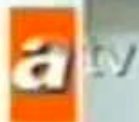


Kardiyojenik Şok (KŞ)

Dr. Mustafa SERİNKEN





19:21



POLIKLINIK 1

CHAPTER 54. CARDIOGENIC SHOCK

Hastaneye canlı ulaşan AMİ başlıca ölüm nedeni

İnsidans? (çoğu hastane dışında eks)

Hastaneye ulaşanlarında ilk 2 h içinde yarısı eks.



The image features a stylized illustration of two brown footprints on a grey background. The footprint on the right has a small, light-brown rectangular tag attached to its heel with a thin brown string. The tag contains the handwritten text 'Kardiöjenik sok' in a dark brown, cursive-like font. In the center, between the two footprints, is the large white text '%57'.

%57

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Contemporary Reviews in Cardiovascular Medicine

Cardiogenic Shock

Current Concepts and Improving Outcomes

Harmony R. Reynolds, MD; Judith S. Hochman, MD

[+ Author Affiliations](#)

Correspondence to Judith S. Hochman, MD, New York University School of Medicine, 530 First Ave, SKI-9R, New York, NY 10016. E-mail Judith.Hochman@nyumc.org

Yüksek erken ölüm oranı

Hızlı ve doğru müdahale
iyi bir yaşam kalitesi için
mükemmel bir şans olabilir.

Agresif yaklaşım

Erken revaskülarizasyon
büyük ölçüde yaşam süresini
uzatmakta



[« Prev Article](#) | [Next Article »](#)
[Table of Contents](#)

This Article

Circulation.
doi:10.1161/
CIRCULATIONAHA.106.613596

• [Extract Free](#)
• [Figures Only Free](#)

The SHOCK (Should We Emergently Revascularize Occluded Coronaries for Cardiogenic Shock?) trial

European Heart Journal

Hızlı revaskülarizasyonla

mortalite **%38**

Yoksa **%70**

Emergency revascularization in patients with cardiogenic shock on admission: a report from the SHOCK trial and registry

Raban V. Jeger¹, Shannon M. Harkness², Krishnan Ramanathan¹, Christopher E. Buller³, Matthias E. Pfisterer⁴, Lynn A. Sleeper², Judith S. Hochman¹, and for the SHOCK Investigators

KŞ tanım

Primer olarak miyokard fonksiyon bozukluğu nedeniyle kalp debisinin yeterli derecede sürdürülememesi

Bu hastalarda yeterli damar içi sıvı volümünü varlığında, düşük kalp debisi bulguları

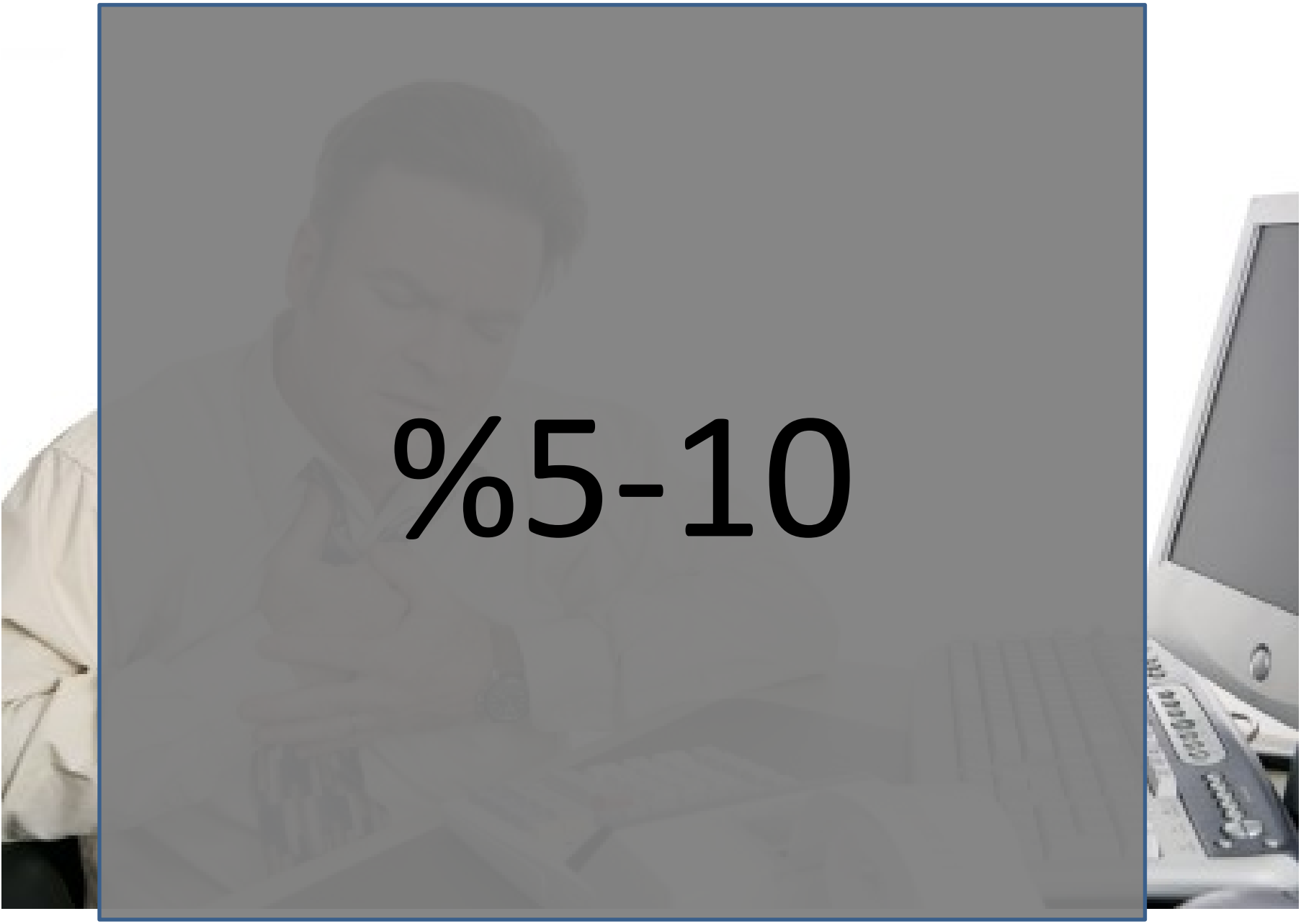
Hemodinamik kriterleri

Sistemik hipotansiyon (90 mmHg<)

Dirençli hipotansiyon (30 dk ve üzeri)

Kardiyak indeksin ≤ 2.2 L/dakika/m²

PCWP > 15 mmHg olması

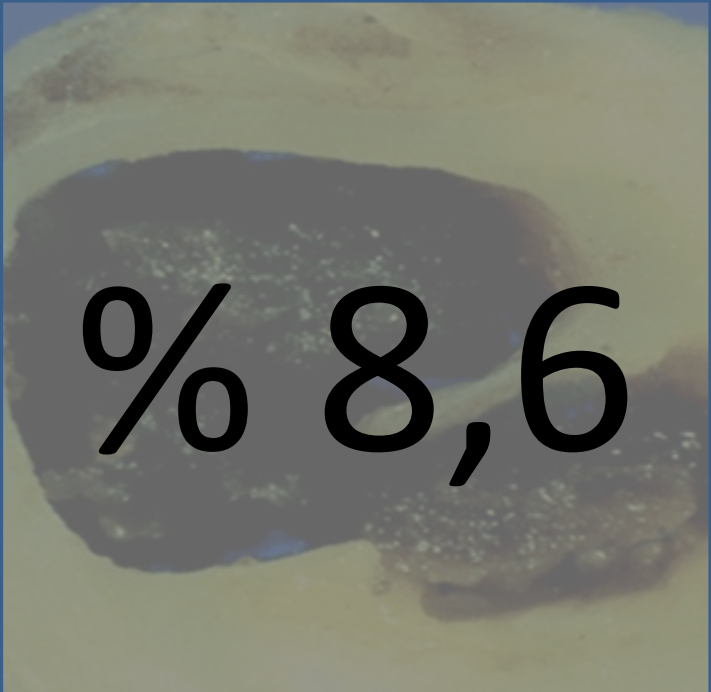
A man in a white lab coat is seated at a desk, looking down at a document. He is wearing a watch on his left wrist. To his right is a large computer monitor and a keyboard. The background is a solid grey color.

%5-10

AKS alt tipleri

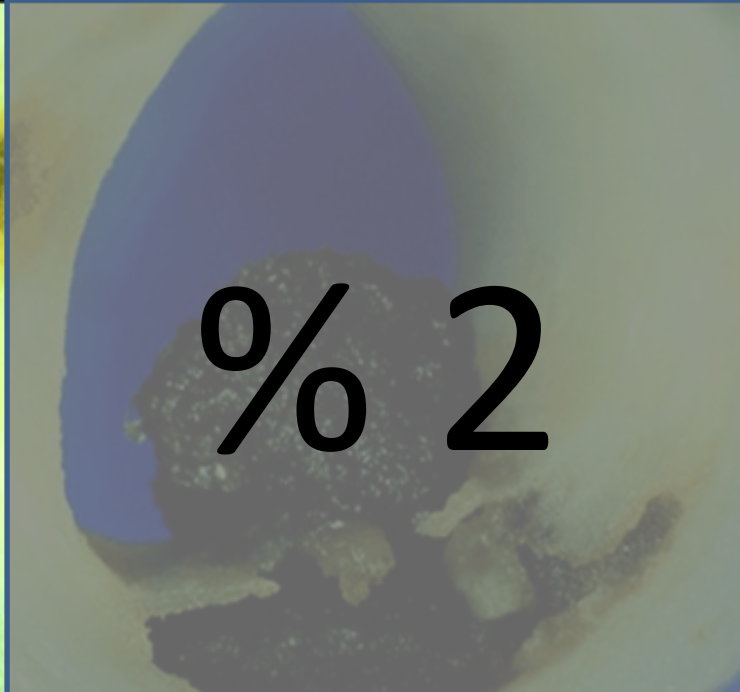
ST Elevation MI

% 8,6



Non ST elevation MI
(Unstable angina)

% 2

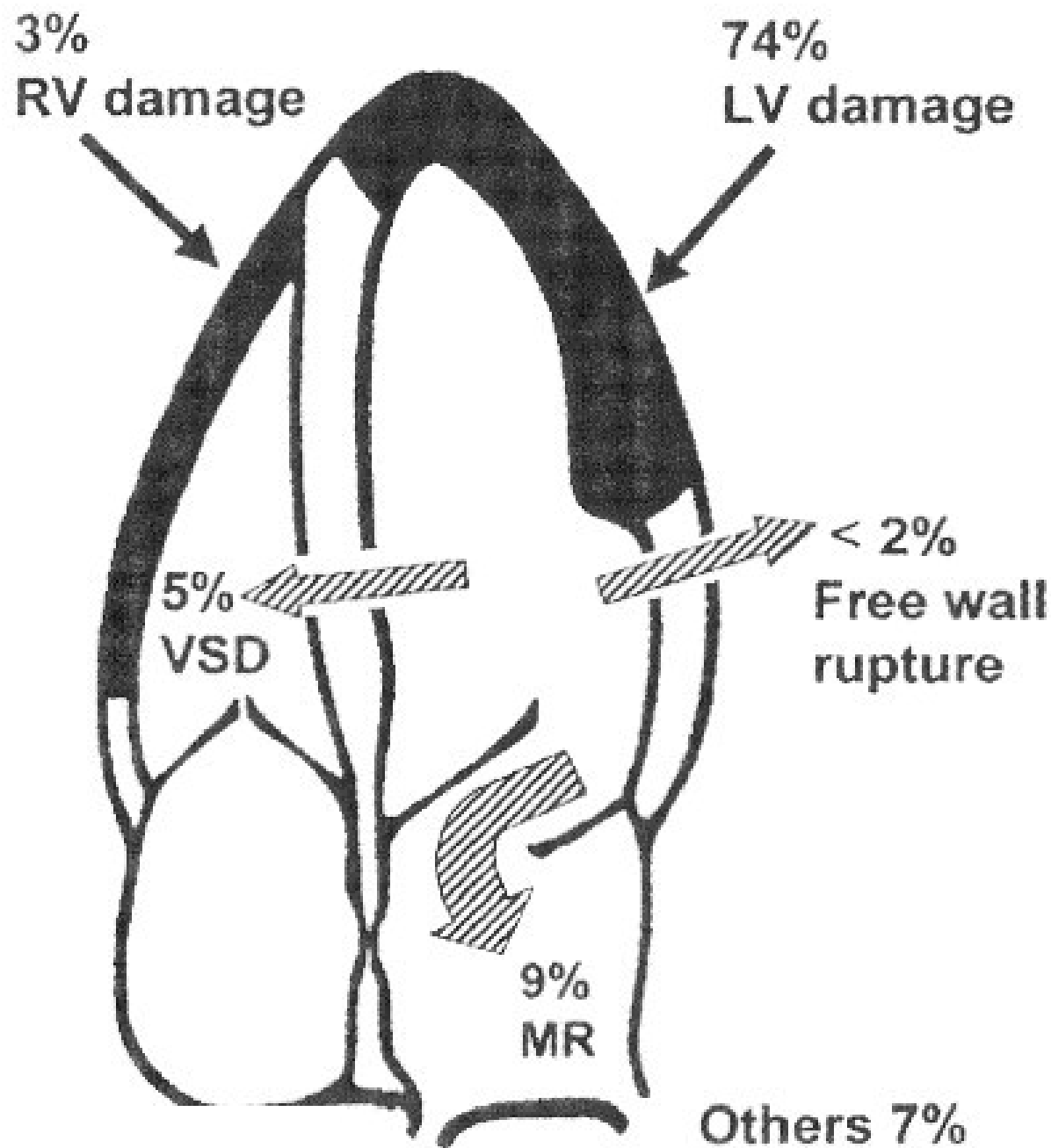


Kardiyojenik şok gelişim zamanı?

- şokun hangi nedenle ortaya çıktığına ve tedaviye bağlı olarak değişmekte
- GUSTO-I çalışmasında kardiyojenik şok %11'inde başvuru anında, %89'unda ise izleyen iki hafta içerisinde
- SHOCK çalışmasında STEMI sonrası kardiyojenik şokun ortalama gelişim süresi 5h



Table 54-2 Causes of Cardiogenic Shock
Acute myocardial infarction
Pump failure
Mechanical complications
Acute mitral regurgitation secondary to papillary muscle rupture
Ventricular septal defect
Free-wall rupture
Right ventricular infarction



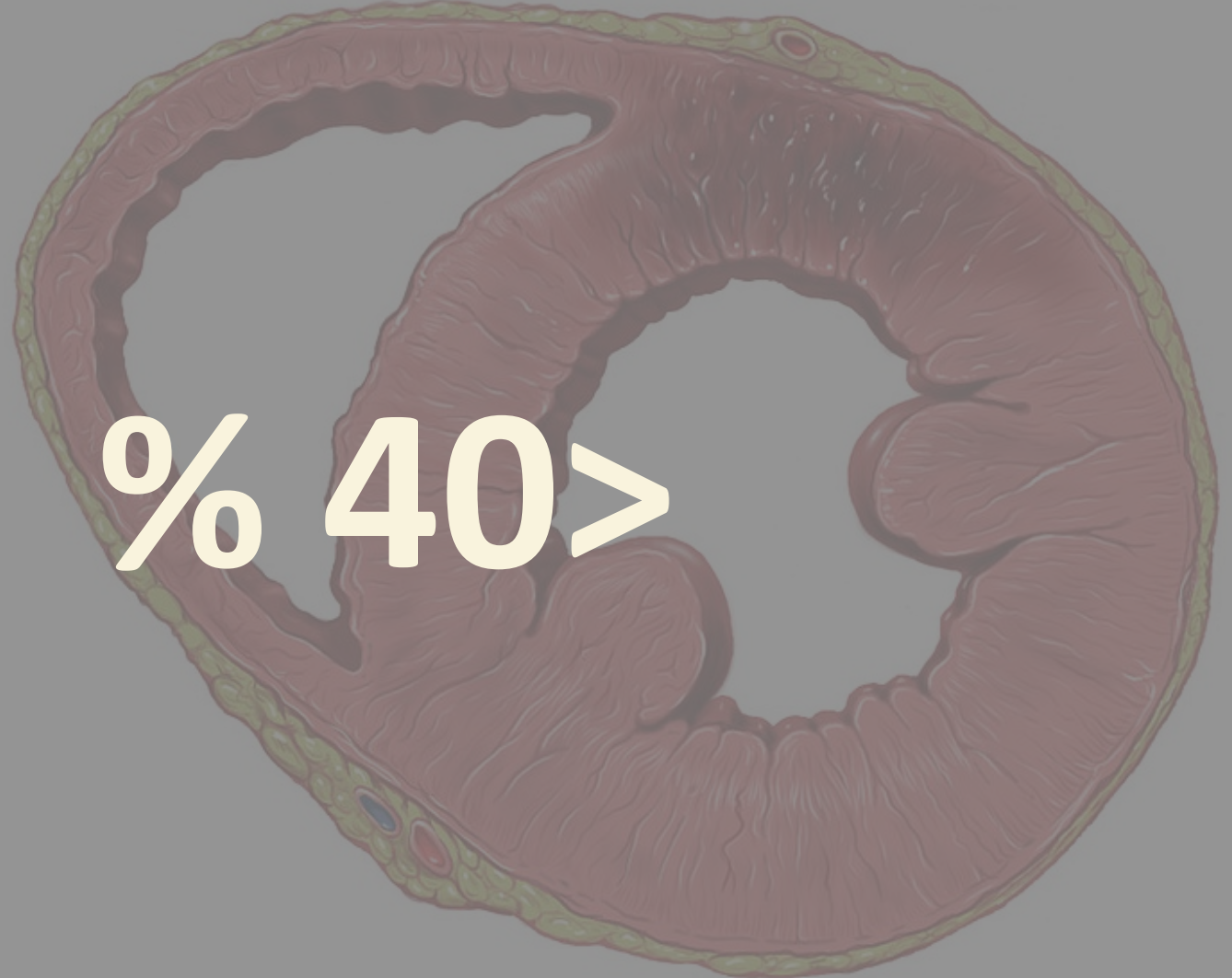
[Conquest Heart Fail](#). 2003 Jan-Feb;9(1):35-9.

Cardiogenic shock: a summary of the randomized SHOCK trial.

[Menon V](#), [Fincke R](#).

- AMİ sonrası izlenen mekanik komplikasyonların kardiyojenik şoka neden olma sıklığı
 1. akut mitral yetersizliği..... %10.7
 2. ventriküler septal defekt (VSD).... %3.1
 3. miyokardiyal rüptür..... %2.8

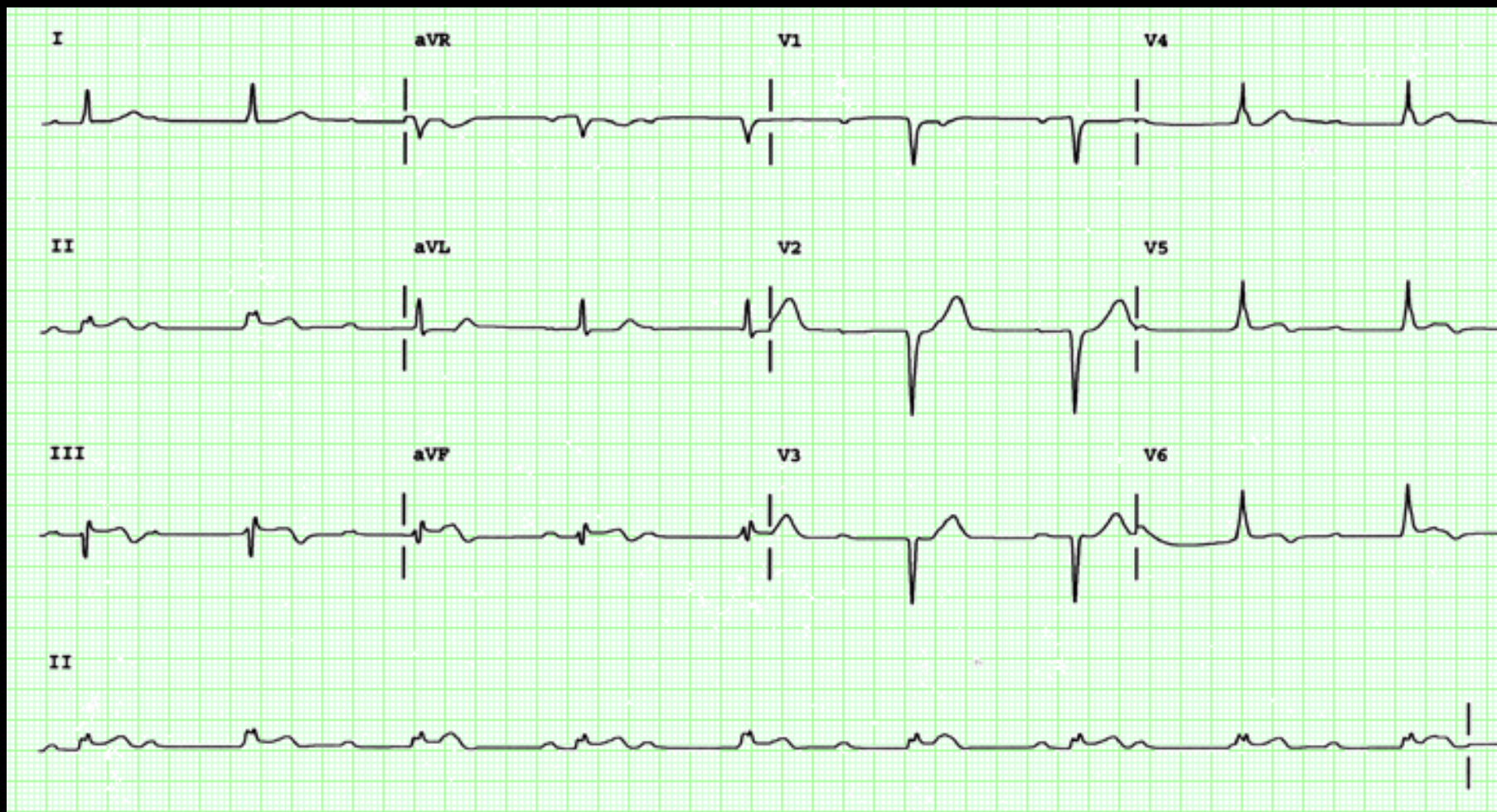
Mi sonrası KŞ'un en sık nedeni sol ventrikül
işlev bozukluğu



% 40>

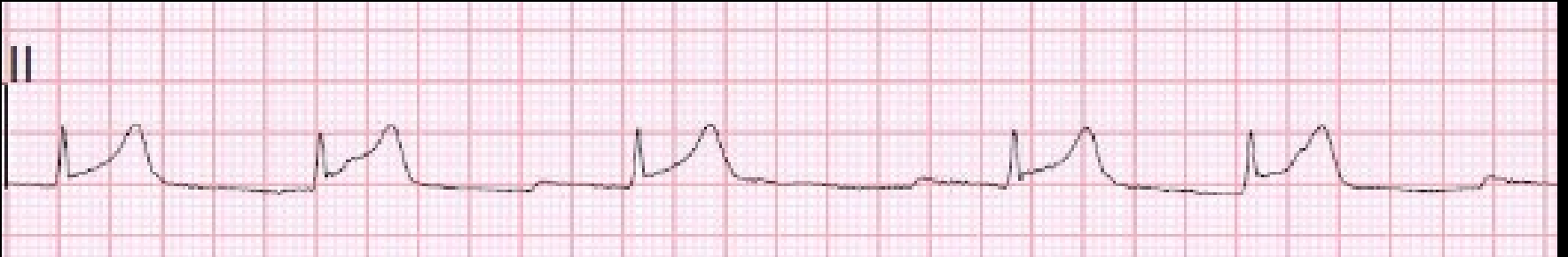
Wall Affected	Leads Showing ST Segment Elevation	Suspected Culprit Artery
Septal	V ₁ , V ₂	Left Anterior Descending (LAD)
Anterior	V ₃ , V ₄	Left Anterior Descending (LAD)
Anteroseptal	V ₁ , V ₂ , V ₃ , V ₄	Left Anterior Descending (LAD)
Anterolateral	V ₃ , V ₄ , V ₅ , V ₆ , I, aVL	Left Anterior Descending (LAD), Circumflex (LCX), or Obtuse Marginal
Extensive anterior (Sometimes called Anteroseptal with Lateral extension)	V ₁ , V ₂ , V ₃ , V ₄ , V ₅ , V ₆ , I, aVL	Left main coronary artery (LCA)
Inferior	II, III, aVF	Right Coronary Artery (RCA) or Circumflex (LCX)
Lateral	I, aVL, V ₅ , V ₆	Circumflex (LCX) or Obtuse Marginal
Posterior (Usually associated with Inferior or Lateral but can be isolated)	V ₇ , V ₈ , V ₉	Posterior Descending (PDA) (branch of the RCA or Circumflex (LCX))
Right ventricular (Usually associated with Inferior)	II, III, aVF, V ₁ , V ₄ R	Right Coronary Artery (RCA)

Wall Affected	Leads Showing ST Segment Elevation	Suspected Culprit Artery
Septal	V ₁ , V ₂	Left Anterior Descending (LAD)
Anterior	V ₃ , V ₄	Left Anterior Descending (LAD)
Anteroseptal	V ₁ , V ₂ , V ₃ , V ₄	Left Anterior Descending (LAD)
Anterolateral	V ₃ , V ₄ , V ₅ , V ₆ , I, aVL	Left Anterior Descending (LAD), Circumflex (LCX), or Obtuse Marginal
Extensive anterior (Sometimes called Anteroseptal with Lateral extension)	V ₁ , V ₂ , V ₃ , V ₄ , V ₅ , V ₆ , I, aVL	Left main coronary artery (LCA)
Inferior	II, III, aVF	Right Coronary Artery (RCA) or Circumflex (LCX)
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Posterior (Usually associated with Inferior or Lateral but can be isolated)	V ₇ , V ₈ , V ₉	Posterior Descending (PDA) (branch of the RCA or Circumflex (LCX))
Right ventricular (Usually associated with Inferior)	II, III, aVF, V ₁ , V ₄ R	Right Coronary Artery (RCA)



Mi komplikasyonlarından iletim anomalileri

- AV blok ve sinüs bradikardisi !!!
- AMİ'de tedavide kullanılan ilaçlar !!!



Kaş yapayım derken gözünden oldurmayın !!!

AMİ de B bloker ve ACE inh. gibi ilaçlar
kullanırken

•

•

•

[CJEM](#), 2008 May;10(3):215-23.

Do beta-blockers reduce short-term mortality following acute myocardial infarction? A systematic review and meta-analysis.

[Al-Reesi A](#), [Al-Zadiali N](#), [Perry J](#), [Fergusson D](#), [Al-Shamsi M](#), [Al-Thaqafi M](#), [Stiell I](#).

Cardiogenic shock: current concepts and improving outcomes.

Reynolds HR, Hochman JS.

STEMİ sonrası kardiyojenik şok gelişen hastaların sadece %29'unda ilk başvuruda kardiyojenik şok mevcut.

Hastaneye başvuruda kalp hızının yüksek olması ve hafif hipotansiyon varlığı hastaneye başvuru sonrası kardiyojenik şok gelişeceğinin göstergesi olabilir.

Pre-şok dönemi

- Sistolik KB 80 - 90mmHg
- kalp hızında artış
- Nefes darlığı
- Akciğer bazallerinde raller
- Serebral fonksiyon azalmaya başlamış

Clinical profile, contemporary management and one-year mortality in patients with severe acute heart failure syndromes: The EFICA study.

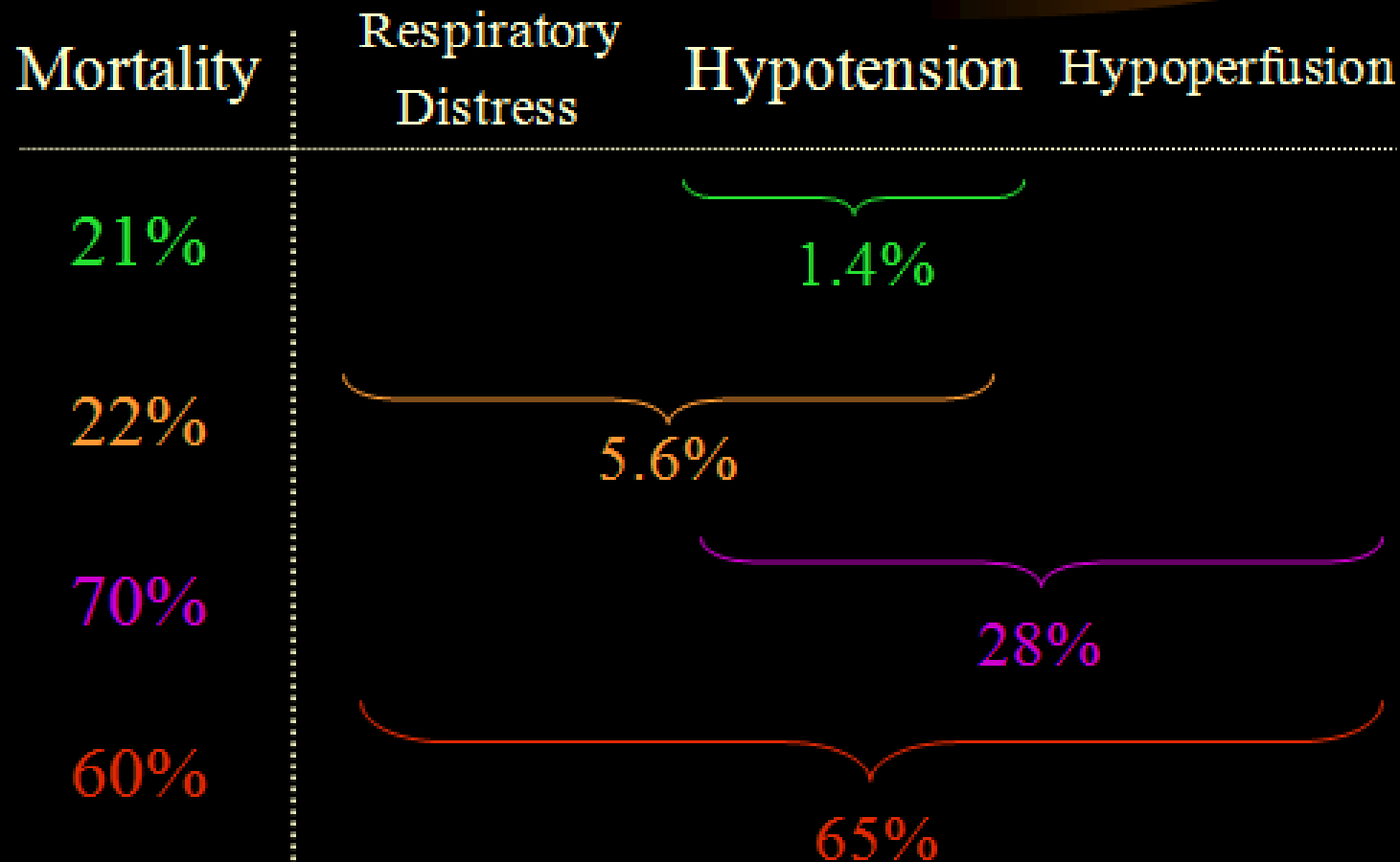
Zannad F, Mebazaa A, Juillière Y, Cohen-Solal A, Guize L, Alla F, Rouqué P, Blin P, Barlet MH, Paolozzi L, Vincent C, Desnos M, Samii K; EFICA Investigators.

Department of Cardiology, University Hospital of Nancy, France. f.zannad@chu-nancy.fr

	<u>All patients</u>	<u>Cardiogenic shock</u>		<i>p</i> ^a
	(<i>n</i> = 581)	Yes	No	
		(<i>n</i> = 166)	(<i>n</i> = 415)	
<i>Symptoms on admission (%)</i>				
Cardiogenic shock	29	100	0	<0.0001
Pulmonary oedema	82	60	91	<0.0001
Peripheral oedema	27	20	30	0.02
Angina	14	17	13	0.29
Hepatomegaly	20	24	18	0.09
Syncope	4	9	2	0.0002
Arrhythmia	23	26	21	0.17
Stroke	1	1	1	1.00

Cardiogenic shock complicating acute myocardial infarction--etiologies, management and outcome: a report from the SHOCK Trial Registry. Should we emergently revascularize Occluded Coronaries for cardiogenic shock?

Hochman JS, Buller CE, Sleeper LA, Boland J, Dzavik V, Sanborn TA, Godfrey E, White HD, Lim J, LeJemtel T.



KŞ semptom ve klinik bulgular

Risk faktörleri

- ❑ ileri yaş
- ❑ Kadın>
- ❑ ST elevasyonlu Mi
- ❑ Anterior Mi
- ❑ LBBB
- ❑ DM

Table 54-1 Risk Factors for Cardiogenic Shock

Elderly
Female
Acute or prior ischemic event associated with the following:
Impaired ejection fraction
Extensive infarct (evidence of large myocellular leak)
Proximal left anterior descending coronary artery occlusion
Anterior myocardial infarction location
Associated with multivessel disease
Prior medical history
Previous myocardial infarction
Congestive heart failure
Diabetes

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CHAPTER 54. CARDIOGENIC SHOCK

Özgeçmiş

Am Heart J. 1999 Jul;138(1 Pt 1):21-31.

Cardiogenic shock complicating acute myocardial infarction: predictors of death. GUSTO Investigators. Global Utilization of Streptokinase and Tissue-Plasminogen Activator for Occluded Coronary Arteries.

Hasdai D, Holmes DR Jr, Califf RM, Thompson TD, Hochman JS, Pfisterer M, Topol EJ.

ilk yaklaşımda ayırıcı tanıda
hatırlanması gereken dörütlü ?

Table 54-3 Differential Diagnosis of Cardiogenic Shock

Acute myocardial infarction

Pulmonary embolus

Chronic obstructive pulmonary disease exacerbation

Pericarditis

Myocarditis

Aortic dissection

Pericardial tamponade

Acute valvular insufficiency

Sepsis

Hemorrhage

Toxins/drugs of abuse

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CHAPTER 54. CARDIOGENIC SHOCK

KŞ Tanısı

FM bulguları

Sistolik KB < 80-90 mmHg

Daralmış nabız basıncı < 20mmHg

Sinüs taşikardisi (sık)

Taşipne, dispne, agonal solunum

Pulmoner ödem

JVD

Soğuk ve terli ekstremiteler

Siyanoz

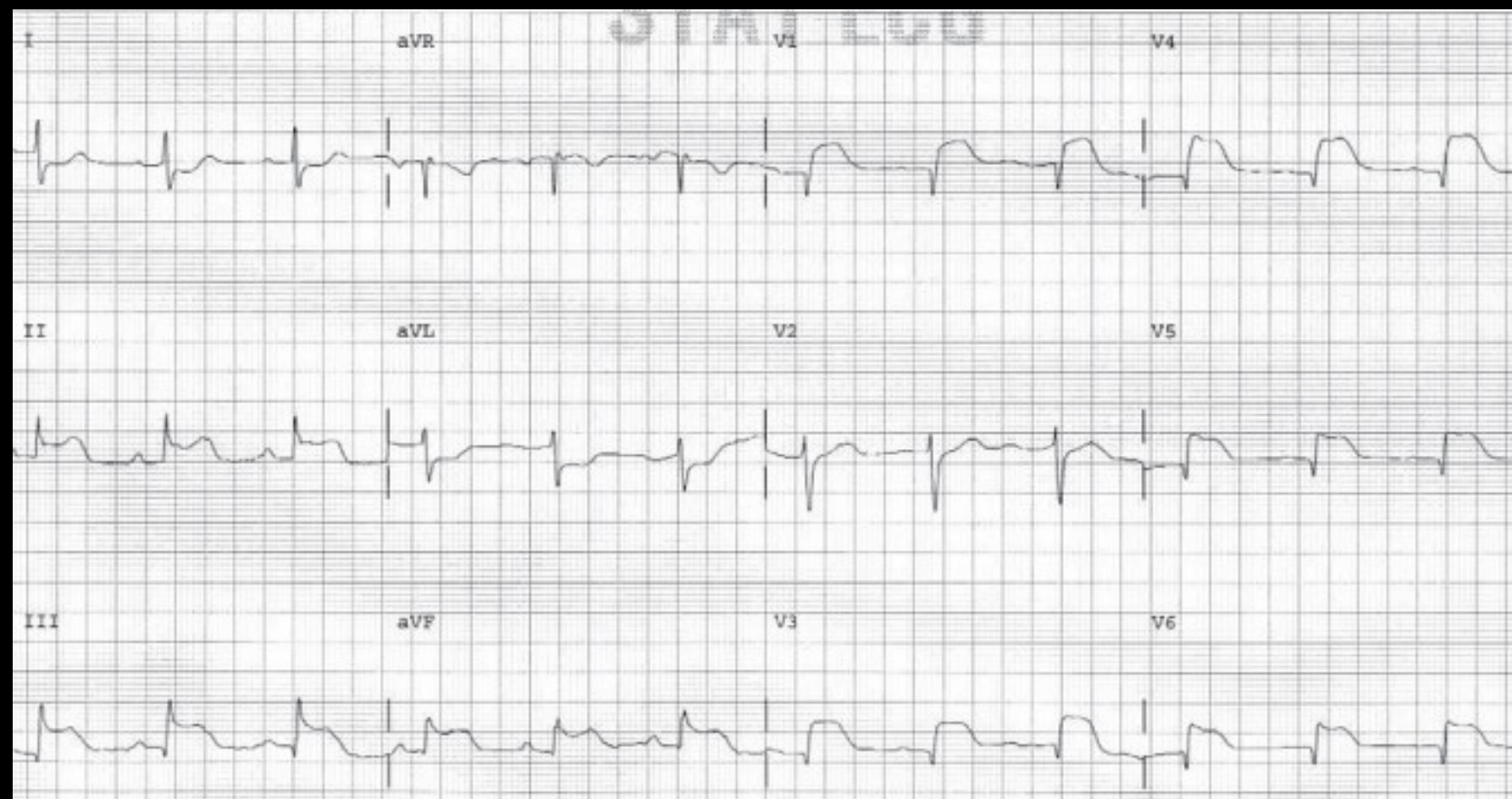


AMİ sonrası KŞ un dörtte birinde mekanik komplikasyonlar vardır !

Crit Pathw Cardiol. 2006 Mar;5(1):1-6.

The evaluation and management of cardiogenic shock.

Gogo PB Jr.



Source: Tintinalli JE, Stapczynski JS, Ma OJ, Cline DM, Cydulka RK, Meckler GD:
Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 7th Edition:
<http://www.accessmedicine.com>

Right ventricular infarction as an independent predictor of prognosis after acute inferior myocardial infarction.

[Zehender M](#), [Kasper W](#), [Kauder E](#), [Schönthaler M](#), [Geibel A](#), [Olschewski M](#), [Just H](#).

- İnférieur Mİ ya, sağ ventrikül infarktüsü eşlik ettiğinde sol ventrikül fonksiyon bozukluğu daha ağır
- mortalite %6 dan %31'e çıkıyor

laboratuvar

- CBC
- Biyokimya
- Kardiyak enzim
- AKG
- **Laktat** (Hipoperfüzyon bulguları olan bir hastada artmış laktat değerleri kötü prognozu gösterir)
- BNP

BNP

hipotansif hastada normal
BNP (<100 picograms/mL)
kardiyojenik şoku dışlatır

fakat yüksek BNP
değerleri tanı koydurmaz



[Circulation](#). 2002 Apr 16;105(15):1760-3.

Multimarker approach to risk stratification in non-ST elevation acute coronary syndromes: simultaneous assessment of troponin I, C-reactive protein, and B-type natriuretic peptide.

[Sabatine MS](#), [Morrow DA](#), [de Lemos JA](#), [Gibson CM](#), [Murphy SA](#), [Rifai N](#), [McCabe C](#), [Antman EM](#), [Cannon CP](#), [Braunwald E](#).



EKO

- ❖ Akinetik yada diskinetik ventrikül duvarı
- ❖ Mekanik nedenler hızlı tanınır
 - ✓ kapak disfonksiyonları
 - ✓ akut VSD
 - ✓ serbest myokardial duvar rüptürü
 - ✓ perikardiyal tamponad
 - ✓ papillar kas rüptürü

EKO

sol ventrikul işlev bozukluğunun derecesi, EF ?

Eğer sol ventrikül hiperdinamik bulunursa, şokun diğer sebepleri (sepsis, anemi vb) araştırılır.

Sağ ventrikül dilatasyonu varlığı kötü prognoz göstergesidir !

- TEDAVI



Pre-şok dönemi

- Amaçımız AKS da şok gelişimini önlemek
- Neler yapabiliriz sorusu? Önemli !!!
- ✓ Pre-şok döneminin zamanında tanınması
- ✓ İskeminin giderilmesi
- ✓ Aritmilerin tedavisi veya proflaksisi
- ✓ + inotropik ajanlarla hemodinaminin sağlanması
- ✓ PKG için erken sevk

Tedavi

Adana'da "STENT FOR LIFE" Projesi

Yazı Tarihi: 30 Ocak 2011.



Adana Numune Hastanesi'ne baęlı Fatma-Kemal Timuçin Kalp Merkezi ile Seyhan Uygulama Hastanesi'nde, kalp hastalıklarında hayat kurtarıcı olarak Avrupa ülkelerinde uygulanan ve Sağlık



Participating Countries

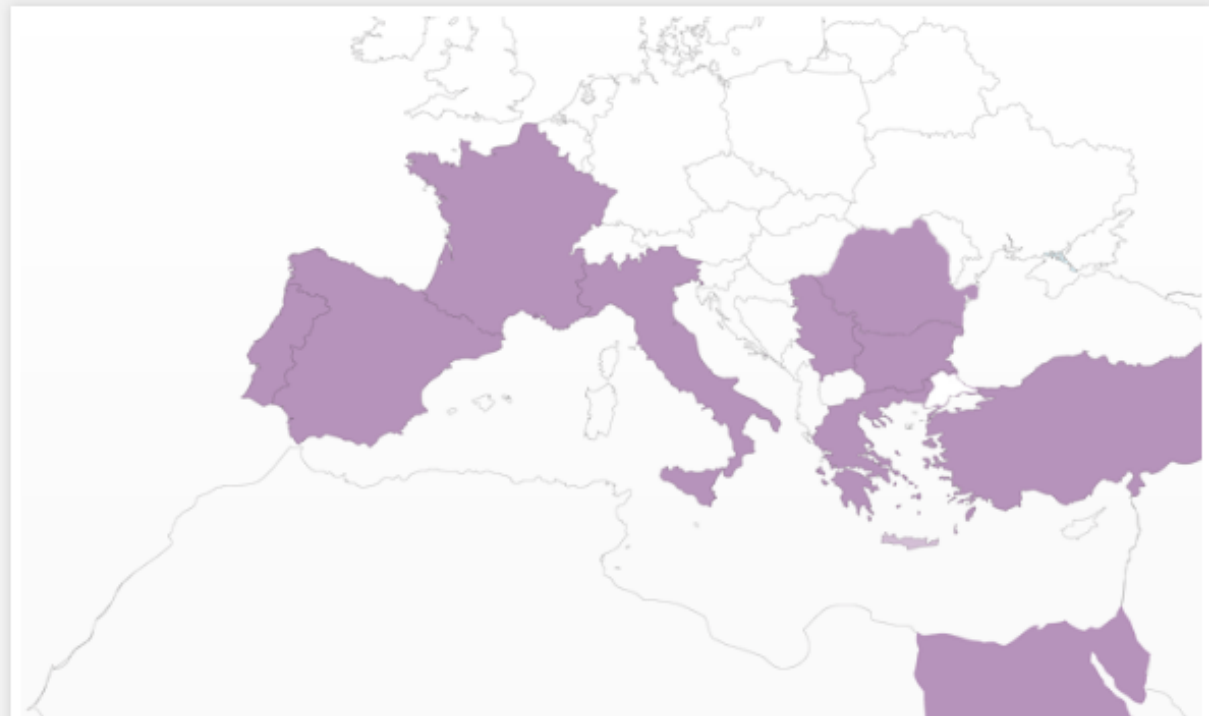
Interactive map

[Bulgaria](#)[Egypt](#)[France](#)[Greece](#)[Italy](#)[Portugal](#)[Romania](#)[Serbia](#)[Spain](#)[Turkey](#)

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Participating Countries

The Stent for Life Initiative is currently supported by **10 National Cardiac Societies** and/or working groups or associations of Interventional Cardiology including Bulgaria, Egypt, France, Greece, Italy, Portugal, Romania, Serbia, Spain and Turkey. Each country is implementing a tailored action programme to increase patient access to p-PCI. Find out more by clicking on each of the countries.

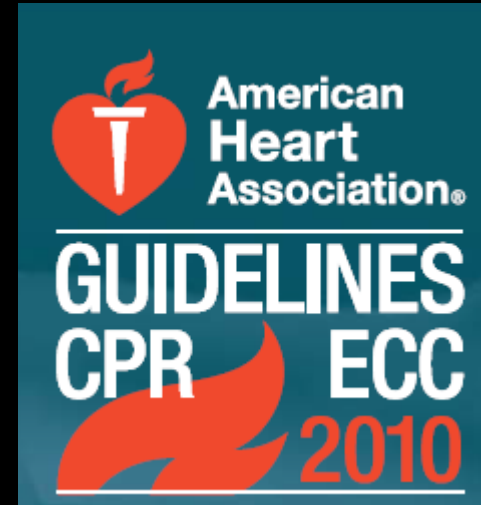


AKS' da KŞ gelişen 75 yaş< Erken revaskülarizasyon

Primer PCI Kapasitesi Olan Hastaneye Triaj

Hastane Öncesi 12 Kanallı EKG'ler

STEMI bakım sisteminin önemli ve anahtar bileşeni, hastane öncesi 12 kanallı EKG'lerin EMS sağlayıcıları tarafına ulaştırılması ve yorumlanması ile kabul eden kuruma iletilmesidir. Hastane öncesi 12 kanallı EKG kullanımı CPR ve ECC için AHA Kılavuzlarında 2000'den bu yana önerilmektedir ve fibrinolitik tedavi ile reperfüzyon zamanını azalttığı rapor edilmiştir. Daha yakında, hastane öncesi 12 kanallı EKG'lerin Primer PCI zamanını azalttığı ayrıca gösterilmiştir ve PCI seçilen strateji olduğu takdirde





dikkat

Early intravenous then oral metoprolol in 45,852 patients with acute myocardial infarction: randomised placebo-controlled trial.

Chen ZM, Pan HC, Chen YP, Peto R, Collins R, Jiang LX, Xie JX, Liu LS; COMMIT (CLOpidogrel and Metoprolol in Myocardial Infarction Trial) collaborative group.

Akut Mİ'da erken beta-bloker tedavisi reinfark ve VF riskini azaltır fakat KŞ riskini arttırır.

Sonuç olarak, B bloker tedavi Mİ sonrası hemodinamik durum stabilize edildikten sonra ve hastanede başlanması uygundur.

B bloker

- AMİ de mortaliteyi azaltır
- KŞ taki AMİ'li hastalarda ve AMİ geçirmekten olan KŞ yönünden riskli hastalarda verilmemeli.

Table 54-1 Risk Factors for Cardiogenic Shock
Elderly
Female
Acute or prior ischemic event associated with the following:
Impaired ejection fraction
Extensive infarct (evidence of large myocellular leak)
Proximal left anterior descending coronary artery occlusion
Anterior myocardial infarction location
Associated with multivessel disease
Prior medical history
Previous myocardial infarction
Congestive heart failure
Diabetes

[ACC/AHA 2007 guidelines for the management of patients with unstable angina/non-ST-Elevation myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines](#) (Writing Committee to Revise the 2002 Guidelines for the Management of Patients With Unstable Angina/Non-ST-Elevation Myocardial Infarction) developed in collaboration with the American College of Emergency Physicians, the Society for Cardiovascular Angiography and Interventions, and the Society of Thoracic Surgeons endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation and the Society for Academic Emergency Medicine.

Anderson JL, Adams CD, Antman EM, Bridges CR, Califf RM, Casey DE Jr, Chavey WE 2nd, Fesmire FM, Hochman JS, Levin TN, Lincoff AM, Peterson ED, Theroux P, Wenger NK, Wright RS, Smith SC Jr, Jacobs AK, Adams CD, Anderson JL, Antman EM, Halperin JL, Hunt SA, Krumholz HM, Kushner FG, Lytle BW, Nishimura R, Ornato JP, Page RL, Riegel B; **American College of Cardiology**; **American Heart Association Task Force on Practice Guidelines** (Writing Committee to Revise the 2002 Guidelines for the Management of Patients With Unstable Angina/Non-ST-Elevation Myocardial Infarction); **American College of Emergency Physicians**; Society for Cardiovascular Angiography and Interventions; Society of Thoracic Surgeons; **American Association of Cardiovascular and Pulmonary Rehabilitation**; Society for Academic Emergency Medicine. J Am Coll Cardiol. 2007 Aug 14;50(7):e1-e157. No abstract available. Erratum in: J Am Coll Cardiol. 2008 Mar 4;51(9):974.

CHAPTER 53. ACUTE CORONARY SYNDROMES: ACUTE MYOCARDIAL INFARCTION AND UNSTABLE ANGINA

50 milligrams PO every 12 hours first day, unless significant hypertension, may consider 5 milligrams IV over 2 min every 5 min up to 15 milligrams; withhold -blockers initially if the patient is at risk for cardiogenic shock/adverse effects.

LOE B). There is no direct evidence for the use of prasugrel in the ED or prehospital settings. In patients who are not at high risk for bleeding, administration of prasugrel (60-mg oral loading dose) prior to angiography in patients determined to have STEMI ≤ 12 hours after the initial symptoms may be substituted for administration of clopidogrel (Class IIa, LOE B). Prasugrel is not recommended in STEMI patients managed with fibrinolysis or NSTEMI patients before angiography.

potension (SBP < 100 mm Hg), signs of poor peripheral perfusion, second-degree or third-degree heart block, or reactive airway disease. Studies of β -blockers varied significantly in the treatment times used, with no high quality papers studying the administration of β -blockers in the prehospital setting or in the very early ED setting (ie, within the first hour of a suspected ACS).

For patients with ACS, there is no evidence to support the routine administration of IV β -blockers in the prehos-

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S802 *Circulation* November 2, 2010

pital setting or during initial assessment in the ED. IV β -blocker therapy may be considered as reasonable in specific situations such as severe hypertension or tachyarrhythmias in patients without contraindications (Class IIa, LOE B). In the absence of contraindications, PO β -blockers should be administered within the first 24 hours to patients with suspected ACS (Class 1, LOE A). Patients with initial contraindications should be re-evaluated periodically. It is reasonable to start oral β -blockers with low doses after the patient is stabilized prior to discharge (Class IIa, LOE B).



**American
Heart
Association®**

**GUIDELINES
CPR ECC
2010**

Tedavi

- Reperfüzyon temel tedavi fakat bu sağlanıncaya kadar çoklu organ hasarının engellenmesi için destekleyici ek tedaviler
 - Vazopresor-pozitif inotropik ajanlar,
 - mekanik ventilasyon
 - intraaortik balon pompası(iABP)

oksijenasyon

Noninvaziv ventilasyon yöntemleri
akut kardiyak pulmoner ödemde

IV sıvı-diüretik

Vazopresor-pozitif inotropik ajanlar

Table 54-5 Inotropic Medications for Cardiogenic Shock*

Drug	Dose	Comments
Dopamine	3–5 micrograms/kg per minute, titrated up to 20–50 micrograms/kg per minute as needed	Use lowest effective dose
Dobutamine	2–5 micrograms/kg per minute, titrated up to 20 micrograms/kg per minute	May need dopamine also
Norepinephrine	2 micrograms/minute, titrate to response	Vasoconstrictor and inotrope
Milrinone	50 micrograms/kg IV over 10 minutes	Inotrope and vasodilator; lowers blood pressure
	Maintenance infusion of 0.5 micrograms/kg per minute	

dobutamin

levosimendan

Levosimendan ilk tercih edileceđi durumlar

Vazopressör ve inotropik ajanlar

The use of **vasopressors** and **inotropes** in the **emergency medical treatment of shock**.

Ellender TJ, Skinner JC.

Emerg Med Clin North Am. 2008 Aug;26(3):759-86, ix. Review.

Critical care aspects in the **management of patients** with **acute coronary syndromes**.

Naples RM, Harris JW, Ghaemmaghani CA.

Emerg Med Clin North Am. 2008 Aug;26(3):685-702, viii. Review.

Trombolitik tedavi

İnvaziv tedavi uygulanamayacak hastalara kontendikasyon yoksa trombolitik verilmeli.

American College of Cardiology (ACC)/American Heart Association (AHA) klavuzunda **Sınıf I** öneri

TPA ların kardiyojenik şokta mortaliteyi düşürmediği yönde bir çok çalışma var.

Lancet. 1990 Feb 24;335(8687):427-31.

Long-term effects of intravenous anistreplase in acute myocardial infarction: final report of the AIMS study. AIMS Trial Study Group.

N Engl J Med. 1993 Sep 2;329(10):673-82.

An international randomized trial comparing four thrombolytic strategies for acute myocardial infarction. The GUSTO investigators.

iABP

- kardiyak output ve koroner kan akımını arttırır.



IABP

Systole



IABP

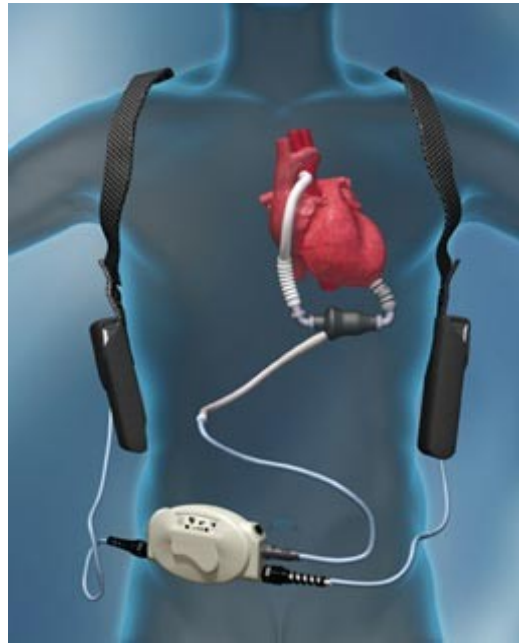
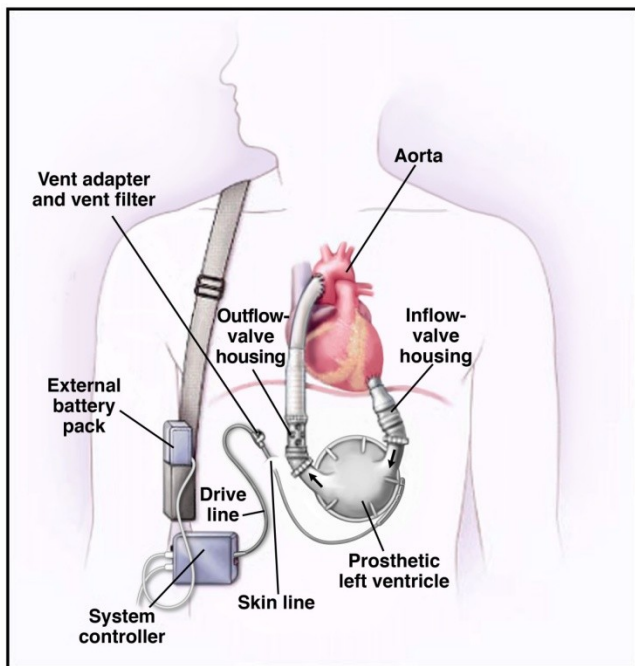
Intra-aortic
Balloon
Pump

Diastole

iABP

Intraaortic Balloon Support for Myocardial Infarction with Cardiogenic Shock.

[Thiele H](#), [Zeymer U](#), [Neumann FJ](#), [Ferenc M](#), [Olbrich HG](#), [Hausleiter J](#), [Richardt G](#), [Hennersdorf M](#), [Empen K](#), [Fuernau G](#), [Desch S](#), [Eitel I](#), [Hambrecht R](#), [Fuhrmann J](#), [Böhm M](#), [Ebelt H](#), [Schneider S](#), [Schuler G](#), [Werdan K](#); the IABP-SHOCK II Trial Investigators.





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Mekanik dolařım desteęi

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[Subramaniam K](#), [Boisen M](#), [Shah PR](#), [Ramesh V](#), [Pete A](#).

[Heart Lung.](#) 2012 Sep;41(5):500-4. Epub 2012 May 16.

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[Pollack A](#), [Uriel N](#), [George J](#), [Kodali S](#), [Takayama H](#), [Naka Y](#), [Jorde U](#).

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[Westaby S](#), [Anastasiadis K](#), [Wieselthaler GM](#).

PKG

Eur Heart J. 2001 Mar;22(6):472-8.

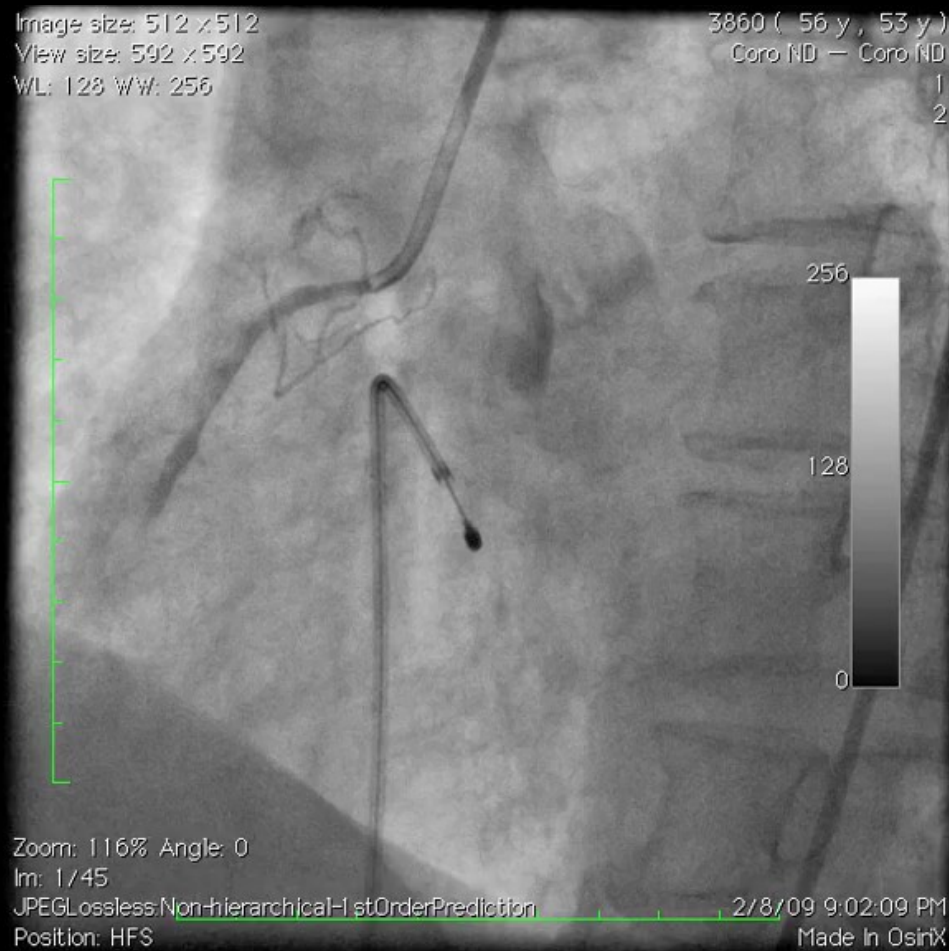
Trends in cardiogenic shock: report from the SHOCK Study. The SHould we emergently revascularize Occluded Coronaries for cardiogenic shock?

Carnendran L, Abboud R, Sleeper LA, Gurunathan R, Webb JG, Menon V, Dzavik V, Cocke T, Hochman JS.

Image size: 512 x 512
View size: 592 x 592
WL: 128 WW: 256

3860 (56 y , 53 y)
Coro ND — Coro ND

1
2



Zoom: 116% Angle: 0
Im: 1/45

JPEGLosslessNon-hierarchicalHistogramPrediction
Position: HFS

2/8/09 9:02:09 PM
Made In OsiriX