi

- SDGD hastada standart tedavini parçası
- Hangi hastalara uygulanmalı
- Tedavi süresi ve zamanlaması
- Hedef hipotermi ısısı
- İndüklenmiş hipotermimin normal vücut ısısına geri döndürülmesi
- Nörolojik iyileşmeyi geliştiren tek müdahale?



Post-resüsitatif Bakım

9- Sedasyon, nöromusküler blokaj ve nöbet kontrolü

- Mekanik ventilasyon ve terapötik hipotermi
- Devamlı EEG monitörizasyonu önerilmektedir
- Propofol, benzodiazepinler, tiyopental vb



Post-resüsitatif Bakım

10-Kan şekeri kontrolü

- Hiperglisemi mortalite ile ilişkili
- Hedef 144-180 mg/dl
- Hipoglisemiden kaçın



Post-resüsitatif Bakım

11- Nöron koruyucu tedavi

- Beyin hasarını önlediğini gösteren çalışmalar yetersiz
- Anestezikler, antikonvülzanlar, Ca ve Na kanal antagonistleri, NMDA reseptör antagonistleri, immünosüpresörler, büyüme faktörleri, proteaz inhibitörleri, magnezyum, GABA agonistleri, koenzim Q10



Post-resüsitatif Bakım

12-Adrenal disfonksiyon, steroidler

- Rölatif adrenal yetmezlik SDGD hastalarda sıktır
- Fakat rutin steroid kullanımı önerilmemektedir



Post-resüsitatif Bakım

13- Renal yetmezlik

- Hastaların yaklaşık %10 unda hemodiyaliz endikasyonu vardır
- Hiperkalemi, toksinler
- KBY



Post-resüsitatif Bakım

14- Enfeksiyonlar

- Kardiyak arrest sonrası SDGD hastalarda bir komplikasyondur
- Hipotermi sağlanan ve normotermik vakalar arasında fark yok ?
- Aspirasyon kaynaklı pnömoni %50 sıklıkta



PKAS prognostik faktörler

- SDGD hastalarda arrest öncesi ve arrest sırasındaki hiçbir parametre tek başına yada birlikte sonucu doğru olarak tahmin ettiremez
- İlk 24 saat içindeki hiçbir nörolojik muayene yada EEG bulgusu anlamlı değildir
- 72 saatden sonra sonra pupiller ışık ve korneal reflekslerin yokluğu en önemli muayene bulgusu
- Kan ve BOS'da NSE, S100B, GFAP, CK-BB



Teşekürler

