

# Yeni Resüsitasyon Kılavuzundan Beklenenler

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**EPAT**

Emergency Physicians Association of Turkey



**ATUDER**

Acil Tıp Uzmanları Derneği

# Resüsitasyon Kılavuzları

- AHA ve ILCOR (International Liaison Committee on Resuscitation) üyeleri her 5 yılda bir resüsitasyon kılavuzlarını güncellemekte.



American  
Heart  
Association®



**EUROPEAN  
RESUSCITATION  
COUNCIL**



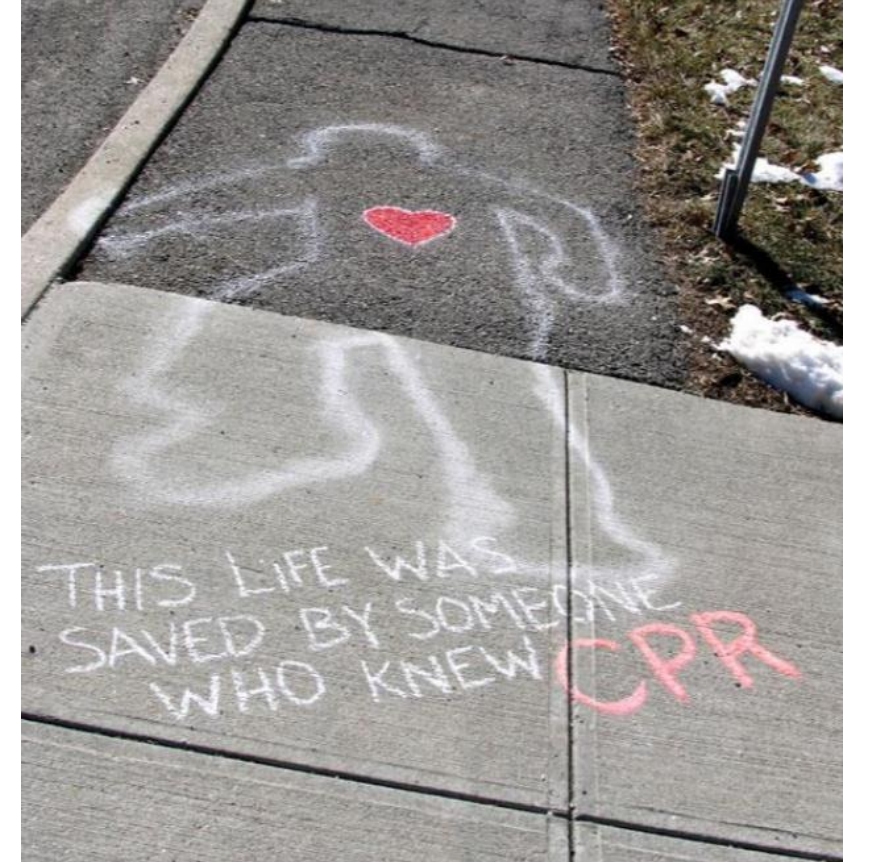
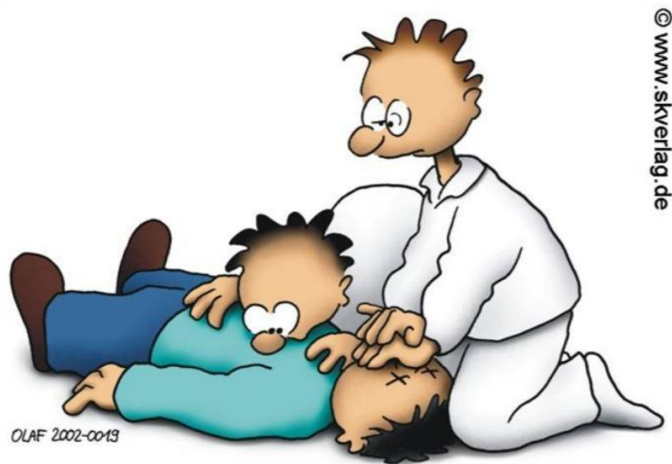
# Tartışmalı konular?

- Adrenalin, Lidokain
- TYD'nde solunum
- Erken CPR ... telefonla CPR.... (en çok vurgulanan)
- Mekanik CPR
- Hastane öncesi hipotermi
- ECMO
- CPR sırasında nöroproteksiyon



# Temel Yaşam Desteđi

- Ani kardiyak arreste baęlı 300,000 ölüm/yıl
- Erken CPR ve erken defibrilasyon
- Etkin kompresyon



# Telefonla CPR

- **Telefonla CPR Uygulaması**

- tüm kılavuzların güncellemeleri (2015)
- Telefon destekli CPR'a başlanması konusunda önemli gelişmeler yaşandı.

- **2017 AHA güncellemesinde öneri seviyesinde değişik**

- Olası bir hastane dışı kardiyopulmoner arrestten süphelenildiği durumlarda 112 personelinin telefonla 112 yi arayan kişilere sadece göğüs kompresyonları kullanılarak CPR talimatlarını sağlamalıdır. (*Class I; Level of Evidence C-LD*).

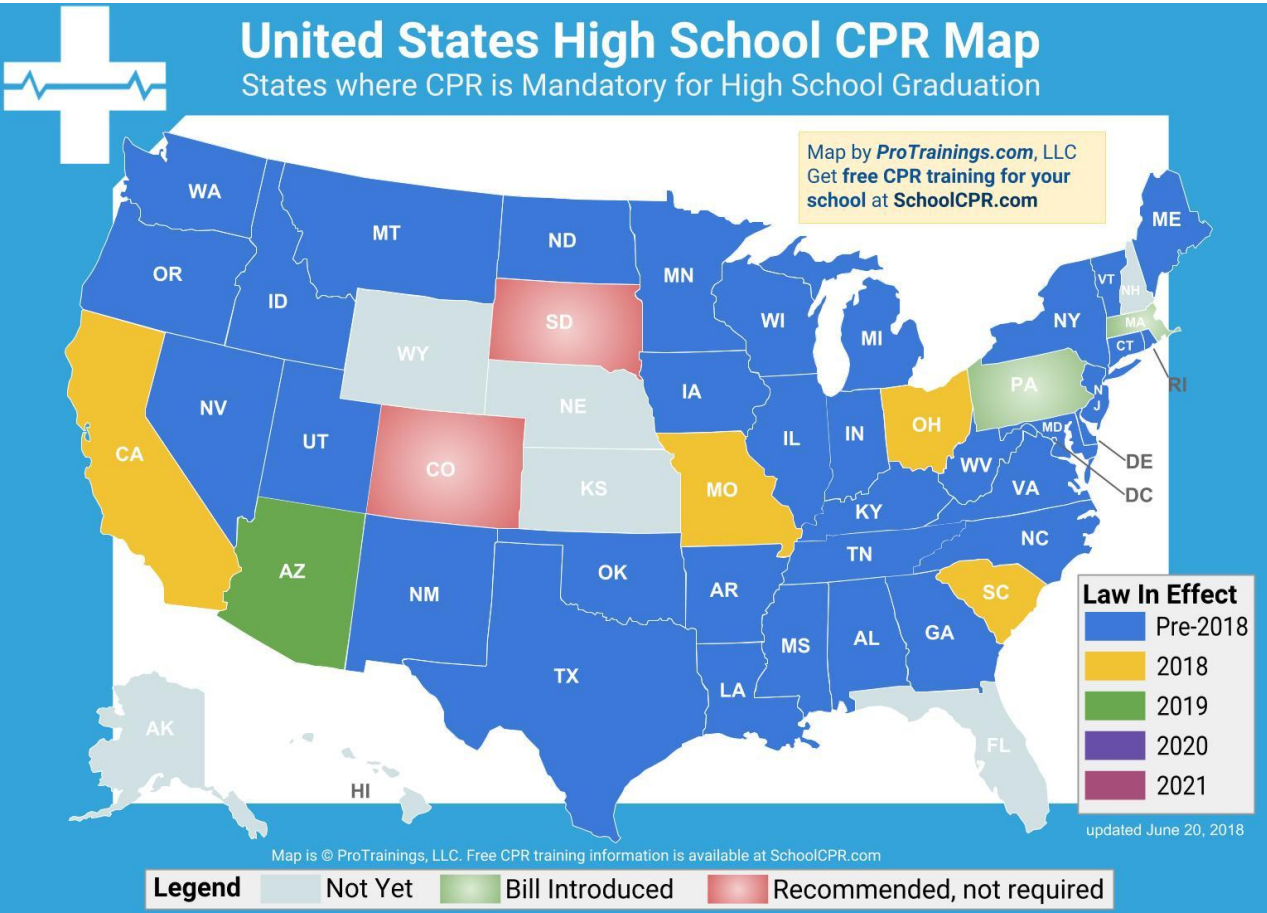
# Mobil uygulamalar ve resüsitasyon

- Kurtarıcıları, kurbanın olduğu yere yönlendiren mobil uygulamaları kullanılabilir (Sınıf IIb, KD B)
- Kurbanda yakın CPR yapmak isteyen uygulama sahiplerine gönderilen mesaj ile olay yeri tarifi





# Okullarda CPR eğitimi



## LIFESAVERS IN SCHOOL

Here are the 24 states that have passed laws requiring CPR as a high school graduation requirement.



Source: National Center for Education Statistics.

## ANNUAL HS GRADUATES

AL	44,400
AR	28,170
CT	36,460
DE	8,320
IA	32,580
ID	16,840
IN	65,990
GA	91,980
LA	35,210
MD	58,560
MS	26,710
MN	57,250
NC	89,820
NJ	93,880
OK	37,800
OR	34,730
RI	9,650
TX	292,940
TN	60,180
UT	31,330
VA	81,870
VT	6,530
WA	66,790
WV	17,410

**TOTAL 1,325,400**

# İnsansız Hava Araçları-Drone


- Teknolojik gelişmeler direkt veya indirekt olarak resüsitasyonu etkiliyor
- Drone'lar tıp alanına da girdi
- Hastane dışı arrestlerde OED'nin hastaya ulaşım süresi sağkalımı etkileyen en önemli faktörlerden





# Drone delivery of an automated external defibrillator – a mixed method simulation study of bystander experience



J. Sanfridsson<sup>1</sup>, J. Sparrevik<sup>2</sup>, J. Hollenberg<sup>1</sup>, P. Nordberg<sup>1</sup>, T. Djärv<sup>1</sup>, M. Ringh<sup>1</sup>, L. Svensson<sup>1</sup>, S. Forsberg<sup>1</sup>, A. Nord<sup>1</sup>, M. Andersson-Hagiwara<sup>3</sup> and A. Claesson<sup>1\*</sup> 

## Abstract

**Background:** Out-of-hospital cardiac arrest (OHCA) affects some 275,000 individuals in Europe each year. Time from collapse to defibrillation is essential for survival. As emergency medical services (EMS) response times in Sweden have increased, novel methods are needed to facilitate early treatment. Unmanned aerial vehicles (i.e. drones) have potential to deliver automated external defibrillators (AED). The aim of this simulation study was to explore bystanders' experience of a simulated OHCA-situation where a drone delivers an AED and how the situation is affected by having one or two bystanders onsite.

**Methods:** This explorative simulation study used a mixed methodology describing bystanders' experiences of retrieving an AED delivered by a drone in simulated OHCA situations. Totally eight participants were divided in two groups of bystanders a) alone or b) in pairs and performed CPR on a manikin for 5 minutes after which an AED was delivered by a drone at 50 m from the location. Qualitative data from observations, interviews of participants and video recordings were analysed using content analysis alongside descriptive data on time delays during bystander interaction.

**Results:** Three categories of bystander experiences emerged: 1) technique and preparedness, 2) support through conversation with the dispatcher, and 3) aid and decision-making. The main finding was that retrieval of an AED as delivered by a drone was experienced as safe and feasible for bystanders. None of the participants hesitated to retrieve the AED; instead they experienced it positive, helpful and felt relief upon AED-drone arrival and were able to retrieve and attach the AED to a manikin. Interacting with the AED-drone was perceived as less difficult than performing CPR or handling their own mobile phone during T-CPR. Single bystander simulation introduced a significant hands-off interval when retrieving the AED, a period lasting 94 s (range 75 s–110 s) with one participant compared to 0 s with two participants.

**Conclusion:** The study shows that it made good sense for bystanders to interact with a drone in this simulated suspected OHCA. Bystanders experienced delivery of AED as safe and feasible. This has potential implications, and further studies on bystanders' experiences in real cases of OHCA in which a drone delivers an AED are therefore necessary.



# Sadece Göğüs Kompresyonu Uygulanan CPR

Reported OHCA in  
Sweden 2000 – 2017

n = 68 126

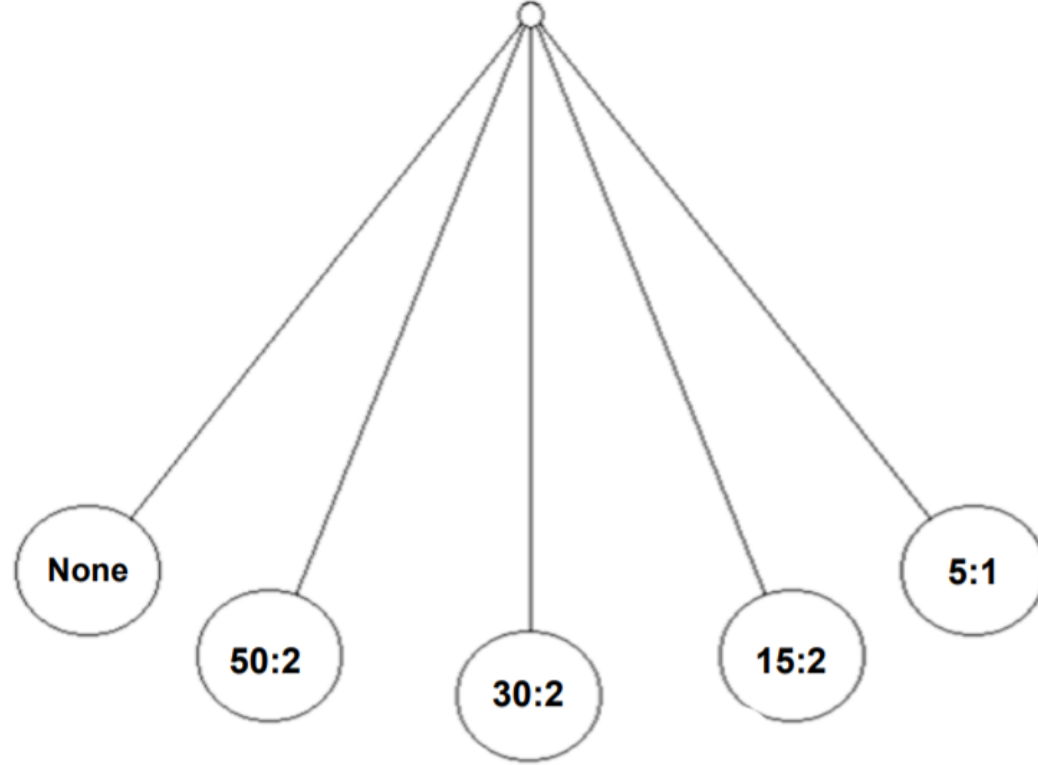
**CONCLUSIONS:** In this nationwide study of out-of-hospital cardiac arrest during 3 periods of different CPR guidelines, there was an almost a 2-fold higher rate of CPR before EMS arrival and a concomitant 6-fold higher rate of CO-CPR over time. Any type of CPR was associated with doubled survival rates in comparison with NO CPR. These findings support continuous endorsement of CO-CPR as an option in future CPR guidelines because it is associated with higher CPR rates and overall survival in out-of-hospital cardiac arrest.

R VT/ VF† (% CI)
Ref
1.99 (1.9–2.20)
1.58 (1.5–1.78)

↓  
Bystander witnessed OHCA  
Included  
n = 30 445

# Sadece Göğüs Kompresyonu Uygulanan CPR

Solunum önemi giderek yitirmekte



# Prehospital Hipotermi

- Çok merkezli randomize kontrollü çalışma
- Hastalar
  - Standart bakım
  - Yüksek volümde 30 ml/kg soğuk SF
- Primer outcome: survival at hospital discharge
- İlk ritmi şoklanabilir ritmi olan hastalarda ROSC azaltığı saptanmış

## ORIGINAL RESEARCH ARTICLE



### Induction of Therapeutic Hypothermia During Out-of-Hospital Cardiac Arrest Using a Rapid Infusion of Cold Saline

The RINSE Trial (Rapid Infusion of Cold Normal Saline)

**BACKGROUND:** Patients successfully resuscitated by paramedics from out-of-hospital cardiac arrest often have severe neurologic injury. Laboratory and observational clinical reports have suggested that induction of therapeutic hypothermia during cardiopulmonary resuscitation (CPR) may improve neurologic outcomes. One technique for induction of mild therapeutic hypothermia during CPR is a rapid infusion of large-volume cold crystalloid fluid.

**METHODS:** In this multicenter, randomized, controlled trial we assigned adults with out-of-hospital cardiac arrest undergoing CPR to either a rapid intravenous infusion of up to 2 L of cold saline or standard care. The primary outcome measure was survival at hospital discharge; secondary end points included return of a spontaneous circulation. The trial was closed early (at 48% recruitment target) due to changes in temperature management at major receiving hospitals.

**RESULTS:** A total of 1198 patients were assigned to either therapeutic hypothermia during CPR (618 patients) or standard prehospital care (580 patients). Patients allocated to therapeutic hypothermia received a mean (SD) of 1193 (647) mL cold saline. For patients with an initial shockable cardiac rhythm, there was a decrease in the rate of return of a spontaneous circulation in patients who received cold saline compared with standard care (41.2% compared with 50.6%,  $P=0.03$ ). Overall 10.2% of patients allocated to therapeutic hypothermia during CPR were alive at hospital discharge compared with 11.4% who received standard care ( $P=0.71$ ).

**CONCLUSIONS:** In adults with out-of-hospital cardiac arrest, induction of mild therapeutic hypothermia using a rapid infusion of large-volume, intravenous cold saline during CPR may decrease the rate of return of a spontaneous circulation in patients with an initial shockable rhythm and produced no trend toward improved outcomes at hospital discharge.

**CLINICAL TRIAL REGISTRATION:** URL: <http://www.clinicaltrials.gov>. Unique identifier: NCT01173393.

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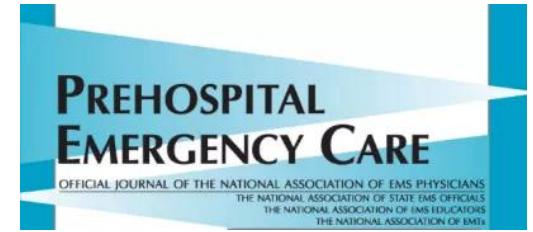
Sources of Funding, see page 804

**Key Words:** cardiac arrest  
■ cardiopulmonary resuscitation  
■ clinical trial ■ emergency medical services ■ therapeutic hypothermia

ORIGINAL RESEARCH ARTICLE



# Prehospital Hypothermi



## Therapeutic Hypothermia for Patients with Out-of-Hospital Cardiac Arrest in North Carolina.

Rao MP, Dupre ME, Pokorney SD, Hansen CM, Tyson C, Monk L, Pearson DA, Nelson RD, Myers B, Jollis JG, Granger CB.

**INTRODUCTION:** While therapeutic hypothermia has been the standard of care for patients who suffer out-of-hospital cardiac arrest (OHCA), recent trials have led to an advisory statement recommending a focus on targeted in-hospital temperature management and against initiation of prehospital hypothermia with rapid infusion of cooled saline. The aim of this study is to review the experience with therapeutic hypothermia in North Carolina.

**METHODS:** We studied patients who suffered OHCA in North Carolina in 2012 captured in the CARES database as part of the Heart Rescue Project. We excluded patients without return of spontaneous circulation and patients without an advanced airway placed in the field to reduce selection bias. Bivariate distributions and multivariate logistic regression models were used to examine differences in survival to discharge and positive neurological outcome.

**RESULTS:** 847 patients were included in the analysis of pre-hospital hypothermia. Of these patients, 55% received prehospital hypothermia. Prehospital initiation of hypothermia was associated with higher survival to hospital discharge (OR 1.55, 95% CI 1.03-2.32) and improved neurologic outcome at discharge (OR 1.56 95% CI 1.01-2.40). In patients who survived to hospital admission (n = 537), in-hospital hypothermia was associated with a non-significant trend toward better survival to discharge (p = 0.18).

**CONCLUSION:** We found that patients who received prehospital hypothermia had improved outcomes, a finding that may be due to a greater likelihood of receiving in-hospital hypothermia or a reflection of higher quality of pre-hospital care. These findings support ongoing efforts to improve all aspects of the chain of survival after cardiac arrest.



# Adrenalin

**Impact of adrenaline dose and timing on out-of-hospital cardiac arrest survival and neurological outcomes.**

[Sigal AP](#)<sup>1</sup>, [Sandel KM](#)<sup>2</sup>, [Buckler DG](#)<sup>3</sup>, [Wasser T](#)<sup>4</sup>, [Abella BS](#)<sup>3</sup>.

## Abstract

### Study Objective

The 2015 ILCOR Advanced Cardiovascular Life Support Guidelines recommend intravenous adrenaline (epinephrine) as a crucial pharmacologic treatment during cardiac arrest resuscitation. Some recent observational studies and clinical trials have questioned the efficacy of its use and suggested possible deleterious effects on overall survival and long-term outcomes. This study aimed to describe the association between time and dose of adrenaline on return of spontaneous circulation (ROSC) and neurologic function.

### Methods

We performed a retrospective analysis of the Penn Alliance for Therapeutic Hypothermia (PATH) data registry. The timing of the first dose of adrenaline and the total dose of adrenaline during cardiac arrests was compared between survivors to discharge and non-survivors for arrests lasting greater than 10 min.

### Results

The registry contained 5594 patients. After excluding patients with an in-hospital cardiac arrest, a non-shockable rhythm, or no adrenaline administration, 1826 were included in the final analysis. Survivors to discharge received adrenaline sooner (median 5.0 vs. 7.0 min,  $p = 0.022$ ) and required a lower total dose than non-survivors (2.0 vs. 3.0 mg,  $p < 0.001$ ). For survivors, there was no significant association between the time to first adrenaline dose and favorable neurological outcome as measured by Cerebral Performance Category (CPC). Among survivors, those that received less than 2 mg of adrenaline had a more favorable neurologic outcome than those administered  $> 3$  mg. (CPC 1–2 16.6% vs. 12.5 %,  $p = 0.004$ )

### Conclusion

Early adrenaline administration is associated with a higher percentage of survival to discharge but not associated with favorable neurological outcome. Those patients with a favorable neurologic outcome received a lower total adrenaline dose prior to ROSC.

# Adrenalin

## [Epinephrine for out of hospital cardiac arrest: A systematic review and meta-analysis of randomized controlled trials.](#)

Maria V, Pasquale B, Carmine I, Giuseppe S.

### Abstract

#### Objective

To evaluate the effectiveness of epinephrine, compared with control treatments, on survival at admission, ROSC, survival at discharge, and a favorable neurologic outcome in adult patients during OHCA.

#### Data source

MEDLINE and PubMed from inception to August 2018.

#### Study selection

Randomized controlled trials (RCTs) on adult patients after OHCA treated with epinephrine versus controls.

#### Data extraction

Independent, double-data extraction; risk of bias assessment with Cochrane Collaboration's criteria.

#### Data synthesis

15 RCTs representing 20 716 OHCA adult patients. Epinephrine, compared with all pooled treatments, was associated with a better survival rate to hospital discharge (RR: 1.16, 95% CI: 1.00–1.35) and a favorable neurologic outcome (RR: 1.24, 95% CI: 1.04–1.48). No difference was found in survival to hospital admission (RR: 1.02, 95% CI: 0.75–1.38) and ROSC when comparing epinephrine with all pooled treatments (RR: 1.13, 95% CI: 0.84–1.53). When epinephrine was compared with a placebo/no drugs, survival to hospital discharge (RR: 1.34, 95% CI: 1.08–1.67), ROSC (RR: 2.03, 95% CI: 1.18–3.51) and survival to hospital admission (RR: 2.04, 95% CI: 1.22–3.43) were increased, but there was not a favorable neurologic outcome (RR: 1.22, 95% CI: 0.99–1.51).

#### Conclusions

In OHCA, standard or high doses of epinephrine should be used because they improved survival to hospital discharge and resulted in a meaningful clinical outcome. There was also a clear advantage of using epinephrine over a placebo or no drugs in the considered outcomes.

# Adrenalin

## Adrenaline can restart the heart, but is no good for the brain

- Yarar-Zarar? Kanıt olmaksızın 60 yıldır
  - Adrenaline (epinephrine) injections have been commonly used during cardiopulmonary resuscitation (CPR) for cardiac arrest for more than 60 years, without clear evidence if they are helpful or harmful.
- 8014 hasta 30 günlük sağkalımda adrenalin (%3.2) >plasebo (%2.4)
  - People who received adrenaline had a slightly higher rate of survival at 30 days, 130/4105 (3.2%) compared with 94/3999 (2.4%) who received the saline placebo (adjusted odds ratio 1.47, 95% confidence interval 1.09 to 1.97).
- Spontan Sirkülasyon(ROSC) adrenalin (%36.3) >plasebo (%11.7)
  - Return of spontaneous circulation was much more likely with adrenaline, occurring in 1457 (36.3%) people in the adrenaline group versus 468 (11.7%) people in the placebo group.
- Nörolojik sakatlık adrenalin (%31) >plasebo (%17.8)
  - Although the overall rate of survival at 30 days was slightly better with adrenaline, 39/126 (31%) people had severe neurological disability in the adrenaline group, compared with 16/90 (17.8%) in the placebo group.
- Nörolojik semptom olmaksızın taburcu olan 27 hasta, adrenalin=plasebo
  - Only 27 people in total had no neurological symptoms at discharge. There were similar numbers of people in each group when combining those with no symptoms, mild or moderate

# End Tidal CO<sub>2</sub>

- **2015** : entübe arrest hastalarda, 20 dk CPR sonrası **ETCO<sub>2</sub>** < 10 mmHg
  - düşük spontan dolaşıma dönüş(ROSC)
  - düşük sağkalım ihtimali
- **Resüsitasyonun** ne zaman sonlandırılacağına karar vermeye yardımcı

# Serebral Oksimetri

RESUSCITATION

OFFICIAL JOURNAL OF THE  
EUROPEAN RESUSCITATION COUNCIL



## End Tidal CO<sub>2</sub> and Cerebral Oximetry for the Prediction of Return of Spontaneous Circulation During Cardiopulmonary Resuscitation. [Engel TW 2nd](#)<sup>1</sup>, [Thomas C](#)<sup>2</sup>, [Medado P](#)<sup>3</sup>, [Bastani A](#)<sup>4</sup>, [Reed B](#)<sup>3</sup>, [Millis S](#)<sup>5</sup>, [O'Neil B](#)<sup>3</sup>.

### Abstract

#### Background

End Tidal CO<sub>2</sub> (ETCO<sub>2</sub>) is a reasonable predictor of Return of Spontaneous Circulation (ROSC) in cardiac arrest (CA), though with many limitations. Cerebral Oximetry (CerOx) non-invasively measures brain O<sub>2</sub> saturation and correlates with flow.

#### Objectives

This study compares ETCO<sub>2</sub> and CerOx for ROSC prediction during both out of hospital (OHCA) and emergency department cardiac arrests (EDCA).

#### Methods

We conducted a prospective study on CA patients resuscitated in the ED. ETCO<sub>2</sub> and CerOx simultaneously measured during ED CPR. Data was analyzed with logistic regression modeling and area under the curve (AUC).

#### Results

176 patients were analyzed, 66.7% were witnessed, 52.8% had bystander CPR. EMS alert to ED arrival was 27.0 ± 10.6 min. Initial rhythm was 31.8% asystole, 27.8% PEA, 25.6% VF/VT with 26.1% achieving ROSC. AUC predictors of ROSC were: last 5 min trend [CerOx = 0.82 ; ETCO<sub>2</sub> = 0.74 ], delta first to last [CerOx = 0.86 ; ETCO<sub>2</sub> = 0.73 ], the penultimate minute [CerOx = 0.81 ; ETCO<sub>2</sub> = 0.76 ], and final minute [CerOx = 0.89 ; ETCO<sub>2</sub> = 0.77 ]. AUC comparison of simultaneous measurements (n = 125) revealed: last 5 min trend [CerOx = 0.80 ; ETCO<sub>2</sub> = 0.79 ], delta first to last [CerOx = 0.83 ; ETCO<sub>2</sub> = 0.75 ], penultimate minute [CerOx = 0.83 ETCO<sub>2</sub> = 0.74 ], and final minute [CerOx = 0.89 ; ETCO<sub>2</sub> = 0.75 ].

#### Conclusions

Our data shows, both ETCO<sub>2</sub> and rSO<sub>2</sub> are good predictors of ROSC. We found CerOx superior to ETCO<sub>2</sub> in predicting ROSC.



CerOx spontan dolaşımın (ROSC) saptanmasında ETCO<sub>2</sub>'ye göre üstün



# Serebral oksimetri

Cerebral oximetry versus end tidal CO<sub>2</sub> in predicting ROSC after cardiac arrest

[Singer AJ](#), [Nguyen RT](#), [Ravishankar ST](#), [Schoenfeld ER](#), [Thode HC Jr](#), [Henry MC](#), [Parnia S](#).

**STUDY OBJECTIVE:** Both end tidal CO<sub>2</sub> (ETCO<sub>2</sub>) and cerebral oxygen saturations (rSO<sub>2</sub>) have been studied to determine their ability to monitor the effectiveness of CPR and predict return of spontaneous circulation (ROSC). We compared the accuracy of ETCO<sub>2</sub> and rSO<sub>2</sub> at predicting ROSC in ED patients with out-of-hospital cardiac arrest (OHCA).

**METHODS:** We performed a prospective, observational study of adult ED patients presenting in cardiac arrest. We collected demographic and clinical data including age, gender, presenting rhythm, rSO<sub>2</sub>, and ETCO<sub>2</sub>. We used receiver operating characteristic curves to compare how well rSO<sub>2</sub> and ETCO<sub>2</sub> predicted ROSC.

**RESULTS:** 225 patients presented to the ED with cardiac arrest between 10/11 and 10/14 of which 100 had both rSO<sub>2</sub> and ETCO<sub>2</sub> measurements. Thirty three patients (33%) had sustained ROSC, only 2 survived to discharge. The AUCs for rSO<sub>2</sub> and ETCO<sub>2</sub> were similar (0.69 [95% CI, 0.59-0.80] and 0.77 [95% CI, 0.68-0.86], respectively), however, rSO<sub>2</sub> and ETCO<sub>2</sub> were poorly correlated (0.12, 95% CI, -0.08-0.31). The optimal cutoffs for rSO<sub>2</sub> and ETCO<sub>2</sub> were 50% and 20mm Hg respectively. At these cutoffs, ETCO<sub>2</sub> was more sensitive (100%, 95% CI 87-100 vs. 48%, 31-66) but rSO<sub>2</sub> was more specific (85%, 95% CI, 74-92 vs. 45%, 33-57).

**CONCLUSIONS:** While poorly correlated, rSO<sub>2</sub> and ETCO<sub>2</sub> have similar diagnostic characteristics. ETCO<sub>2</sub> is more sensitive and rSO<sub>2</sub> is more specific at predicting ROSC in OHCA.

ROSC saptanmasında ETCO2 daha sensitif CerOx2 daha spesifik bulunmuş.

[Am J Emerg Med.](#) 2018 Mar;36(3):403-407. doi: 10.1016/j.ajem.2017.08.046. Epub 2017 Aug 25.

# Mekanik CPR



## Mechanical chest compressions and simultaneous defibrillation vs conventional cardiopulmonary resuscitation in out-of-hospital cardiac arrest: the LINC randomized trial.

Rubertsson S, Lindgren E, Smekal D, Östlund O, Silfverstolpe J, Lichtveld RA, Boomars R, Ahlstedt B, Skoog G, Kastberg R, Halliwell D, Box M, Herlitz J, Karlsten R.

**IMPORTANCE:** A strategy using mechanical chest compressions might improve the poor outcome in out-of-hospital cardiac arrest, but such a strategy has not been tested in large clinical trials.

**OBJECTIVE:** To determine whether administering mechanical chest compressions with defibrillation during ongoing compressions (mechanical CPR), compared with manual cardiopulmonary resuscitation (manual CPR), according to guidelines, would improve 4-hour survival.

**DESIGN, SETTING, AND PARTICIPANTS:** Multicenter randomized clinical trial of 2589 patients with out-of-hospital cardiac arrest conducted between January 2008 and February 2013 in 4 Swedish, 1 British, and 1 Dutch ambulance services and their referring hospitals. Duration of follow-up was 6 months.

**INTERVENTIONS:** Patients were randomized to receive either mechanical chest compressions (LUCAS Chest Compression System, Physio-Control/Jolife AB) combined with defibrillation during ongoing compressions (n = 1300) or to manual CPR according to guidelines (n = 1289).

**MAIN OUTCOMES AND MEASURES:** Four-hour survival, with secondary end points of survival up to 6 months with good neurological outcome using the Cerebral Performance Category (CPC) score. A CPC score of 1 or 2 was classified as a good outcome.

**RESULTS:** Four-hour survival was achieved in 307 patients (23.6%) with mechanical CPR and 305 (23.7%) with manual CPR (risk difference, -0.05%; 95% CI, -3.3% to 3.2%; P > .99). Survival with a CPC score of 1 or 2 occurred in 98 (7.5%) vs 82 (6.4%) (risk difference, 1.18%; 95% CI, -0.78% to 3.1%) at intensive care unit discharge, in 108 (8.3%) vs 100 (7.8%) (risk difference, 0.55%; 95% CI, -1.5% to 2.6%) at hospital discharge, in 105 (8.1%) vs 94 (7.3%) (risk difference, 0.78%; 95% CI, -1.3% to 2.8%) at 1 month, and in 110 (8.5%) vs 98 (7.6%) (risk difference, 0.86%; 95% CI, -1.2% to 3.0%) at 6 months with mechanical CPR and manual CPR, respectively. Among patients surviving at 6 months, 99% in the mechanical CPR group and 94% in the manual CPR group had CPC scores of 1 or 2.

**CONCLUSIONS AND RELEVANCE:** Among adults with out-of-hospital cardiac arrest, there was no significant difference in 4-hour survival between patients treated with the mechanical CPR algorithm or those treated with guideline-adherent manual CPR. The vast majority of survivors in both groups had good neurological outcomes by 6 months. In clinical practice, mechanical CPR using the presented algorithm did not result in improved effectiveness compared with manual CPR.



**Mekanik KPR klinik pratikte etkinliği arttırmıyor**

**4 saatlik sağ kalımda standart yaklaşıma göre üstünlüğü yok**

**Mekanik KPR majör bir komplikasyon yaratmıyor ancak 6 aylık mortalitede standart yaklaşıma üstünlüğü yok**

JAMA. 2014 Jan 1;311(1):53-61. doi: 10.1001/jama.2013.282538.

# Mekanik CPR

[A meta-analysis of the resuscitative effects of mechanical and manual chest compression in out-of-hospital cardiac arrest patients.](#) Zhu N, Chen Q, Jiang Z, Liao F, Kou B, Tang H, Zhou M.

**Objectives:** To evaluate the resuscitative effects of mechanical and manual chest compression in patients with out-of-hospital cardiac arrest (OHCA).

**Methods:** All randomized controlled and cohort studies comparing the effects of mechanical compression and manual compression on cardiopulmonary resuscitation in OHCA patients were retrieved from the Cochrane Library, PubMed, EMBASE, and Ovid databases from the date of their establishment to January 14, 2019. The included outcomes were as follows: the return of spontaneous circulation (ROSC) rate, the rate of survival to hospital admission, the rate of survival to hospital discharge, and neurological function. After evaluating the quality of the studies and summarizing the results, RevMan5.3 software was used for the meta-analysis.

**Results:** In total, 15 studies (9 randomized controlled trials and 6 cohort studies) were included. The results of the meta-analysis showed that there were no significant differences in the resuscitative effects of mechanical and manual chest compression in terms of the ROSC rate, the rate of survival to hospital admission and survival to hospital discharge, and neurological function in OHCA patients (ROSC: RCT: OR = 1.12, 95% CI (0.90, 1.39),  $P = 0.31$ ; cohort study: OR = 1.08, 95% CI (0.85, 1.36),  $P = 0.54$ ; survival to hospital admission: RCT: OR = 0.95, 95% CI (0.75, 1.20),  $P = 0.64$ ; cohort study: OR = 0.98, 95% CI (0.79, 1.20),  $P = 0.82$ ; survival to hospital discharge: RCT: OR = 0.87, 95% CI (0.68, 1.10),  $P = 0.24$ ; cohort study: OR = 0.78, 95% CI (0.53, 1.16),  $P = 0.22$ ; Cerebral Performance Category (CPC) score: RCT: OR = 0.88, 95% CI (0.64, 1.20),  $P = 0.41$ ; cohort study: OR = 0.68, 95% CI (0.34, 1.37),  $P = 0.28$ ). When the mechanical compression group was divided into Lucas and Autopulse subgroups, the Lucas subgroup showed no difference from the manual compression group in ROSC, survival to admission, survival to discharge, and CPC scores; the Autopulse subgroup showed no difference from the manual compression subgroup in ROSC, survival to discharge, and CPC scores.

**Conclusion:** There were no significant differences in resuscitative effects between mechanical and manual chest compression in OHCA patients. To ensure the quality of CPR, we suggest that manual chest compression be applied in the early stage of CPR for OHCA patients, while mechanical compression can be used as part of advanced life support in the late stage.

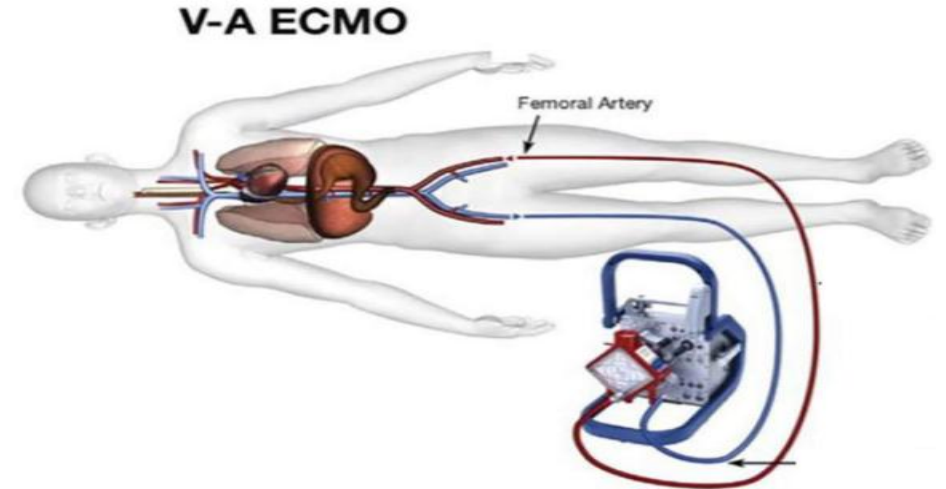


**OHCA'de manuel kompresyon ile mekanik kompresyon arasında fark yok**



# ECPR (Ekstrakorporeal Resüsitasyon)

- Hızla uygulanması halinde **ECPR (Ekstrakorporeal Resüsitasyon)**
  - Geri dönüş potansiyel olabilecek durumlarda
  - Klasik CPR'a yanıt vermeyen arrestlerde kalp nakli için zaman sağlayabilir
- **2015** : ECPR, hızla uygulanabiliyorsa klasik CPR'a yanıt vermemiş arrest hastalarının bazıları için düşünülebilir



# ECPR (Ekstrakorporeal Resüs)

**Cost effectiveness and quality of life analysis of extracorporeal cardiopulmonary resuscitation (ECPR) for refractory cardiac arrest.** [Dennis M](#)<sup>1</sup>, [Zmudzki F](#)<sup>2</sup>, [Burns B](#)<sup>3</sup>, [Scott S](#)<sup>4</sup>, [Gattas D](#)<sup>5</sup>, [Reynolds C](#)<sup>6</sup>, [Buscher H](#)<sup>7</sup>, [Forrest P](#)<sup>8</sup>; [Sydney ECMO Research Interest Group](#).

## Abstract

### Background

The use of extracorporeal membrane oxygenation (ECMO) in refractory cardiac arrest (ECPR) has increased exponentially. ECPR is a resource intensive service and its cost effectiveness has yet to be demonstrated. We sought to complete a cost analysis with modelling of cost effectiveness and quality of life outcomes. We sought to complete a cost analysis with modelling of cost effectiveness and quality of life outcomes of patients who have undergone ECPR.

### Methods

Using data on all extracorporeal cardiopulmonary resuscitation (ECPR) patients at two ECMO centres in Sydney, Australia; we completed a costing analysis of ECPR patients. A Markov model of cost, quality of life and survival outcomes was developed to examine cost per QALY estimates and incremental cost effectiveness ratios (ICERs). Probabilistic sensitivity analysis (PSA) was completed to assess the probability of cost effectiveness for base case and variations.

### Results

Sixty-two consecutive ECPR patients were analysed; mean age of  $51.9 \pm 13.6$  years, 38 (61%) were in hospital cardiac arrests (IHCA). Twenty-five patients (40%) survived to hospital discharge; all with a cerebral performance category (CPC) of 1 or 2. The mean cost per ECPR patient was AUD 75,165 (€50,535;  $\pm$ AUD 75,737). Over 10 years ECPR was estimated to add a mean gain of 3.0 Quality Adjusted Life Years (QALYs) per patient with an incremental cost effectiveness ratio (ICER) of AUD 25,212 (€16,890) per QALY, increasing to 4.0 QALYs and an ICER of AUD 18,829 (€12,614) over a 15-year survival scenario. Mean cost per QALY did not differ significantly by OHCA or IHCA.

### Conclusions

ECMO support for refractory cardiac arrests is cost effective and compares favourably to accepted cost effectiveness thresholds.

Dirençli arrestlerde bedel-etkinliği  
kabul edilebilir sınırlarda



# ECPR (Ekstrakorporeal Resüsitasy

[Patients With Refractory Out-of-Cardiac Arrest and Sustained Ventricular Fibrillation as Candidates for Extracorporeal Cardiopulmonary Resuscitation - Prospective Multi-Center Observational Study.](#) Nakashima T, Noguchi T, Tahara Y, Nishimura K, Ogata S, Yasuda S, Onozuka D, Morimura N, Nagao K, Gaieski DF, Asai Y, Yokota H, Nara S, Hase M, Atsumi T, Sakamoto T; SAVE-J Group.

**Background:** We investigated whether patients with out-of-hospital cardiac arrest (OHCA) and sustained ventricular fibrillation/pulseless ventricular tachycardia (VF/pVT) or conversion to pulseless electrical activity/asystole (PEA/asystole) benefit more from extracorporeal cardiopulmonary resuscitation (ECPR).

**Methods and Results:** We analyzed data from the Study of Advanced Life Support for Ventricular Fibrillation with Extracorporeal Circulation in Japan, which was a prospective, multicenter, observational study with 22 institutions in the ECPR group and 17 institutions in the conventional CPR (CCPR) group. Patients were divided into 4 groups by cardiac rhythm and CPR group. The primary endpoint was favorable neurological outcome, defined as Cerebral Performance Category 1 or 2 at 6 months. A total of 407 patients had refractory OHCA with VF/pVT on initial electrocardiogram. The proportion of ECPR patients with favorable neurological outcome was significantly higher in the sustained VF/pVT group than in the conversion to PEA/asystole group (20%, 25/126 vs. 3%, 4/122,  $P<0.001$ ). Stratifying by cardiac rhythm, on multivariable mixed logistic regression analysis an ECPR strategy significantly increased the proportion of patients with favorable neurological outcome at 6 months in the patients with sustained VF/pVT (OR, 7.35; 95% CI: 1.58–34.09), but these associations were not observed in patients with conversion to PEA/asystole.

**Conclusions:** OHCA patients with sustained VF/pVT may be the most promising ECPR candidates (UMIN000001403).

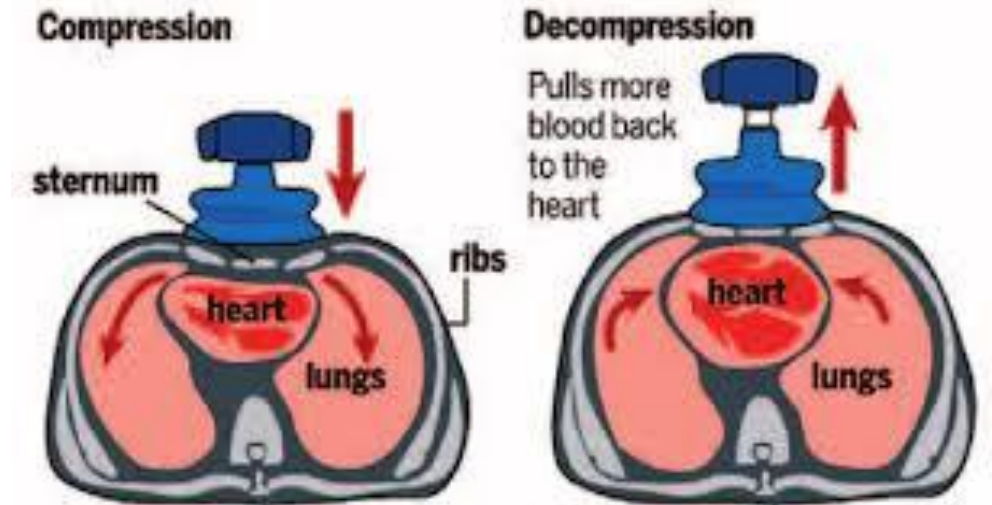
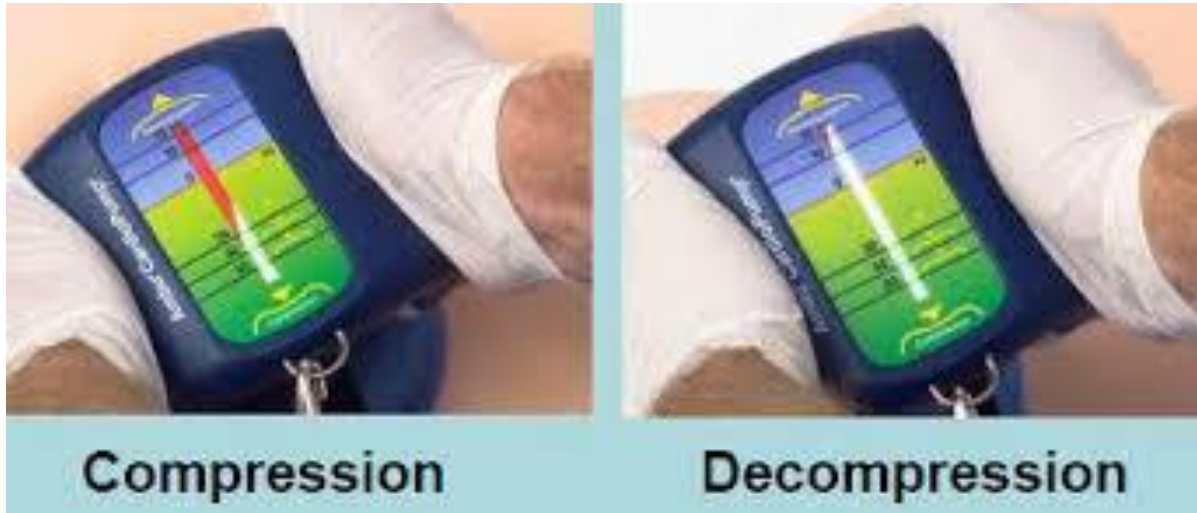
**Key Words:** Extracorporeal life support; Extracorporeal membrane oxygenation; Favorable neurological outcome

Hastane dışı arrestler içinde VF/pVT olanlar ECPR için en umut verici adaylar

# CPR'da nöroproteksiyon

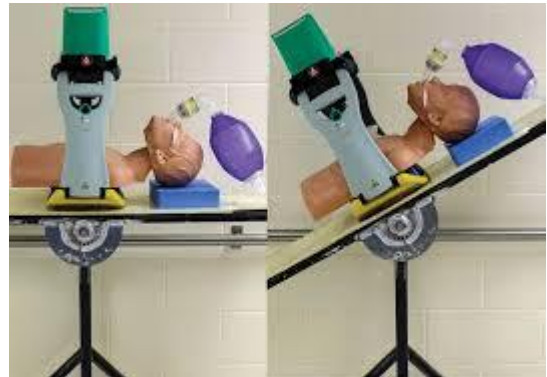
- Flow-enhanced CPR: Active compression/decompression CPR and intrathoracic pressure regulation
- Head Up CPR
- Hayvan deneyi çalışmaları
  - Sodium nitroprusside
  - Adenozin
  - Siklosporin A
  - Melatonin
  - Poloxamer 188 (membran stabilizatörü)
  - Metformin
  - Postconditioning with inhaled gases
  - Stutter CPR (3 siklus 20 saniyelik kompresyon/ventilasyon, 20 saniye duraksama)

# Active compression/decompression CPR



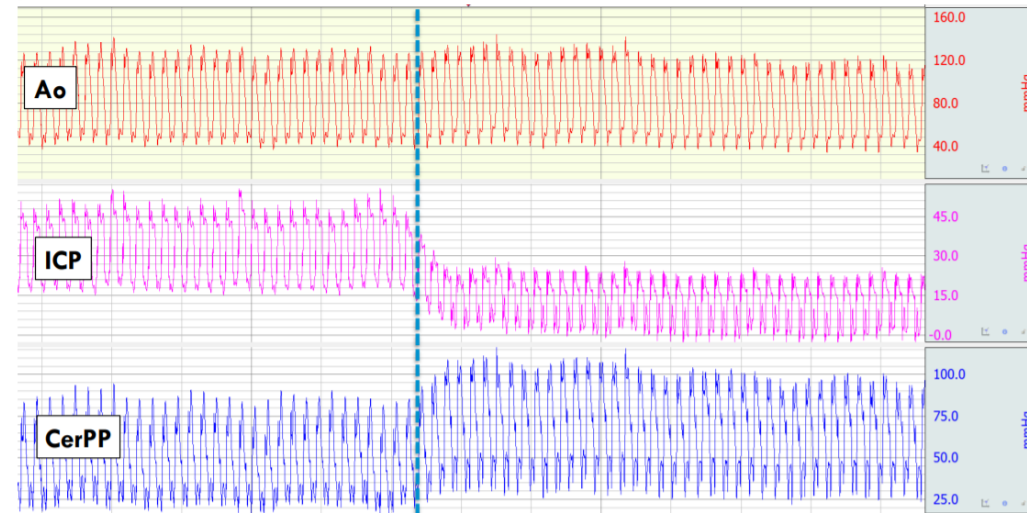
# Head-up CPR

Serebral kan akımını arttırır, intrakraniyal basıncı azaltır



Supine 0° CPR

30° Whole Body Tilt Head Up CPR + ITD



Change of position  
(CPR rate 100/min)

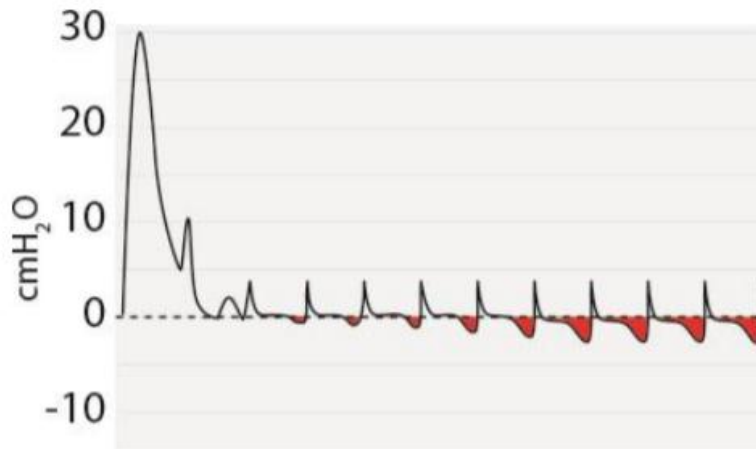


# Impedance Threshold Device

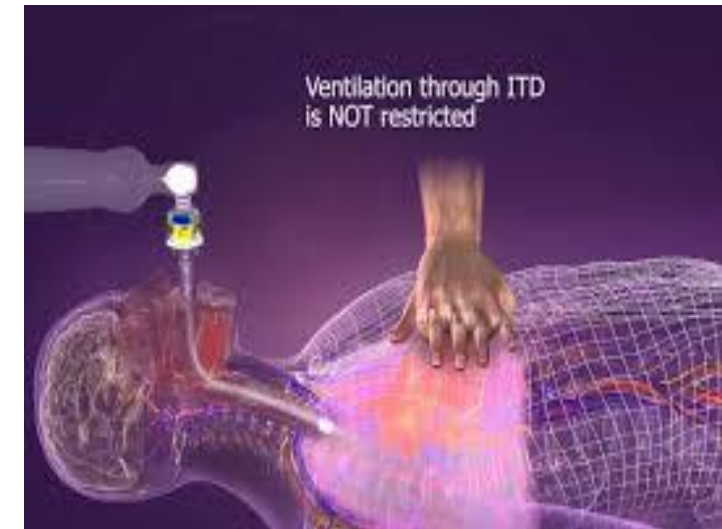
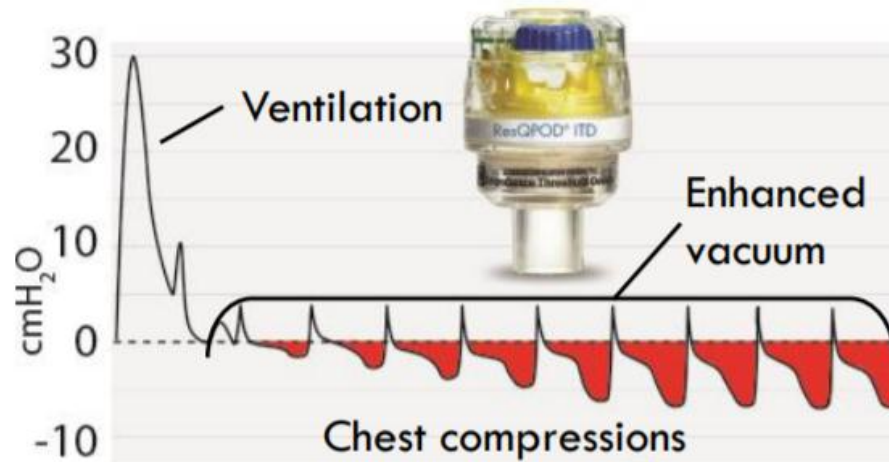


Intratorasik bantıncı düzenler, kalbe venöz dönüşü arttırır  
Greater vacuum (negative pressure) in the chest during chest wall recoil leads to increased venous return and circulation and lower ICP

**Standard CPR**



**CPR with ITD**



# Amiadorone ve Lidokain

- 2018 (güncelleme): Defibrilasyona yanıtı VF/nabızsız VT durumunda amiodoron **veya** lidokain kullanılabilir. İlaç uygulama zamanının kısa olduğu şahitli arrest durumlarında bu ilaçlar özellikle faydalı olabilir. (Class IIb, LOE B-R)
- 2015 :Amiodarone CPR'a, defibrilasyona ve vazopresör tedaviye yanıtı VF/nabızsız VT de kullanılabilir (Class IIb, LOE B-R). Lidokain **amiadorona alternatif olarak** düşünülebilir (Class IIb, LOE C-LD).



## Amiodarone, Lidocaine, or Placebo in Out-of-Hospital Cardiac Arrest.

[Kudenchuk PJ](#), [Daya M](#), [Dorian P](#); [Resuscitation Outcomes Consortium Investigators](#).

7 Mayıs 2012 – 25 Ekim 2015.

Toplam 37,889 hastadan

7051 (%18.6) hasta şok- refrakter VF veya nabızsız VT

Table 3. Outcomes According to Trial Group in the Per-Protocol Population.*									
Outcome	Amiodarone (N=974)	Lidocaine (N=993)	Placebo (N=1059)	Amiodarone vs. Placebo		Lidocaine vs. Placebo		Amiodarone vs. Lidocaine	
				Difference (95% CI)	P Value	Difference (95% CI)	P Value	Difference (95% CI)	P Value
				percentage points		percentage points		percentage points	
Primary outcome: survival to discharge — no./total no. (%)†	237/970 (24.4)	233/985 (23.7)	222/1056 (21.0)	3.2 (-0.4 to 7.0)	0.08	2.6 (-1.0 to 6.3)	0.16	0.7 (-3.2 to 4.7)	0.70
Secondary outcome: modified Rankin score ≤3 — no./total no. (%)‡	182/967 (18.8)	172/984 (17.5)	175/1055 (16.6)	2.2 (-1.1 to 5.6)	0.19	0.9 (-2.4 to 4.2)	0.59	1.3 (-2.1 to 4.8)	0.44
Mechanistic (exploratory) outcomes									
Return of spontaneous circulation at ED arrival — no./total no. (%)	350/974 (35.9)	396/992 (39.9)	366/1059 (34.6)	1.4 (-2.8 to 5.5)	0.52	5.4 (1.2 to 9.5)	0.01	-4.0 (-8.3 to 0.3)	0.07
Admitted to hospital — no. (%)	445 (45.7)	467 (47.0)	420 (39.7)	6.0 (1.7 to 10.3)	0.01	7.4 (3.1 to 11.6)	<0.001	-1.3 (-5.7 to 3.1)	0.55
Modified Rankin score in all patients‡	5.0±1.9	5.1±1.8	5.2±1.8	-0.14 (-0.30 to 0.02)	0.09	-0.06 (-0.22 to 0.10)	0.45	-0.08 (-0.24 to 0.08)	0.34

Taburculuk ve nörolojik sekelsiz veya minimal sekelli taburculuk açısından değerlendirildiğinde, hastane dışı şok dirençli VF veya nabızsız VT hastalarında **amiodaronun ve lidokainin birbirlerine veya placeboya üstünlükleri görülmemiştir.**

# VF/nabızsız VT' bağlı arrestte antiaritmik ilaçlar

- **Magnezyum**
- 2018 (güncelleme): Erişkin kardiyak arrest vakalarında magnezyumun rutin kullanımı önerilmez (Class III: No Benefit; LOE: C-LD).
- Magnesium torsades de pointesde kullanılabilir (Class IIb; LOE:C-LD).
- 2015: VF/nVT'de magnezyumun rutin kullanımı önerilmez (Class III: No Benefit, LOE B-R).



# ROSC sonrası antiaritmik ilaçlar

- **$\beta$ -bloker**
- 2015 : Kardiyak arrest sonrasında  $\beta$ -blokerlerin rutin kullanımını destekleyen yeterli bulgu bulunmamaktadır.
- VF/nVT'ye bağlı arrest nedeniyle hastaneye kaldırılan hastalarda erken dönemde oral ya da IV  $\beta$ -bloker kullanılmaya başlanması ya da devam edilmesi düşünülebilir.
- 2018 (güncelleme): Spontan dolaşımın geri dönmesi (ROSC) sonrası erken dönemde (ilk 1 saatte)  $\beta$ -bloker kullanımını destekleyen yahut reddeden yeterince kanıt yok.

# ROSC sonrası antiaritmik ilaçlar

- **Lidokain**
- 2015 : Spontan Dolaşıma Dönüş (ROSC) sonrasında lidokain kullanımı hakkındaki çalışmalar çelişkili veriler ortaya koymuştur ve lidokainin rutin kullanımı önerilmez.
- 2018: ROSC sonrası erken dönemde (ilk 1 saatte) lidokain kullanımını destekleyen yahut reddeden yeterince kanıt yok.
- Kontrendikasyonların yokluğunda lidokainin profilaktif kullanımı bazı özel durumlarda düşünülebilir (EMS transportu gibi) rekürren VF/ nVT (Sınıf IIb; KD C-LD).

Guidelines never saved anyone....  
Performing **CPR SAVES LIVES!!**

Teşekkürler.....