


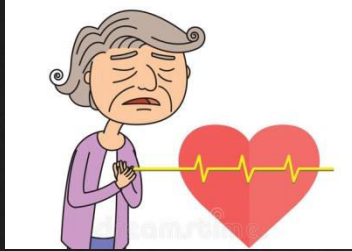
# RV Infarct : The Remorseless Killer



Presented By  
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Second Year Resident

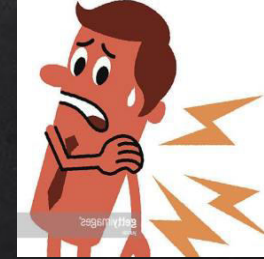
Department of Emergency Medicine  
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Pimpri Pune

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## Case History

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A 70 year old female came with **left sided chest pain** radiating to right shoulder and back since 6 hours. Referred to our hospital for MI.

- Received tablet **Sorbitrate**  
Airway – Patent  
before coming our hospital.  
Breathing – RR 20 per minute,

- A known case of DM and HTN since many years on regular treatment  
Saturation 85 % on RA  
and 97 % with 6 litre O<sub>2</sub>  
Circulation – Pulse – 92/min,  
BP – **140/90**

A 45 year male came with **left sided chest pain** radiating to left shoulder and jaw since 3 hrs. Referred to our hospital for MI.

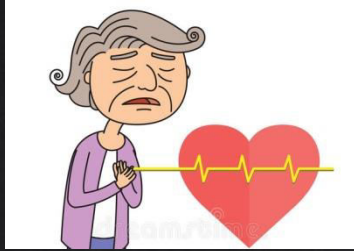
- Received tablet **Sorbitrate**  
Airway – Patent  
before coming to our hospital.  
Breathing – RR 18 per minute,

- No history of comorbidities  
Saturation 97 % on RA  
Circulation – Pulse – 80/min  
BP – **110/80**

Differential based on history

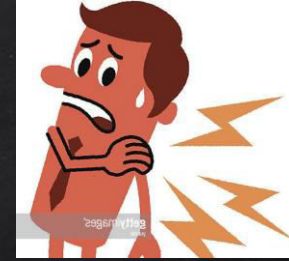
Acute coronary syndrome

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## Examination

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Conscious oriented and cooperative. In pain.

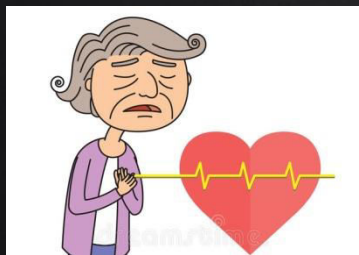
**JVP raised with positive  
hepatojugular reflux**

Bilateral pedal edema

Conscious oriented and cooperative.

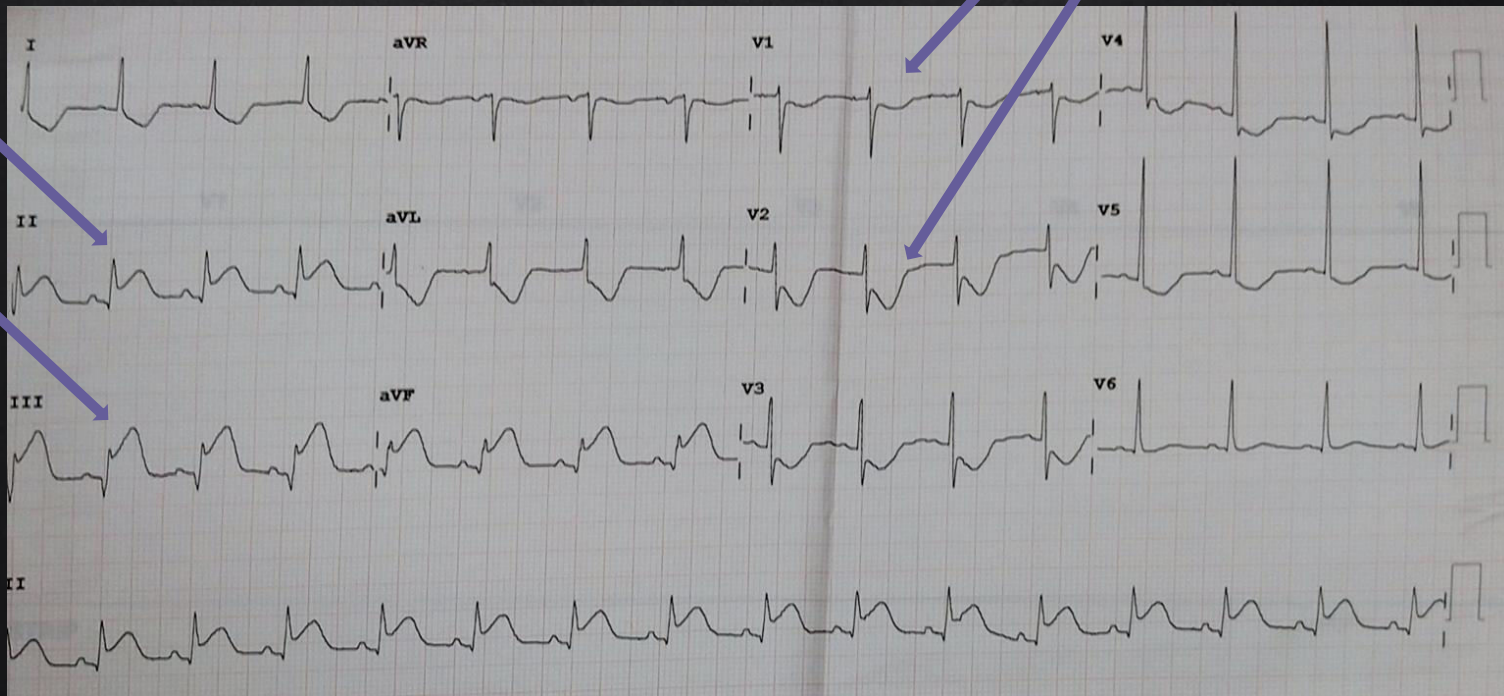
Trop I – 0.8 (Normal upto 0.2)

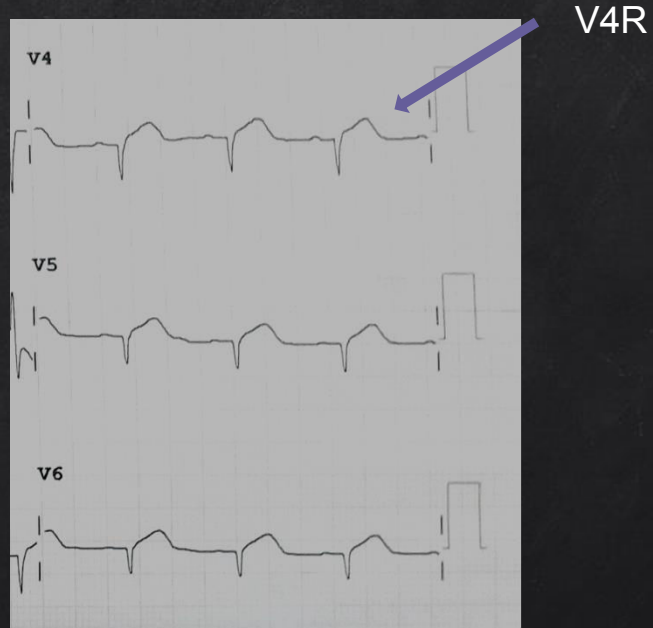
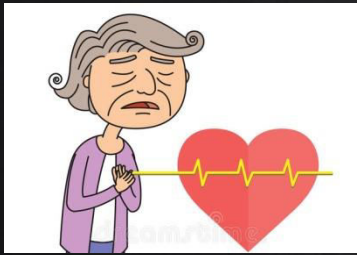
Trop T positive



ST depression in  $V2 > V1$

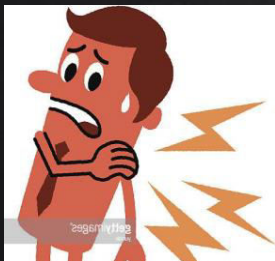
ST  
elevati  
on  
 $III > II$





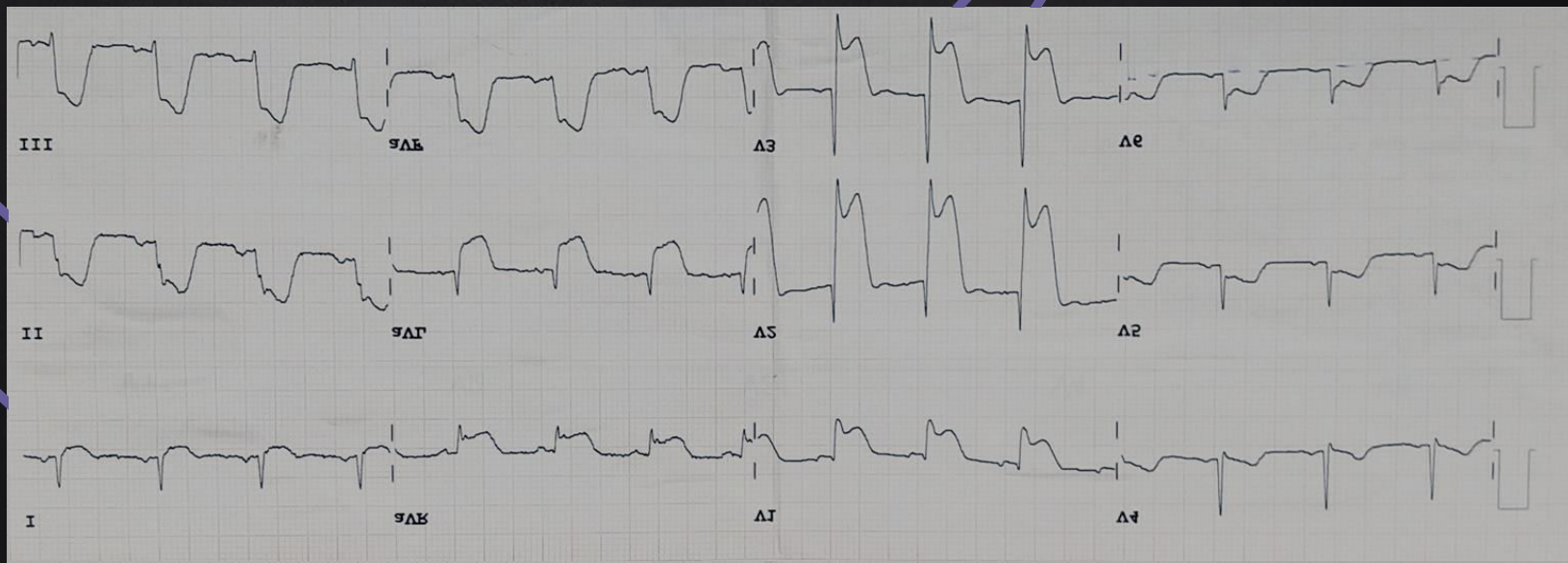
**ECG diagnosis : Inferior wall Myocardial Infarction with RV infarct**





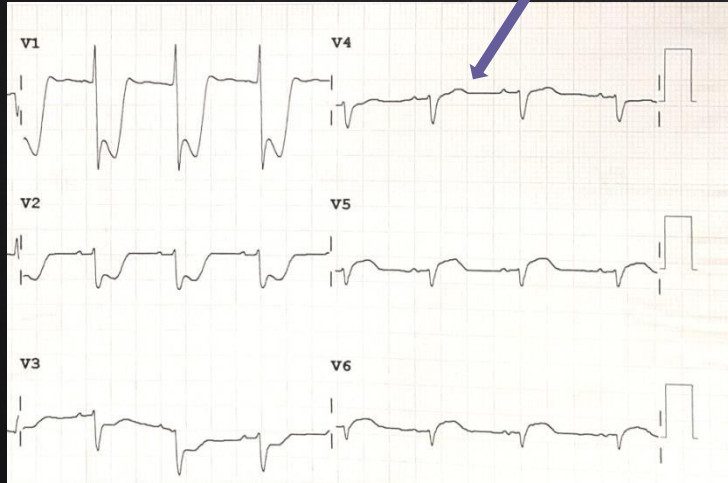
ST depression in  $V2 > V1$

ST  
elevati  
on  
 $III > II$

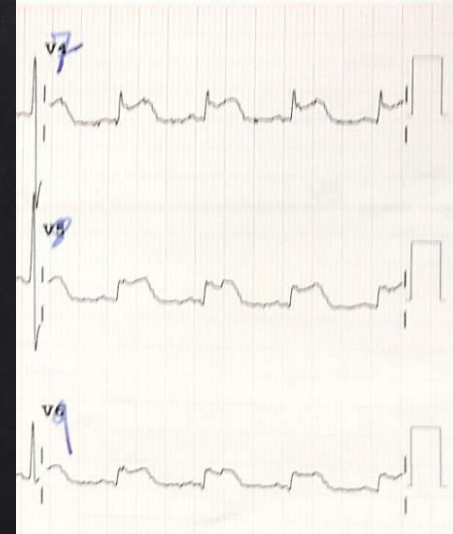




Right sided

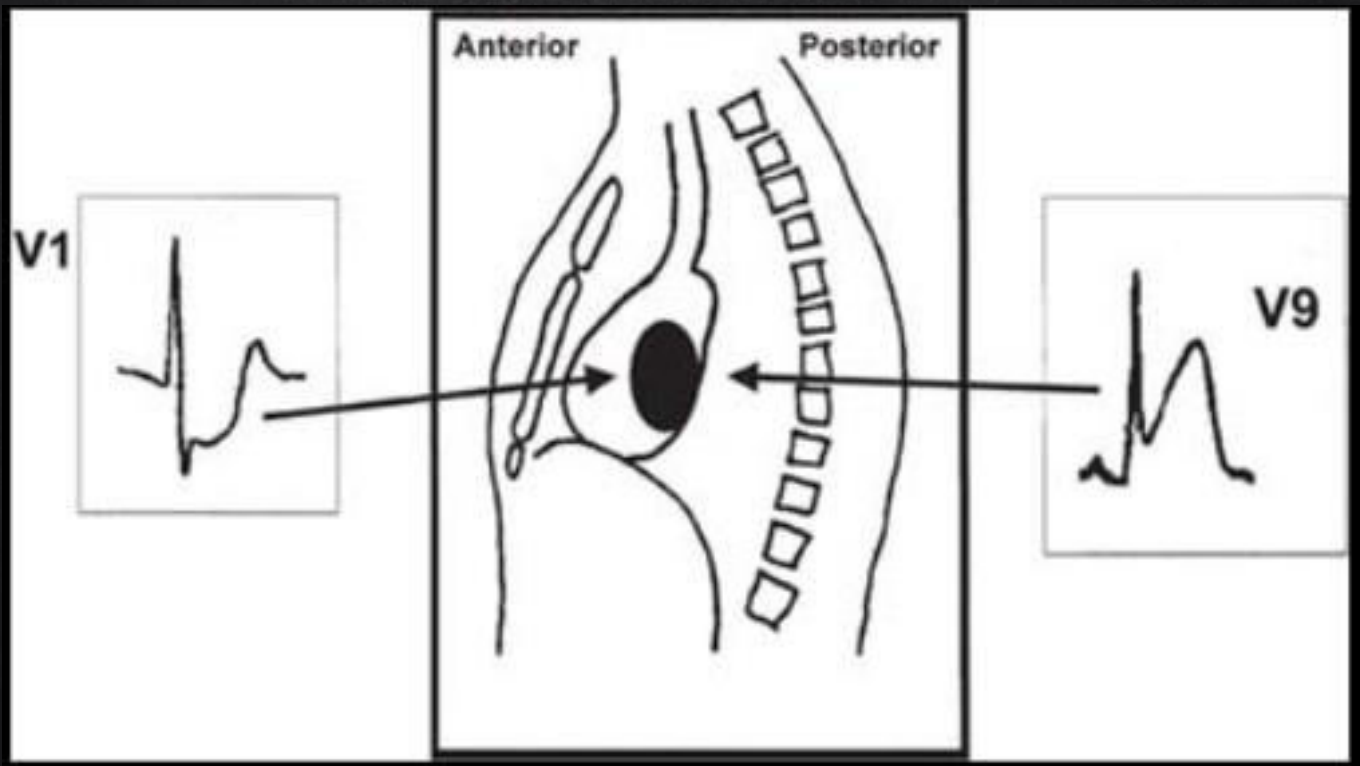


Posterior

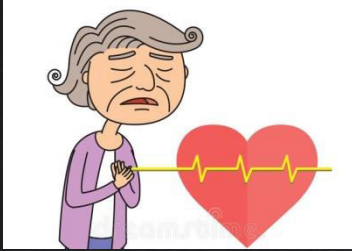


**ECG Diagnosis : Infero-postero-lateral wall Myocardial Infarction with RV infarct**



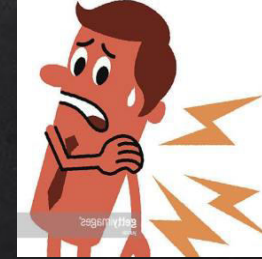


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## Diagnosis

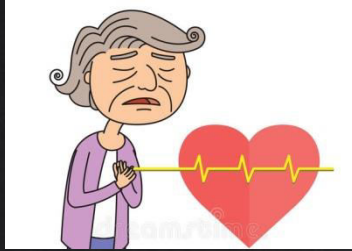
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Acute inferior wall myocardial infarction with  
RV infarct

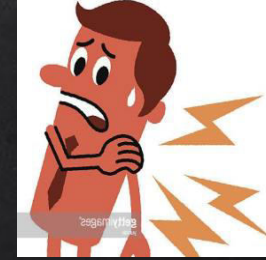
Acute Infero-postero-lateral wall with right  
ventricular Myocardial Infarction

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## Course in the hospital

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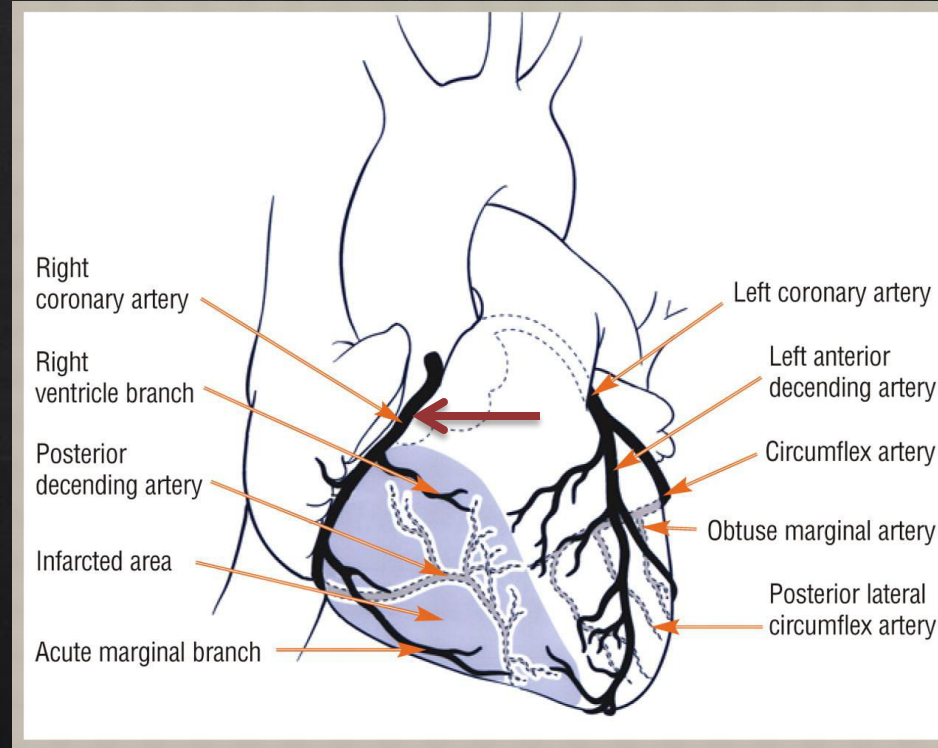
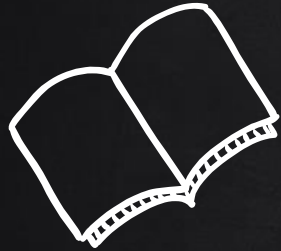


Profound hypotension (nitrates in RV infarct)

Cardiac arrest

Could not be revived

# Discussion : RV Infarction



## Clinical signs

### Classical clinical triad

Distended neck veins

Clear lung fields

Hypotension

Specificity (96%) Sensitivity (25%).<sup>1</sup>

### Other signs

S4 heart gallop increasing with inspiration;

Possible Kussmaul sign

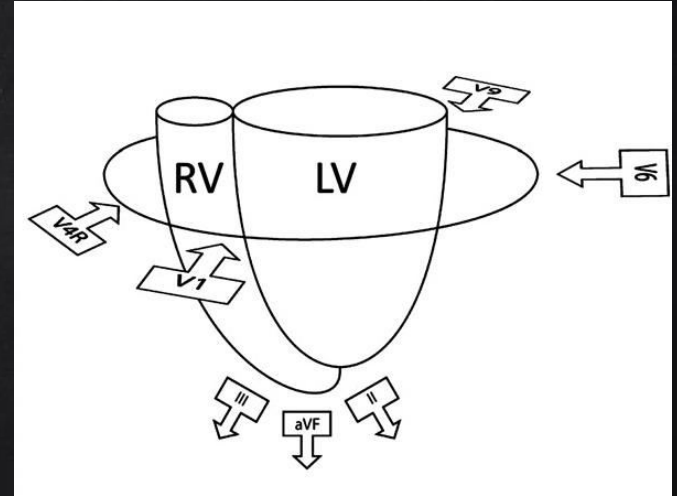
Paradoxical pulse

Elevated JVP plus Kussmaul's sign indicate a hemodynamically significant right ventricular infarction (sensitivity = 88% and specificity = 100%)



# ECG Findings

**ST elevation in V1**  
**ST elevation in lead III > lead II**  
**ST elevation in V1 > V2.**  
**ST elevation in V1 + ST depression in V2**  
**Isoelectric ST segment in V1 with marked ST depression in V2**



# Literature

## ECG Diagnosis: Right Ventricular Myocardial Infarction

Manvi R Nagam, MBBS; David R Vinson, MD; Joel T Levis, MD, PhD, FACEP, FAAEM

Perm J 2017;21:16-105

E-pub: 10/05/2016

<https://doi.org/10.7812/TPP/16-105>

Using right-sided precordial leads, ST-segment elevation in lead  $V_4R \geq 1.0$  mm is diagnostic of RVMI.<sup>4</sup> The ECG finding of ST elevation in lead  $V_4R$  for diagnosis of RVMI has 100% sensitivity, 87% specificity, and 92% predictive accuracy.<sup>4,5</sup> Right precordial ST-segment elevation is a transient event that may be absent in up to half of patients with RVMI 12 hours after the onset of pain.<sup>6,7</sup> ST-segment elevation in right-sided precordial leads, especially in  $V_4R$ , correlates with reduced

right ventricle ejection fraction and is associated with major complications and inhospital mortality.<sup>6-8</sup>

# ECG Diagnosis

- ❑ False-positives for V4R - PE, pericarditis, acute anteroseptal STEMI, and anteroseptal aneurysm.
  
- ❑ Other common, non diagnostic ECG findings
  - ❑ Sinus brady/tachycardia,
  - ❑ Atrial fibrillation (seen in up to one third of cases),
  - ❑ Atrioventricular blocks and
  - ❑ Right bundle branch block (poor prognosis)

# Echocardiography

- ❑ Reduced TAPSE (Tricuspid Annular Peak Systolic Excurtion)
- ❑ Right ventricular dilatation or abnormal movement of the right ventricular free wall
- ❑ Paradoxical motion of the septum
- ❑ Right atrial enlargement
- ❑ TR
- ❑ VSD/ASD

# Pulmonary or Swan Ganz Catheter

- ❑ Right atrial pressure exceeding 10 mm of Hg
- ❑ Ratio of right atrial pressure to pulmonary capillary wedge pressure exceeds 0.8 (normal  $<0.6$ )



# Cardiac MRI

- ❑ Sensitive
- ❑ Specific
- ❑ Diagnostic
- ❑ Prognostic

# Management

The first and the foremost step is to suspect and diagnose RVMI by taking right sided leads.

Early diagnosis avoids

- incorrect management,
- improves clinical outcomes,
- decreases electrical and mechanical complications,
- decreases mortality and
- improves over all short-term and long-term prognoses

# Rapid Recovery

- ❑ The systolic function of the right ventricular free wall recovers faster and more completely than the left ventricular inferior wall
- ❑ Factors that help in fast recovery and may contribute to the fact that the right ventricle is more likely to stun than to infarct are
  - ❑ Lesser mass
  - ❑ Low pressure
  - ❑ Low oxygen demand,
  - ❑ Collaterals
  - ❑ Blood flow throughout the cardiac cycle
  - ❑ Potential supply through thebesian veins



## Goals of treatment

Optimization of oxygen supply and demand

Optimization of ventricular preload

Restoration of physiologic rhythm

Inotropic support for hemodynamic compromise

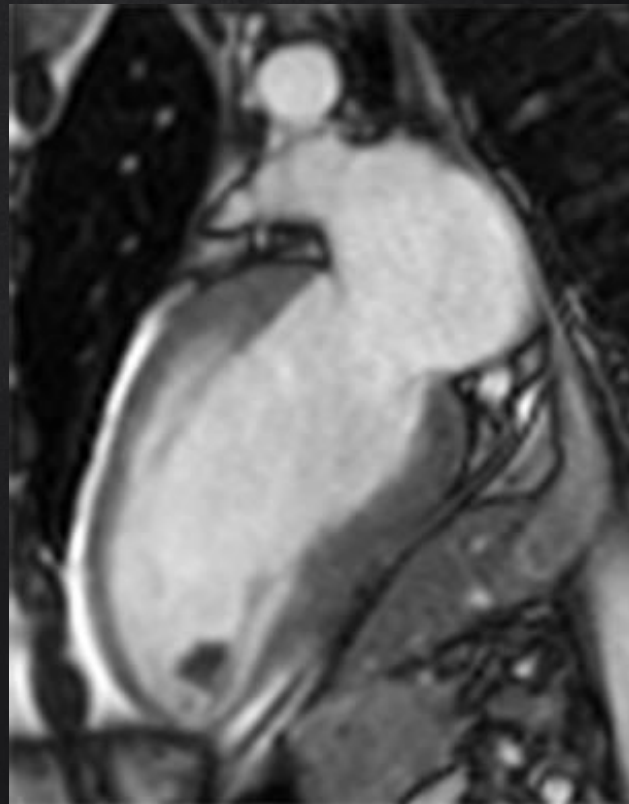
Reperfusion

Mechanical support with IABP and RV assist devices

# Optimize RV preload

If Systolic BP < 90 then give a fluid bolus of 200 ml to 500 ml to help LV filling (central venous pressure [CVP] of 15 mm Hg)

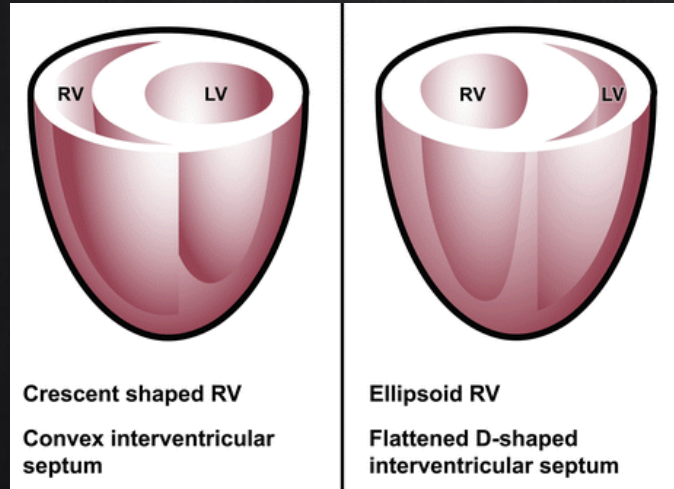
Avoid : morphine, diuretics, b-blockers, nitrates





# Pericardium mediated interventricular dependence

If patient is given too much fluid bolus  $>1$  Litre then LV function is compromised If CVP  $> 15$  cm of Hg then avoid fluids and consider inotrops as dilated RV impedes filling of LV



Ondrus T, Kanovsky J, Novotny T, Andrsova I, Spinar J, Kala P. Right ventricular myocardial infarction: From pathophysiology to prognosis. Exp Clin Cardiol 2013;18(1): 27–30.

# Inotrope stimulation of stunned right ventricular tissue

- ❑ Preferred inotrops

  - Dopamine

  - Dobutamine

  - Milrinone

- ❑ Inotrops such as Noradrenaline paired with pulmonary vasodilators

- ❑ Calcium sensitizers, such as levosimendan,

# Reperfusion

- ❑ Primary PCI is preferable to thrombolysis
- ❑ Fibrinolysis – if PCI not possible
  - ❑ 4.2 times reduction in mortality
  - ❑ Hypotension decreases efficacy
  - ❑ Tenecteplase preferred

Zeheder et al, Thrombolysis in Right Ventricular Infarction;  
JACC/1994/24

# AV synchrony

- ❑ Restoring sinus rhythm (if in atrial fibrillation) and
- ❑ Consider dual-chamber temporary pacing

# COMPLICATIONS OF RIGHT VENTRICULAR INFARCTION

- ❑ Shock (usually with little pulmonary congestion)
- ❑ Mechanical
- ❑ Patency of a foramen ovale with right-to-left shunting (hypoxemia unresponsive to supplemental oxygen)
- ❑ Pulmonary embolism
- ❑ Pacer perforations
- ❑ Pericarditis



# Key Points

- ❑ The syndrome of low output and hypotension
- ❑ Higher incidence of clinical events and risk,
- ❑ Independent predictor of prognosis
- ❑ ST elevation in V4R establishes a 30% in-hospital mortality
- ❑ Ventricular interdependence
- ❑ Right atrial mechanical function

# Take home message

- Prehospital care should be made aware to diagnose RVMI and not to administer Nitrates in patients with RV infarct
- Take Right sided ECG for V4R and posterior ECG
- Primary angiography should be immediately mobilized in such cases and Cardiologist should be involved.
- Fibrinolysis with vigilant cardiac monitoring and Tenectapase should be preferred
- Notorious to develop arrhythmias
- Guarded prognosis

# References

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4. **Right ventricular ischemic injury in patients with acute ST-segment elevation myocardial infarction: characterization with cardiovascular magnetic resonance.** Masci PG, Francone M, Desmet W, Ganame J, Todiere G, Donato R, Siciliano V, Carbone I, Mangia M, Strata E, Catalano C, Lombardi M, Agati L, Janssens S, Bogaert J Circulation. 2010 Oct 5; 122(14):1405-12.
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# Right Ventricular Physiology, Adaptation and Failure in Congenital and Acquired Heart Disease

Mark K. Friedberg  
Andrew N. Redington  
*Editors*

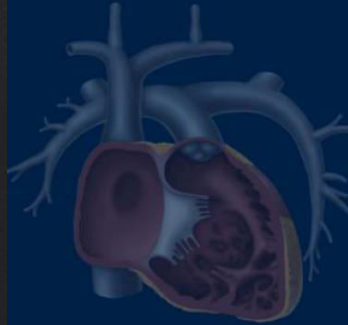
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## HUTCHISON

# COMPLICATIONS OF MYOCARDIAL INFARCTION

Clinical Diagnostic Imaging Atlas



SAUNDERS  
ELSEVIER

DVD  INCLUDED

THEROUX



# ACUTE CORONARY SYNDROMES

*A Companion to* BRAUNWALD'S  
**HEART DISEASE**



SECOND  
EDITION

SAUNDERS  
ELSEVIER



A vibrant field of red poppies in full bloom, with green stems and leaves visible. The flowers are densely packed, creating a sea of red. In the center, the word "thanks!" is written in a white, sans-serif font, enclosed within a white rectangular box with slightly irregular, hand-drawn edges.

thanks!