# State of the art on JVP

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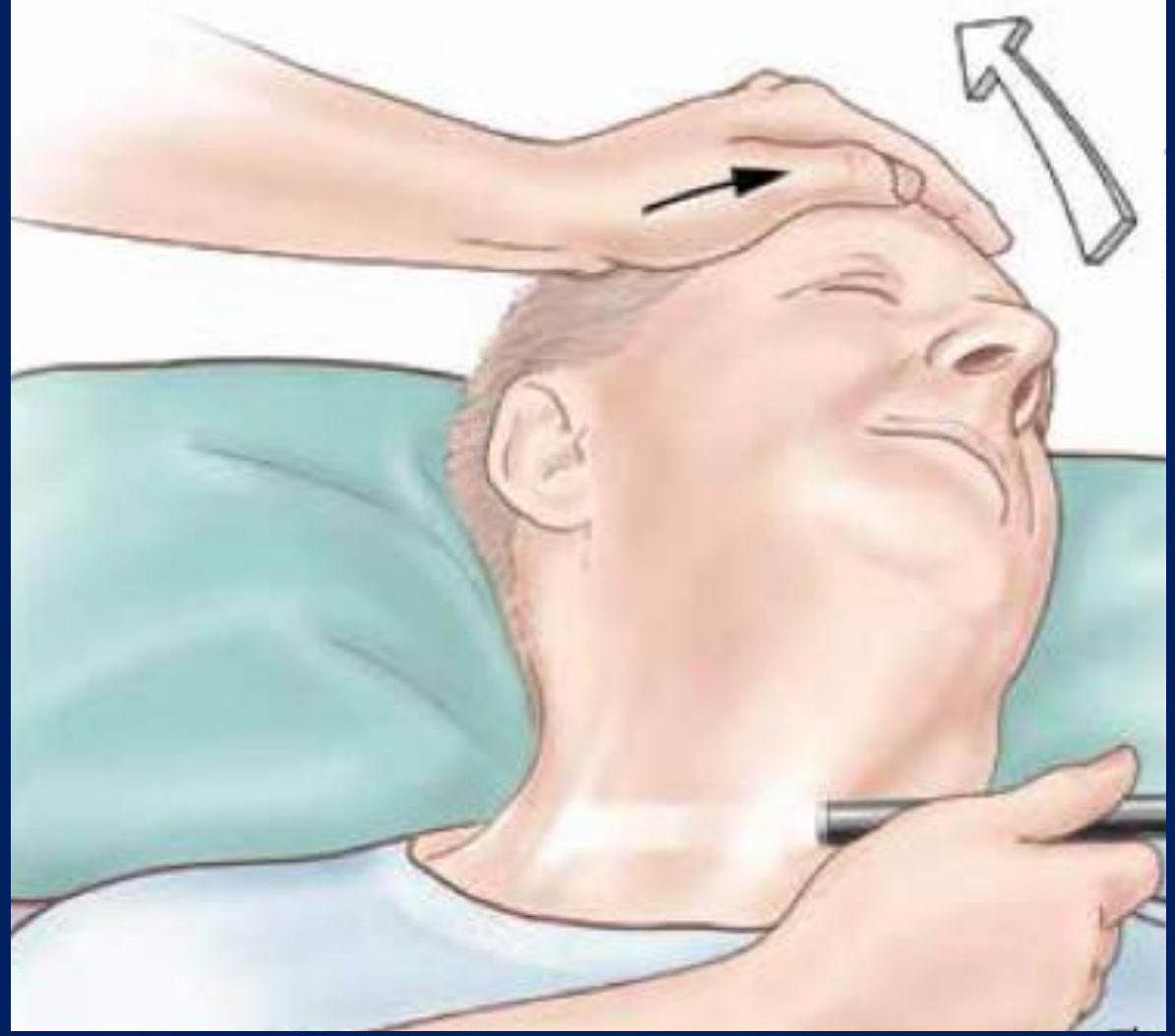
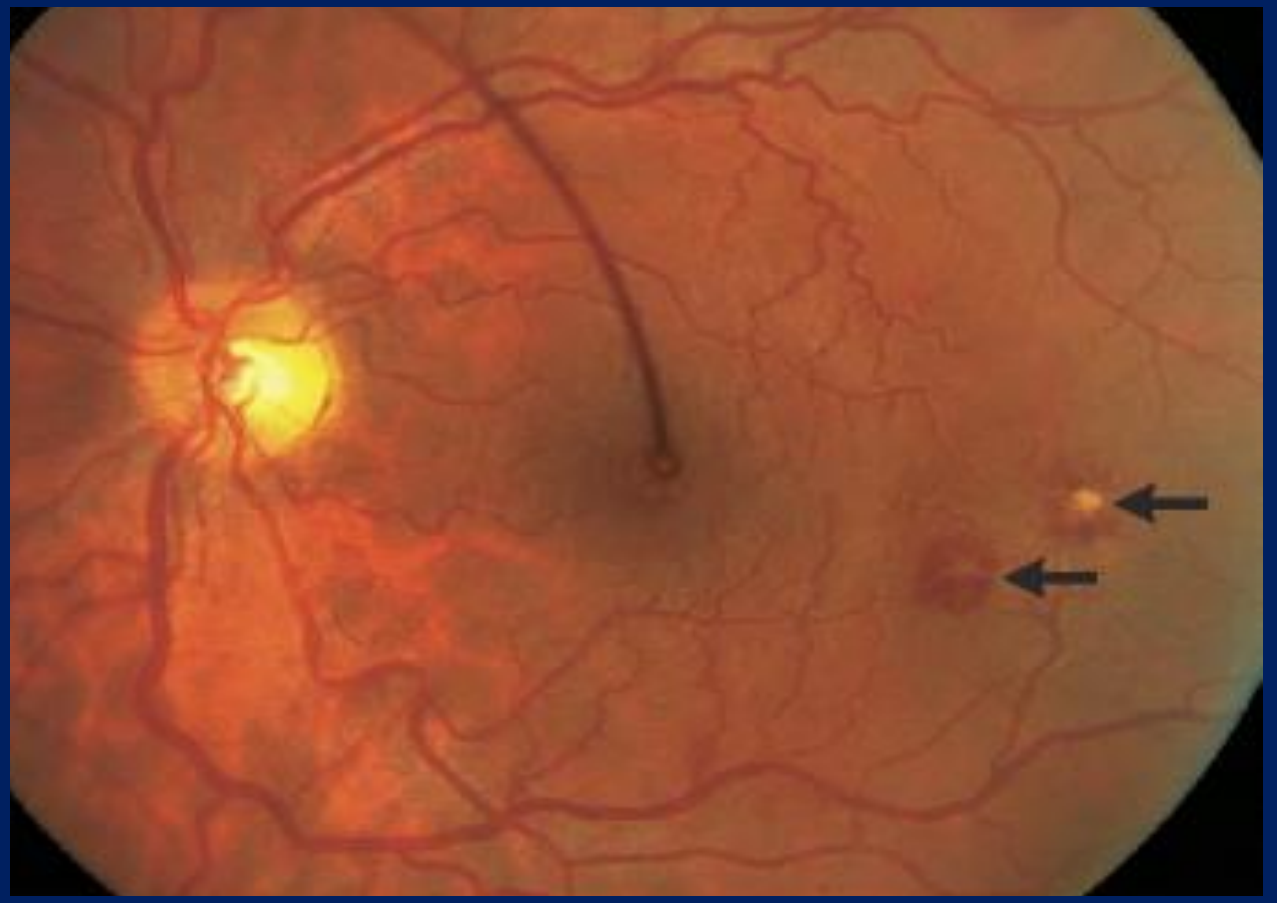
# State of the heart through JVP





Published in final edited form as:

*Cleve Clin J Med*. 2013 October ; 80(10): 638–644. doi:10.3949/ccjm.80a.13039.


# The jugular venous pressure revisited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CLINICAL MEDICINE

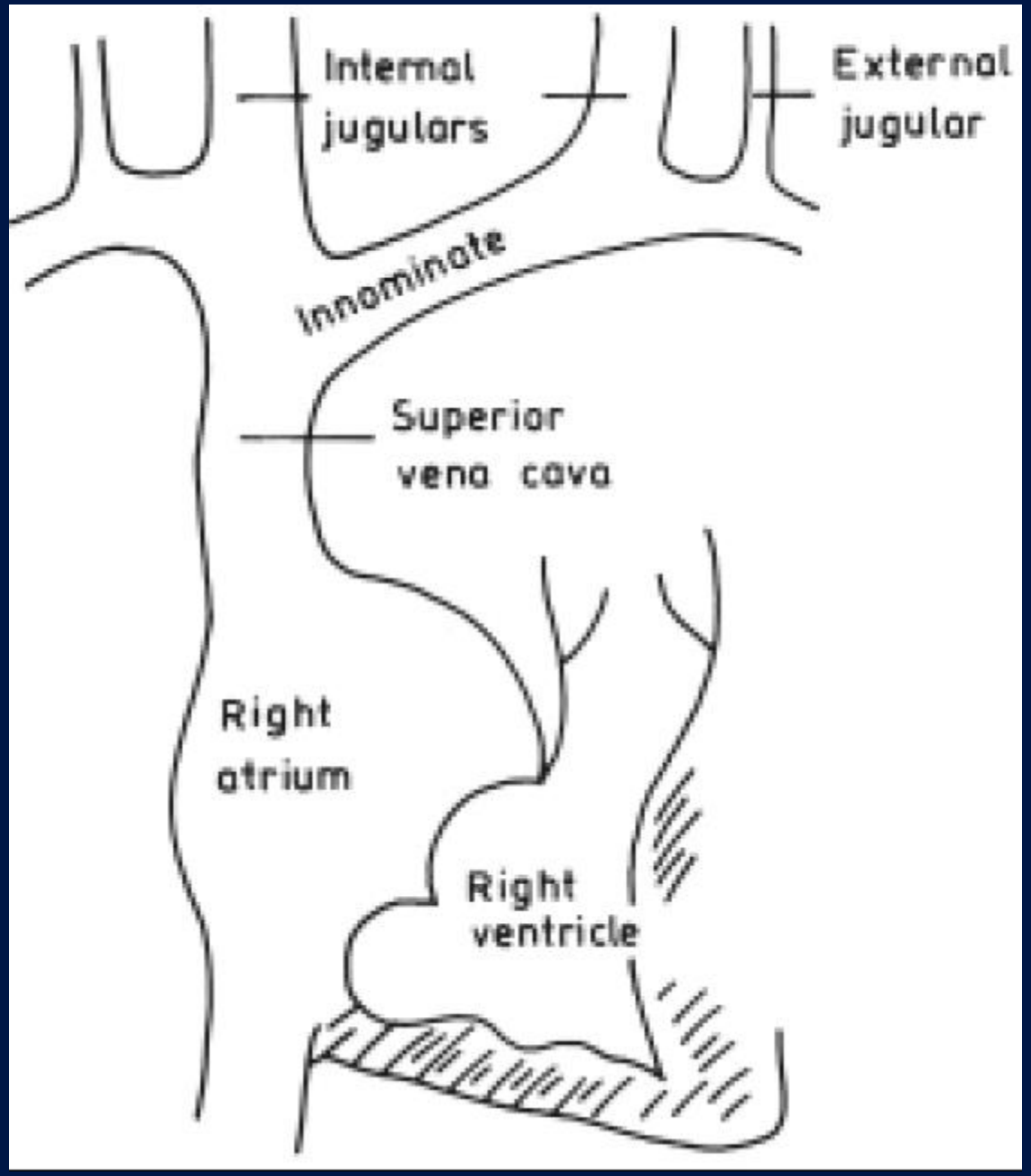
# Jugular Venous Pulse : An Appraisal

*Naveen Garg*, Nitish Garg***

*Journal, Indian Academy of Clinical Medicine • Vol. 1, No. 3 • October-December 2000*

# JVP: GENERAL CONCEPTS

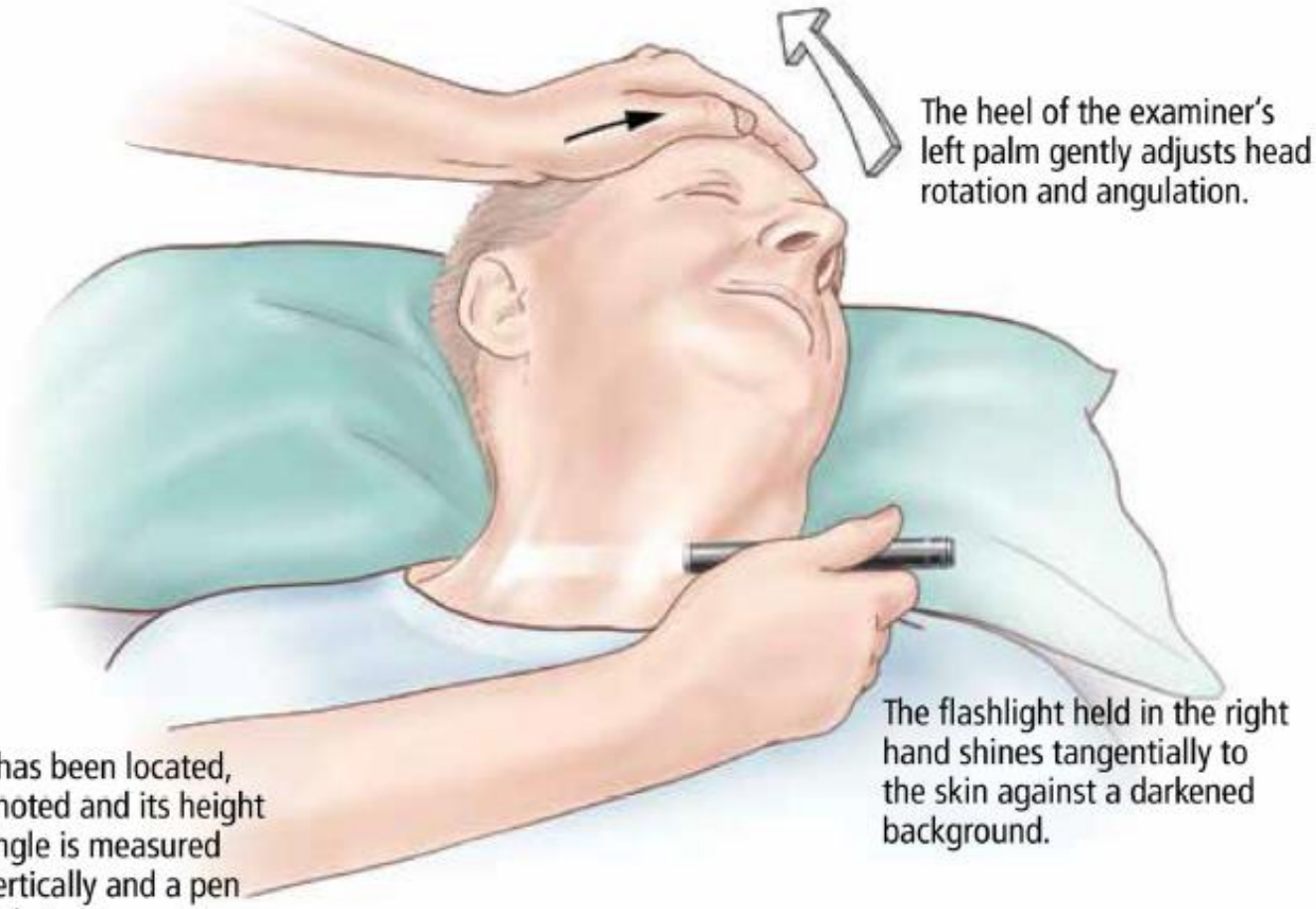
- Venous volume changes
- Internal jugular vein
- Right side better than left


Internal
jugulars
External
jugular
Innominate
Superior
vena cava
Right
atrium
Right
ventricle

# Practical aspects

## The jugular venous pressure examination

The patient lies comfortably at an angle that brings the pulsating column into view. The head lies on the pillow with the shoulders on the mattress, relaxing the sternocleidomastoid.



The heel of the examiner's left palm gently adjusts head rotation and angulation.

The flashlight held in the right hand shines tangentially to the skin against a darkened background.

Once the meniscus has been located, its anatomic site is noted and its height above the sternal angle is measured using a ruler held vertically and a pen held horizontally to that site.

# Distinguishing venous from arterial pulsation

Internal jugular pulsation :

- Is soft, diffuse, undulant
- Is not palpable
- Has two crests and two troughs per cardiac cycle
- Has crests that do not coincide with the palpated carotid pulse)
- Has higher pressure in expiration, lower in inspiration (exceptions may be seen when Kussmaul physiology is present)
- Has pressure that rises with abdominal pressure
- Is obliterated by light pressure at the base of the neck.
- In addition to the above criteria, a wave whose movement is predominantly a descent is nearly always venous.

# JVP: static observation and dynamic changes

- CVP
- Type of venous pattern
- HJR
- Effects of respiration

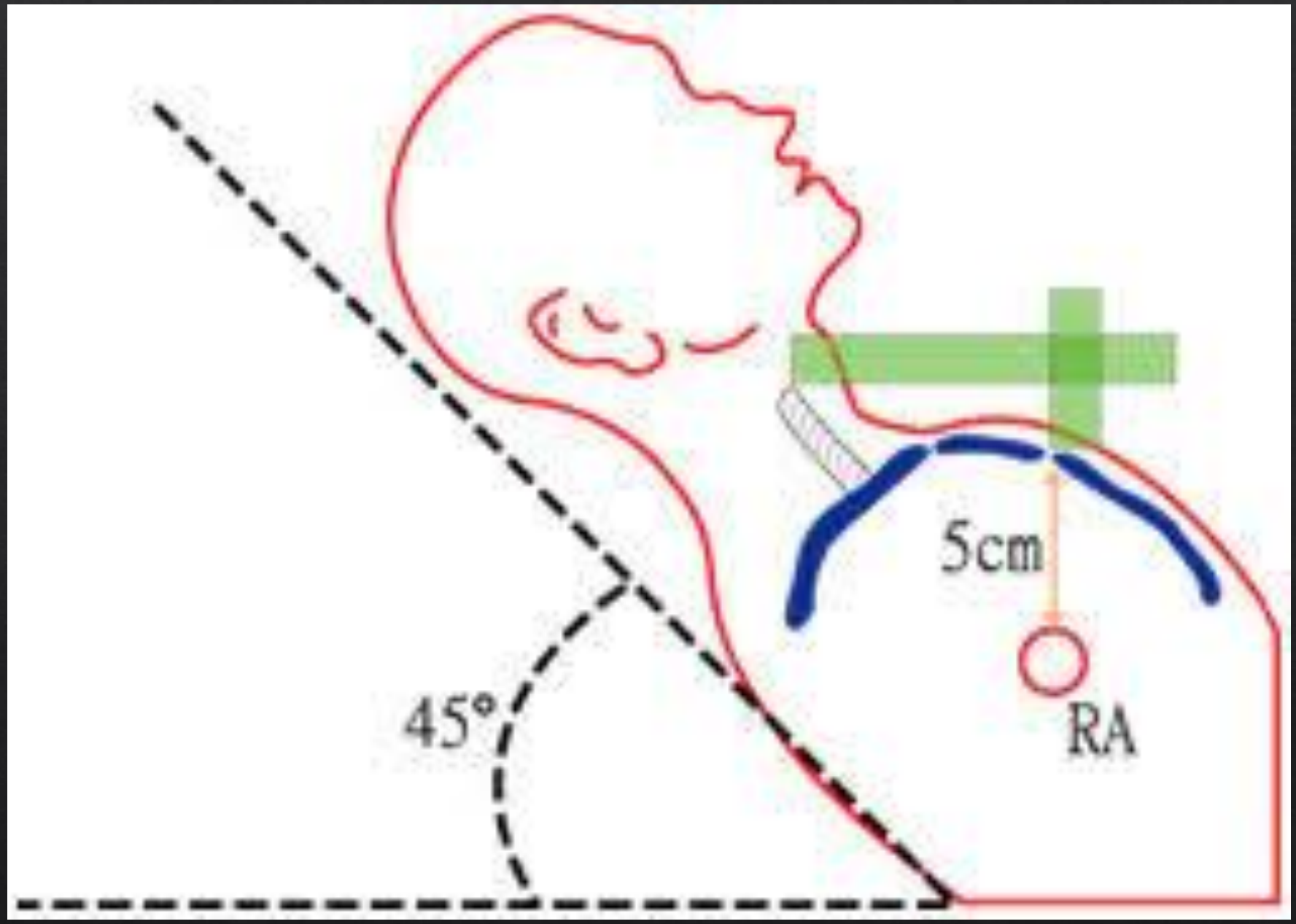

5cm
RA
45°

**Table 2 | Studies of clinical assessment of jugular venous pressure (JVP) for estimation of central venous pressure (CVP)**

| Reference | What was done | Patients | Clinicians | No of patients (observations) | Summary of study conclusions |
|---|---|---|---|---|---|
| Davison,[65] 1974, USA | External and internal JVP versus invasive CVP | "Seriously ill" | Two clinicians | 39 (128) | IJV not usually visible. EJV measurement correlated poorly with CVP |
| Connors,[66] 1983, USA | JVP versus invasive CVP | ICU | Medical student to attending physician | 62 (310) | JVP underestimated CVP in ICU patients |
| Ducas,[67] 1983, USA | JVP and HJR versus invasive CVP | Not defined | Not defined | 48 | CVP predicted from JVP in 44/48 comparisons |
| Cook,[68] 1990, USA | JVP versus invasive CVP | ICU | 15 different clinicians; medical student to staff physician | 50 (150) | JVP inaccurate in ICU patients |
| Stein,[69] 1997, USA | JVP versus IVC ultrasound RAP and invasive CVP | Patients with severe CHF | Not stated | 22 | Clinical estimates of RAP from JVP were accurate when RAP was normal, but systematically underestimated elevated RAP |
| Vinayak,[70] 2006, USA | External JVP versus invasive CVP | Critically ill in ICU | Student to attending | 35 (118) | JVP using EJV highly reliable for assessing elevated CVP (AUC 0.97, 95% CI 0.92 to 1.00) by attending physicians |
| Sinisalo,[71] 2007, Finland | JVP with patient sitting versus invasive CVP | Pre-cardiac catheterisation | Two cardiologists | 96 | JVP using IJV in sitting patients had sensitivity of 65% and specificity of 85% to identify elevated CVP |
| Brennan,[72] 2007, USA | JVP versus invasive CVP and indirect comparison with ultrasound IVC | Pre-cardiac catheterisation | Four internal medicine residents | 40 (44) | IJV not identified in 37% of patients. Sensitivity of JVP for elevated CVP 14% |
| Deol,[73] 2011, USA | External and internal JVP clinically and by ultrasound versus invasive CVP | ICU | Not defined | 38 | EJV better than IJV in correlation with CVP, but ultrasound superior to both. Clinical and ultrasound measurement both underestimated CVP. |
| Rizkallah,[30] 2014, Canada | JVP clinically versus ultrasound RAP | Routine echocardiography patient population | One student, one resident, one fellow | 325 | JVP sensitivity 86% by cardiology fellow |

AUC=area under curve; CHF=congestive heart failure; EJV=external jugular vein; HJR=hepatojugular reflux; ICU=intensive care unit; IJV=internal jugular vein; IVC=inferior vena cava; RAP=right atrial pressure.

# CVP through JVP: clinical pills

- When unequal, the jugular venous pressure always underestimates the right atrial pressure.
- The lack of correlation is less evident at lower venous pressures.
- In the presence of congestive heart failure, the right atrial pressure is at least as high and perhaps higher than the jugular venous pressure. Hence, if the jugular venous pressure is high, further treatment, especially diuresis, is needed.
- A jugular venous pressure of zero implies a euvolemic state

# Abdomino (Hepato) -jugular reflux

**This can be tested by applying firm pressure to the peri-umbilical region for 10-30 seconds with the patient breathing quietly while the jugular veins are observed; increased respiratory excursions or straining should be avoided.**

**In normal subjects, jugular venous pressure either does not alter significantly or rises less than 3 cm H2O and only transiently for less than 10 sec, while abdominal pressure is continued (sensitivity 24-73%, specificity 96-100%).**

**The dysfunctioning right ventricle is unable to accept the increment in blood volume due to enhanced venous return due to abdominal compression and is transmitted to the neck veins. In patients with right ventricular failure, which often results from left sided heart failure, the venous pressure either rises rapidly or remains elevated by 4 or more centimetres until pressure is released.**

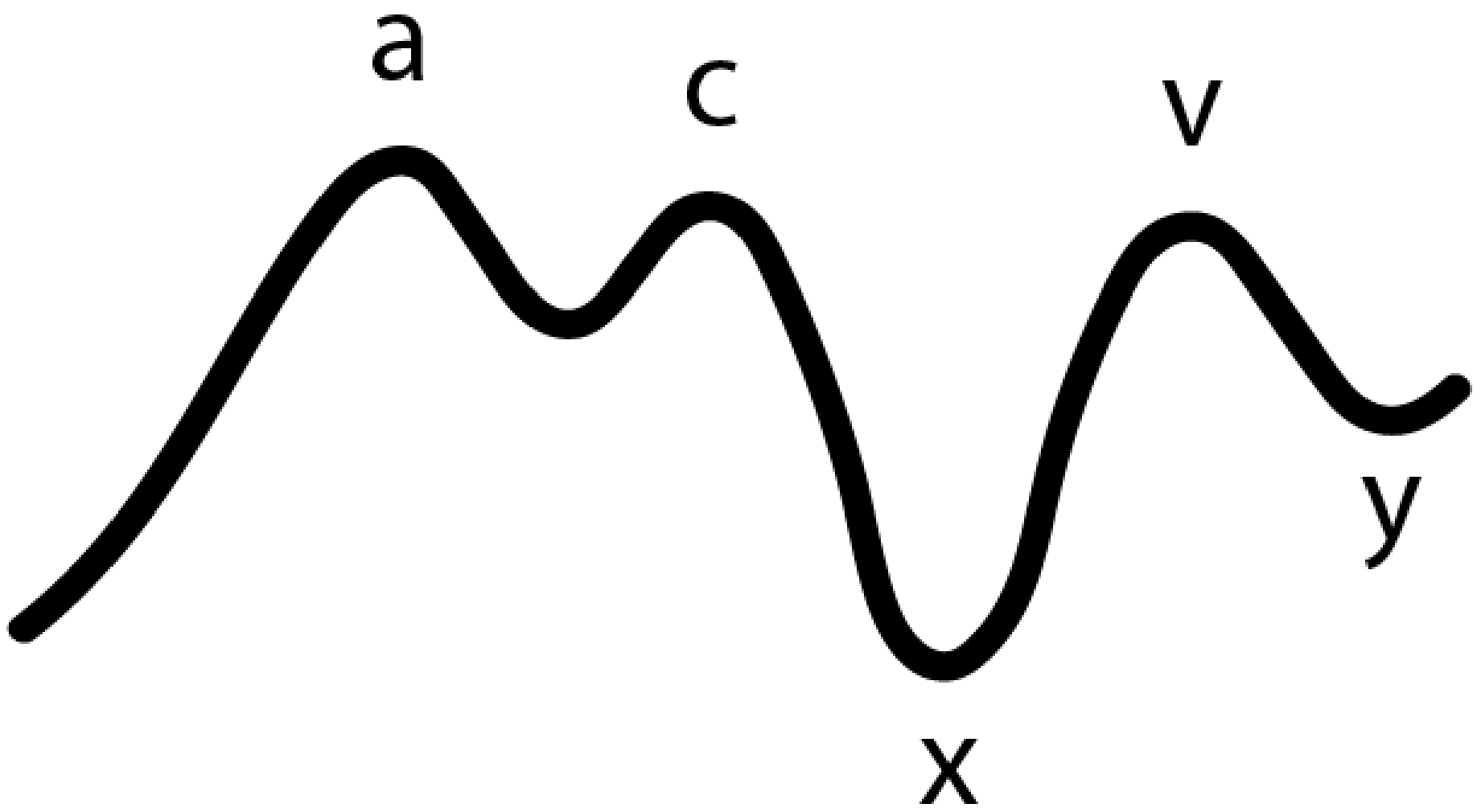
**TABLE 2** Utility of Clinical Findings in Detecting PCWP >22 mm Hg in Patients With Advanced Heart Failure in ESCAPE

| Clinical Finding | Sensitivity | Specificity | PPV | NPV |
|---|---|---|---|---|
| Rales ≥1/3 | 15 | 89 | 69 | 38 |
| Edema ≥2+ | 41 | 66 | 67 | 40 |
| Orthopnea ≥2 pillows | 86 | 25 | 66 | 51 |
| JVP ≥12 mm Hg | 65 | 64 | 75 | 52 |
| HJR | 83 | 27 | 65 | 49 |

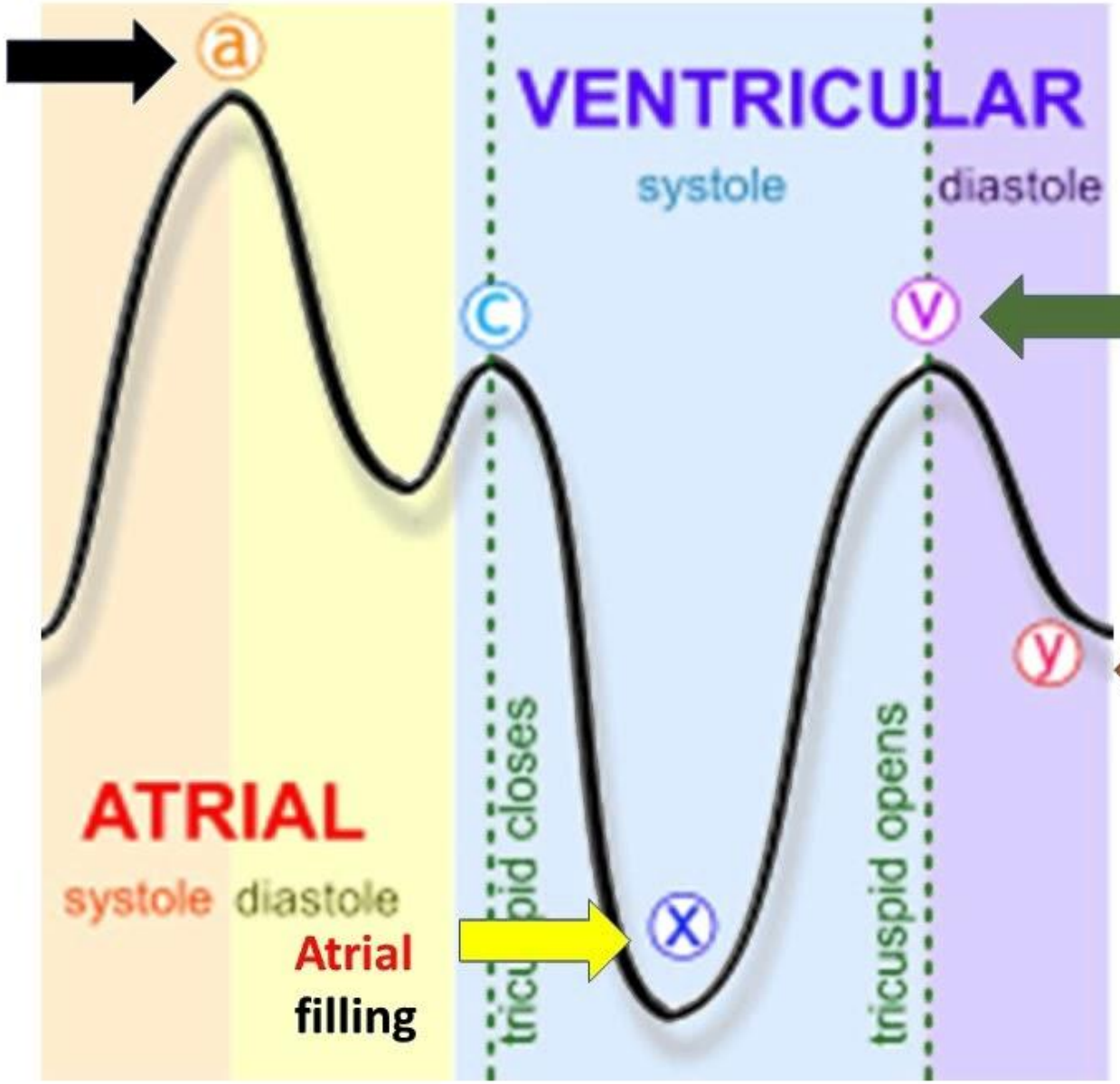
Drazner MH et al , Circ Heart Failure 2008;1:170

# JVP: static observation and dynamic changes

- CVP
- Type of venous pattern
- HJR
- Effects of respiration


a
c
v
x
y

Atrial
Contraction

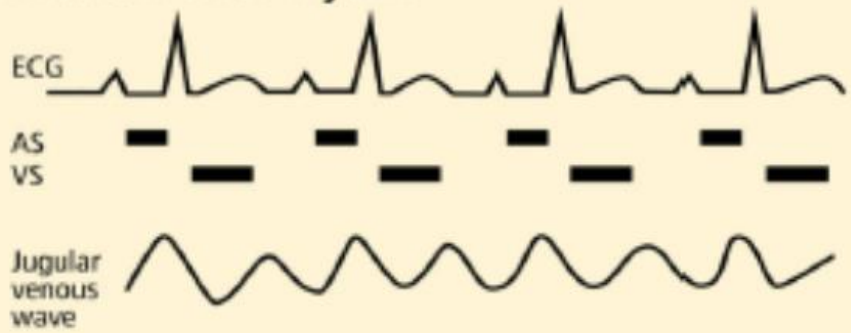



Peak pressure
in right atrium just
before opening of
tricuspid valve

Opening of
tricuspid valve
Followed by
Passive emptying
Of atrium

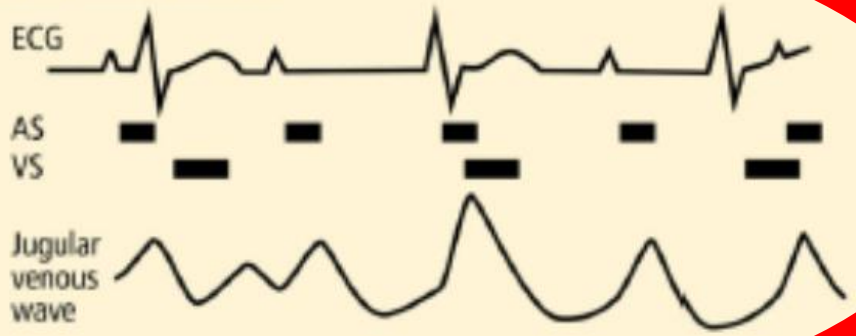
## Jugular venous waveforms in various arrhythmias[a]

### Normal heart in sinus rhythm

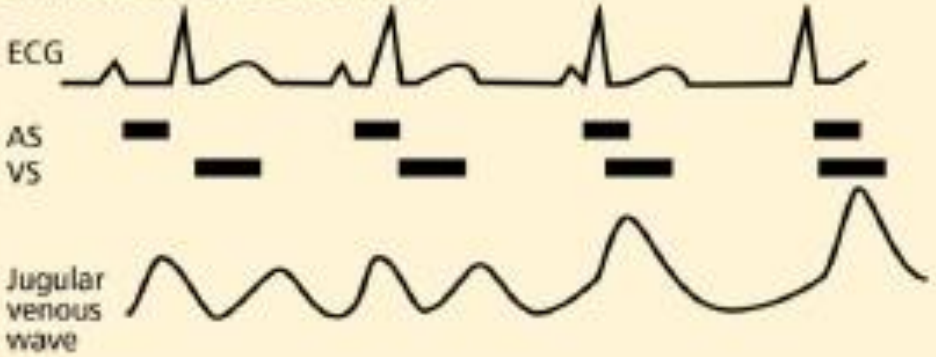



### Premature ventricular beat coinciding with atrial systole[b]

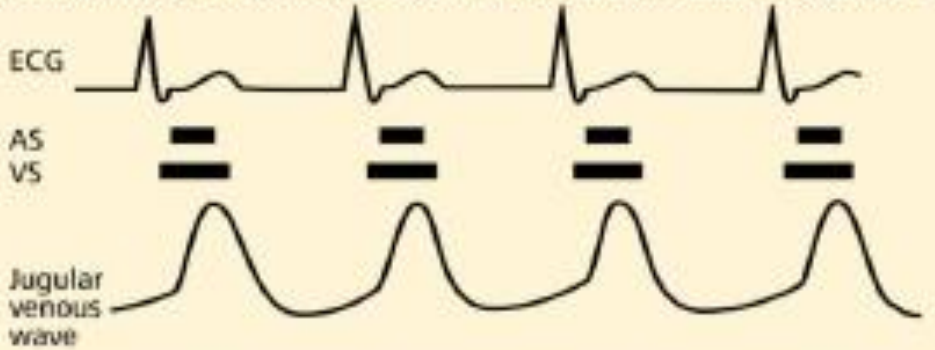

### Complete heart block[b]



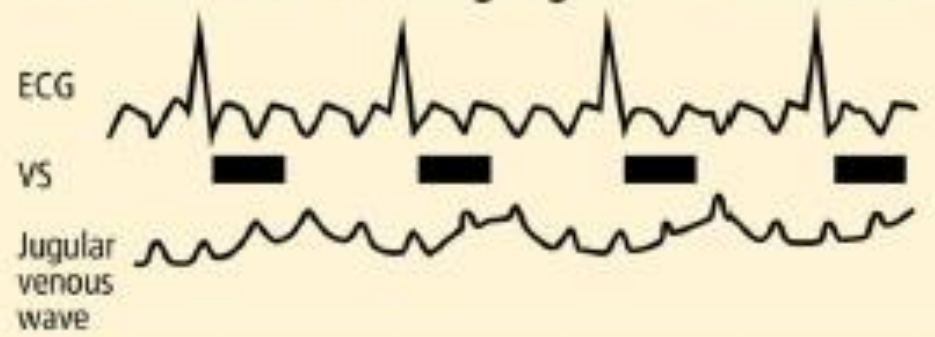

### Atrioventricular dissociation[b]

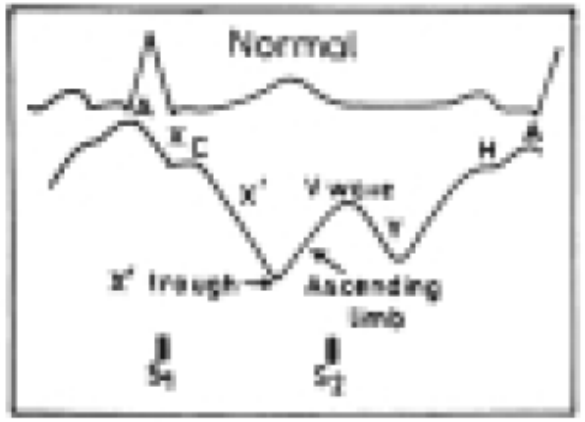



### Atrioventricular junctional rhythm with repetitive giant *a* waves




### Atrial flutter with block showing regular fine oscillations[c]






D. Atrial Septal Defect


A. Tricuspid Regurgitation


E. Atrial Fibrillation


B. Tricuspid Stenosis


F. First Degree AV Block

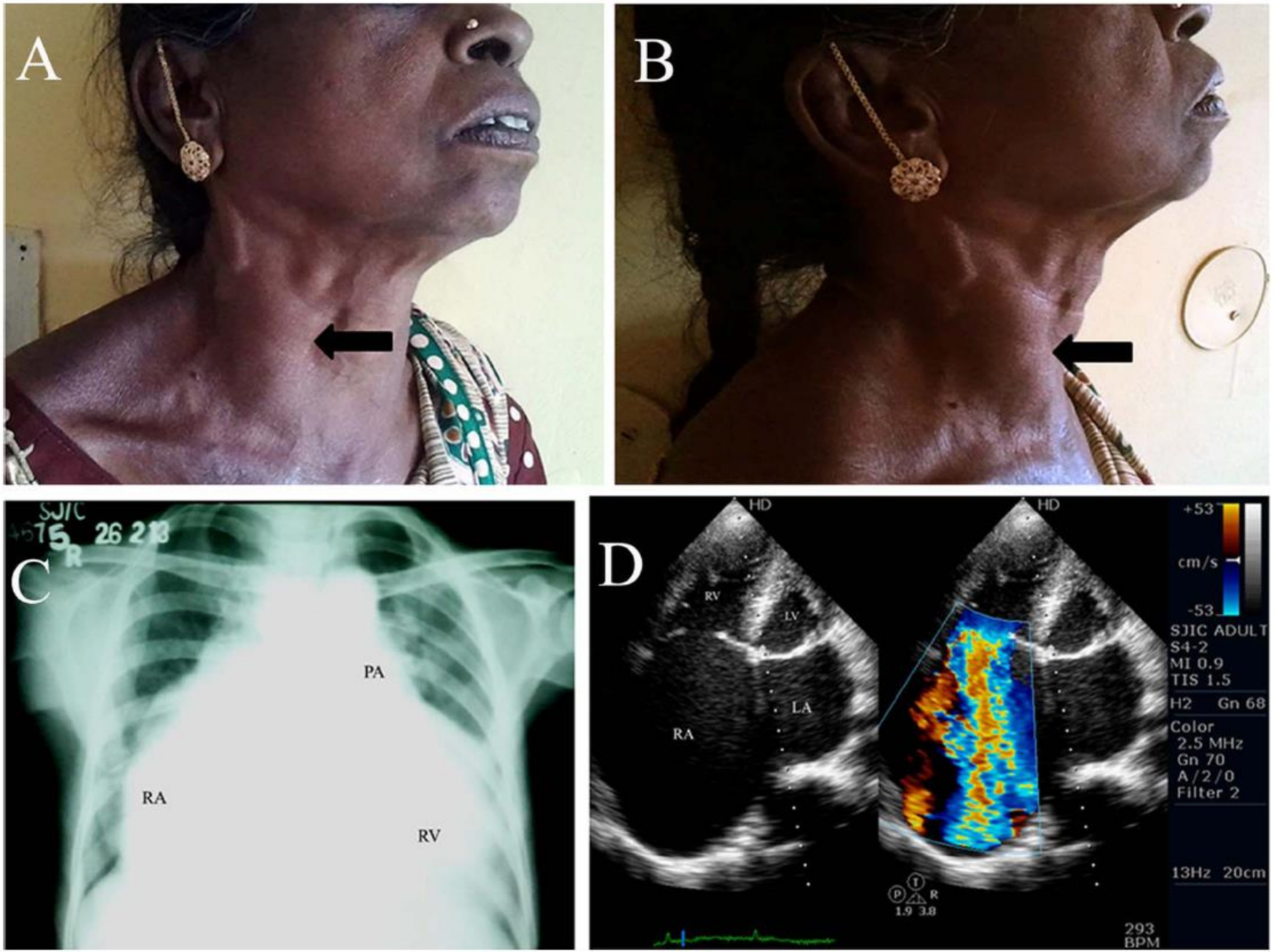

C. Constrictive Pericarditis


G. Complete AV Block

# Abnormal right heart hemodynamics

**Large v waves** (Lancisi sign)—These surges, replacing the usual x descent in systole, are seen in tricuspid insufficiency when the right atrium and its venous attachments are not protected from the right ventricular systolic pressure. High right ventricular pressure will obviously enhance this systolic surge.

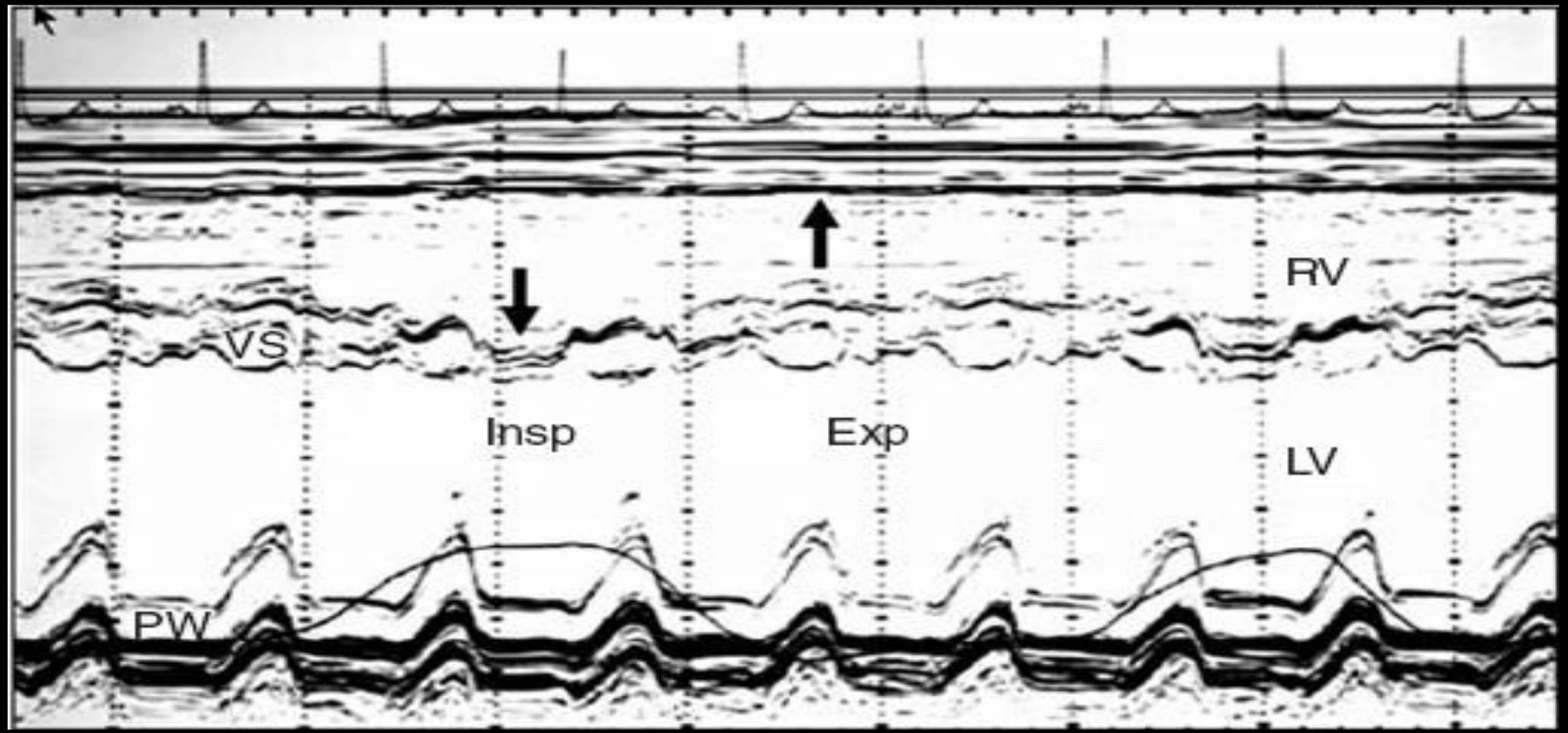
**Large a waves**—These reflect resistance to right atrial outflow and may be seen when right ventricular compliance is reduced by hypertrophy from chronic pressure overload or in tricuspid stenosis

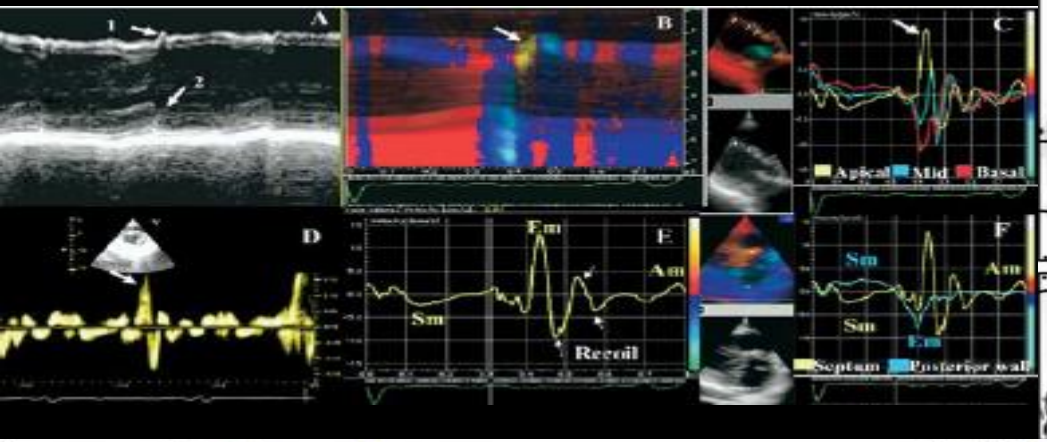

A
B
C
PA
RA
RV
D
HD
HD
RV
LV
LA
RA
+53
cm/s
-53
SJIC ADULT
S4-2
MI 0.9
TIS 1.5
H2 Gn 68
Color
2.5 MHz
Gn 70
A/2/0
Filter 2
13Hz 20cm
1.9 3.8
293
BPM

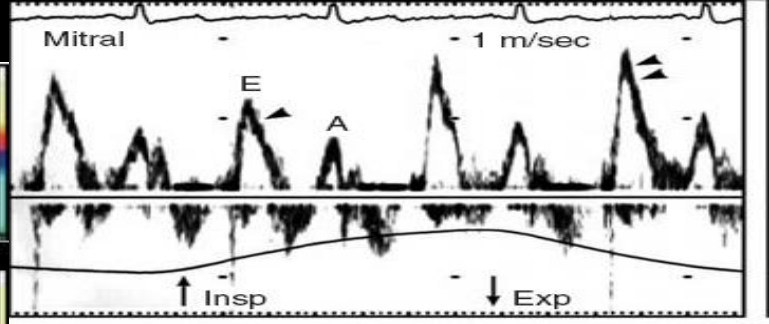
# Pericardial disease

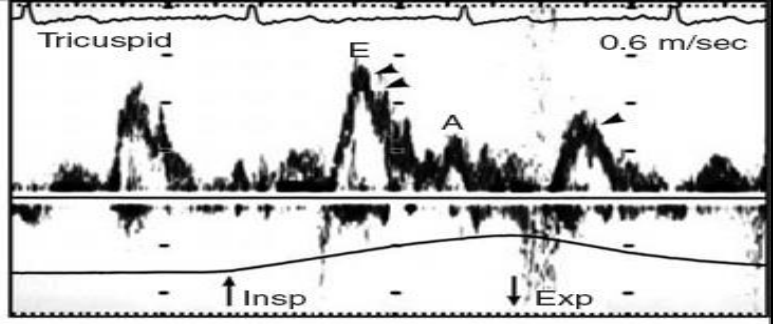
**Kussmaul sign** is the paradoxical increase in jugular venous pressure with inspiration, observed in conditions associated with limited filling of the right ventricle. It is typically associated with constrictive pericarditis, although it occurs in only a minority of people with this condition.
It may also be seen in restrictive cardiomyopathy, massive pulmonary embolism, right ventricular infarction, and tricuspid stenosis

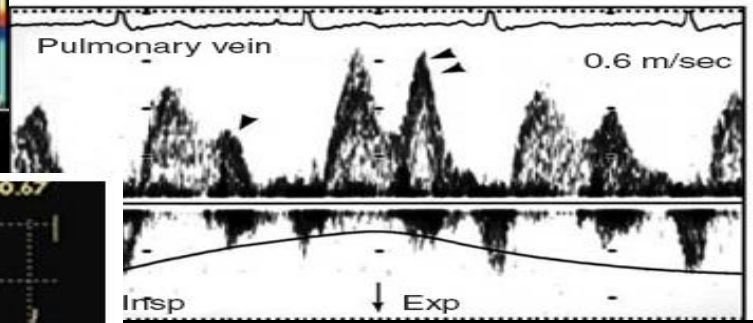
**Exaggerated y descent** is typically seen in pericardial constriction, in which the high pressure of the v wave falls rapidly at the onset of diastole, given initial minimal right ventricular resistance. Flow is abruptly stopped when the intrapericardial space is filled.

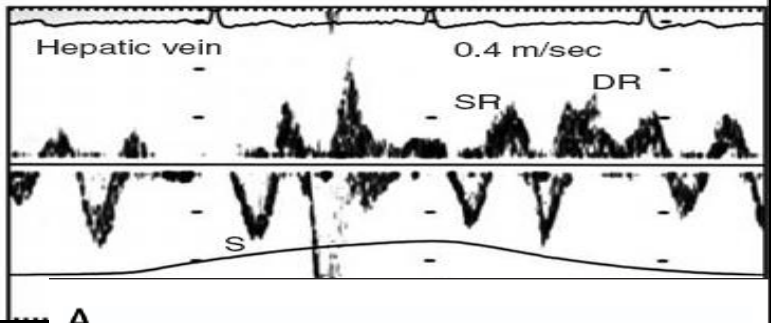

RV
VS
Insp
Exp
LV
PW

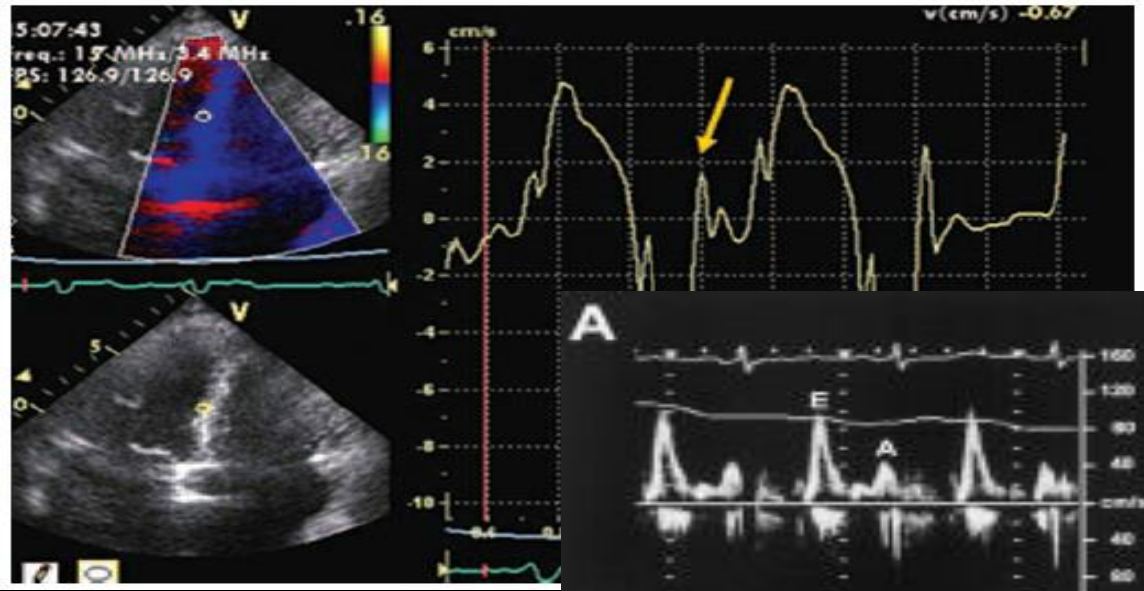

A
B
C
D
E
F
Em
Am
Sm
Recoil
Apical
Mid
Basal
Septum
Posterior wall

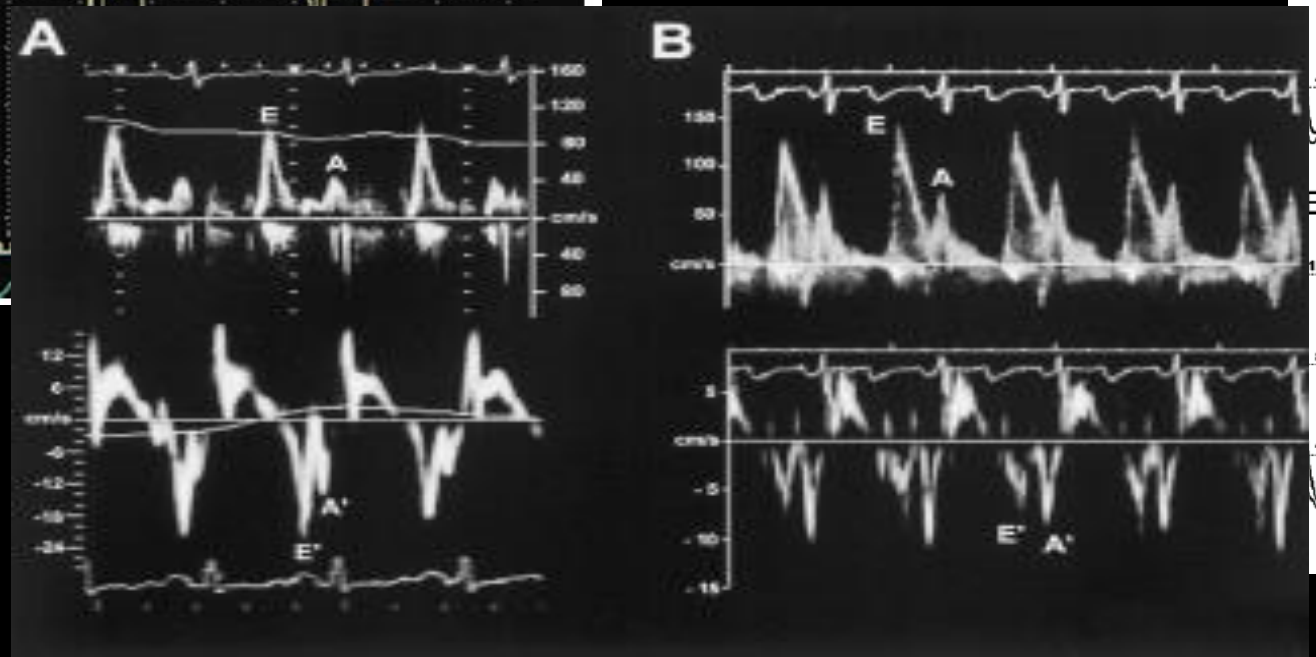

Mitral
1 m/sec
E
A
Insp
Exp

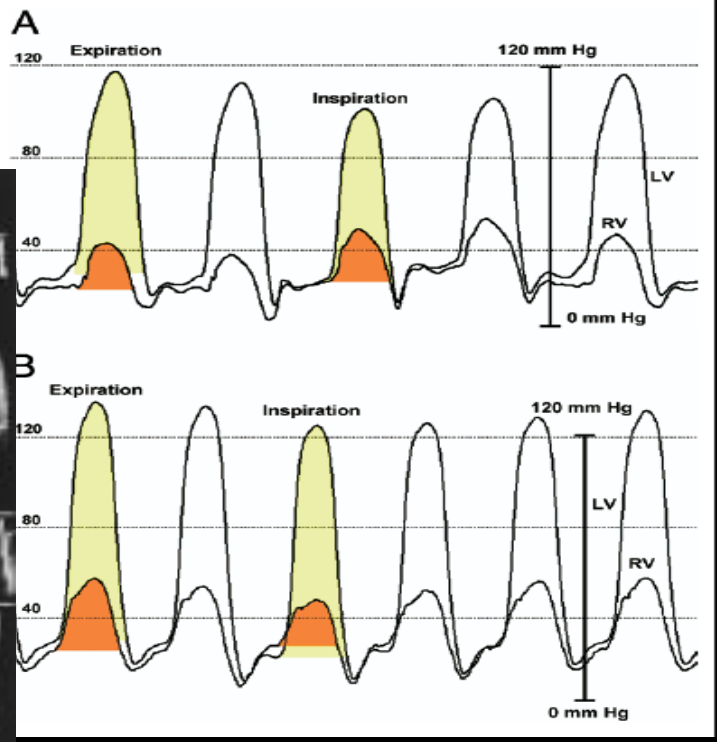

Tricuspid
0.6 m/sec
E
A
Insp
Exp

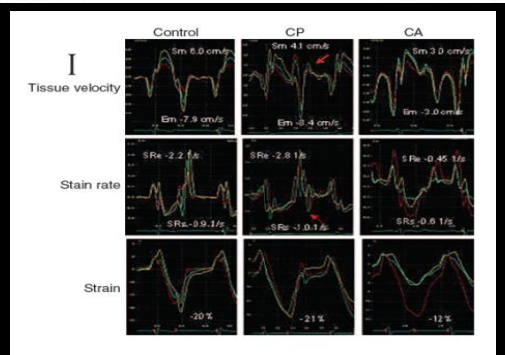

Pulmonary vein
0.6 m/sec
Insp
Exp


Hepatic vein
0.4 m/sec
SR
DR
S


V
cm/s
v(cm/s) -0.67


A
B
E
A
E'
A'


A
Expiration
Inspiration
120 mm Hg
0 mm Hg
LV
RV
B
Expiration
Inspiration
120 mm Hg
0 mm Hg
LV
RV


I
Control
CP
CA
Tissue velocity
Stain rate
Strain

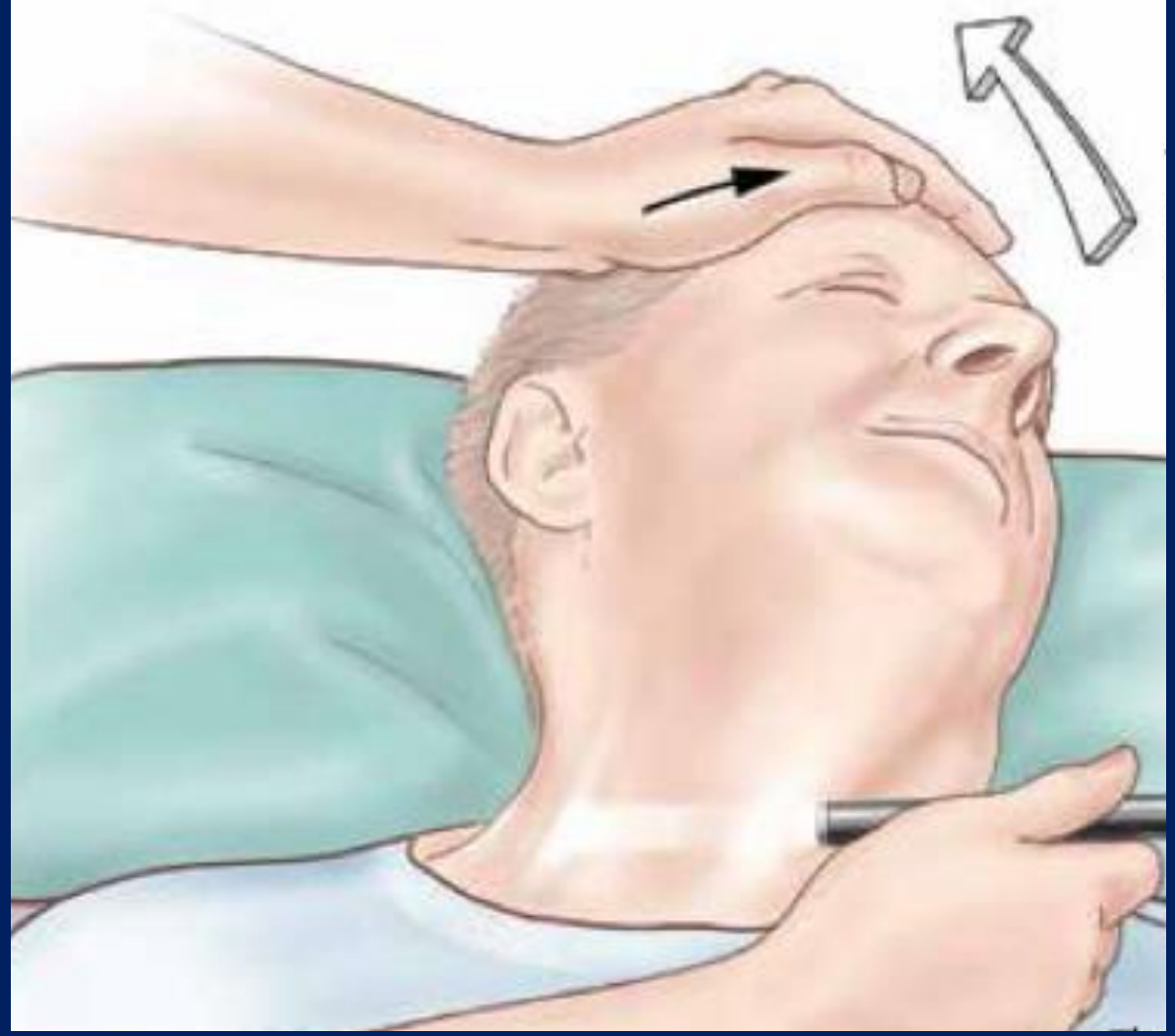
# Metaphoric definitions of CP and RCM

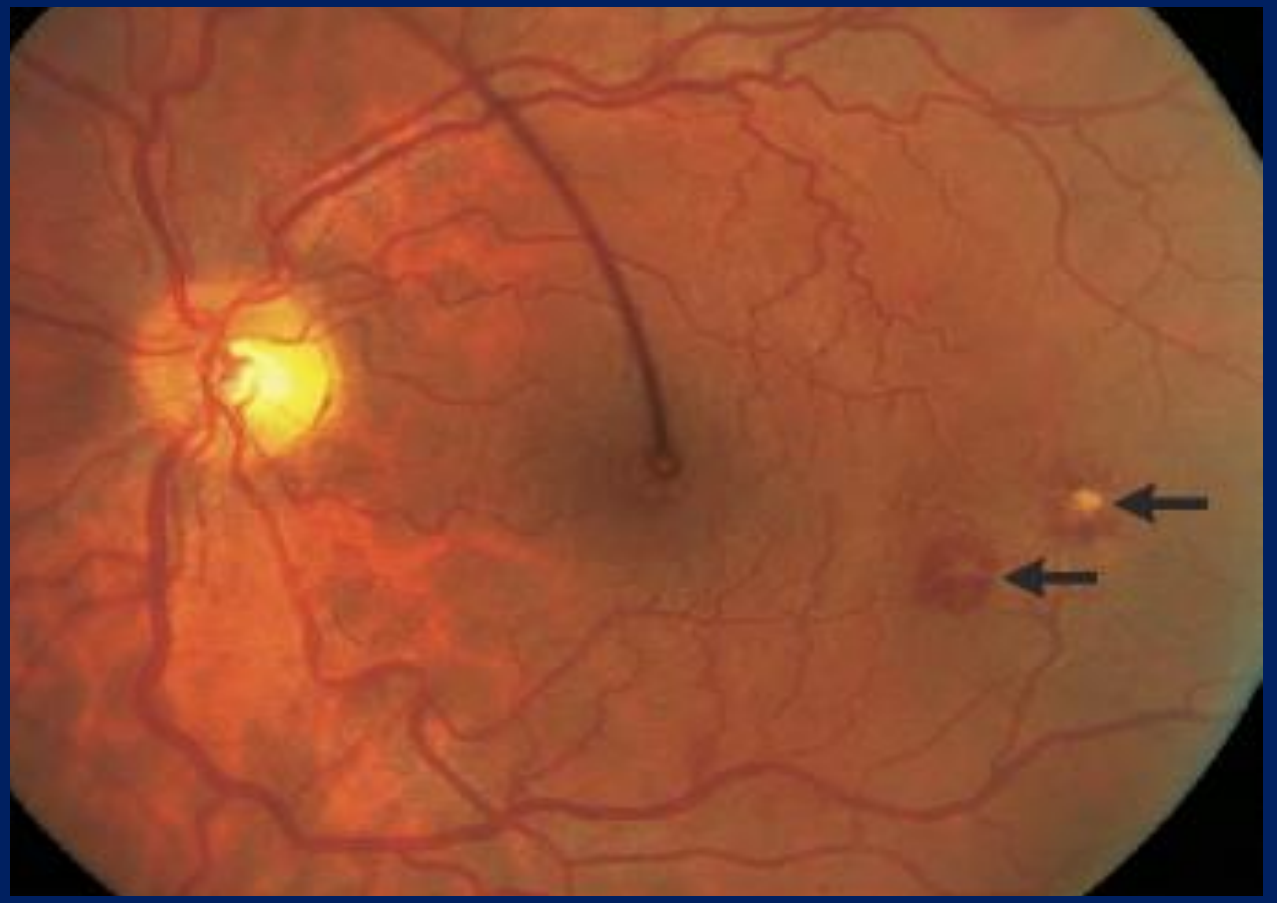
## Constrictive Pericarditis

- The fight of the RV against the LV during inspiration, for the dominance of the pericardial space in a context of normal myocardium

## Restrictive CM

- The fight of atria against ventricles in a context of diseased myocardium





# Shared characteristics of ideal detectives and clinicians

- Ability in observation
- Ability in "deduction"
- Culture (Knowledge)

- Ability to spot inconsistencies

Sir Arthur Conan Doyle