



Cardiac Tamponade

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Objectives

- Understand pathophysiology, etiology and risk factors
- Familiarize with clinical presentation
- Review Differential diagnosis and diagnostic tools and treatment

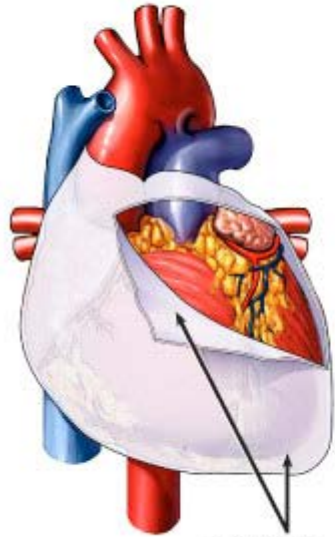
Definition

- Cardiac tamponade occurs when pericardial fluid accumulates to the point that restricts cardiac filling and function.
- Rare in children but can occur at any age, including neonates.

Anatomy

Initial Condition

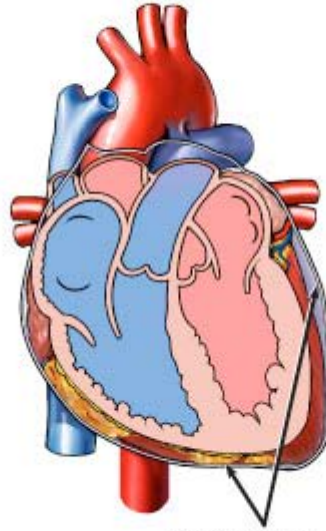
Anterior view



Pericardium
covering the heart

Initial Condition

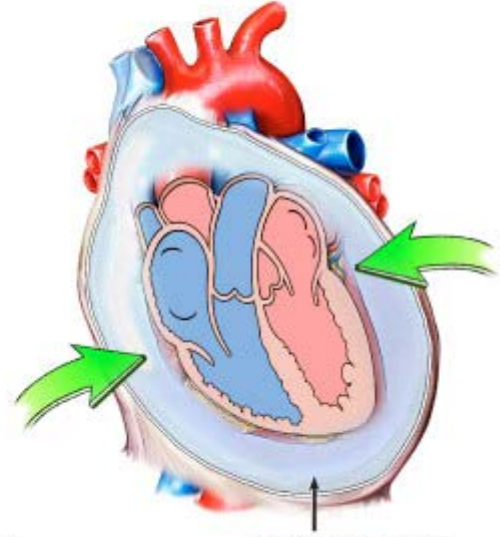
Anterior cut-away view



Cut edge of the pericardium
surrounding the heart

Resulting Cardiac Tamponade

Anterior cut-away view



The pericardial sac fills
with fluid causing severe
compression of the heart

Physiology

Pediatric patients can be more affected than adults

- Children are less capable of increasing cardiac contractility and tolerate pericardial fluid accumulation.

$$CO = HR \times SV$$

- Younger children already have elevated Heart Rate
- Stroke Volume can be greatly impacted and reduced by pericardial effusion
 - Compression of the atria restricts diastolic filling.
 - Compression of the ventricles reduces end-diastolic volume.
 - Both reduce stroke volume and can also impair coronary perfusion.

Etiology

- Acute Fluid Accumulation
- Chronic

Risk Factors

- Acute Trauma (obviously)
- Presence of indwelling central line
- Recent cardio-thoracic surgery/procedure
 - Can occur “early” – in 1st week post-procedure
 - Can also occur “late” – up to 6 months after intervention
- Malignancy
- Heart Failure
- Infection
- Rheumatic Fever
- Collagen Vascular Diseases (ex, Lupus)
- Hypothyroidism
- Severe Renal Disease / Uremia
- Coagulopathy

Clinical Presentation

- Beck's Triad
 - Hypotension
 - Sensitivity 26%
 - ~64% patients can maintain Systolic BP >100
 - Jugular Venous Distention
 - Uncommon in pediatric
 - Sensitivity 76%
 - Unreliable in hypovolemic patients
 - Muffled Heart Sounds
 - Variable due to body habitus and position
 - Sensitivity 28%

Physical Signs

- Tachycardia
 - Earliest signs but sensitivity 69%
- Tachypnea
 - Sensitivity 87-89%
- Pulsus paradoxus
 - Limited in agitated child
 - Not widely used in pediatrics

Differential Diagnosis

Acute:

- Myocardial Infarction (characteristic ECG changes)
- Pulmonary Embolism (no Pulsus Paradoxus)
- Aortic Dissection (no JVD)

Chronic:

- Constrictive Pericarditis, Congestive Heart Failure and Late stage Liver Disease. (Echo can distinguish amongst them)

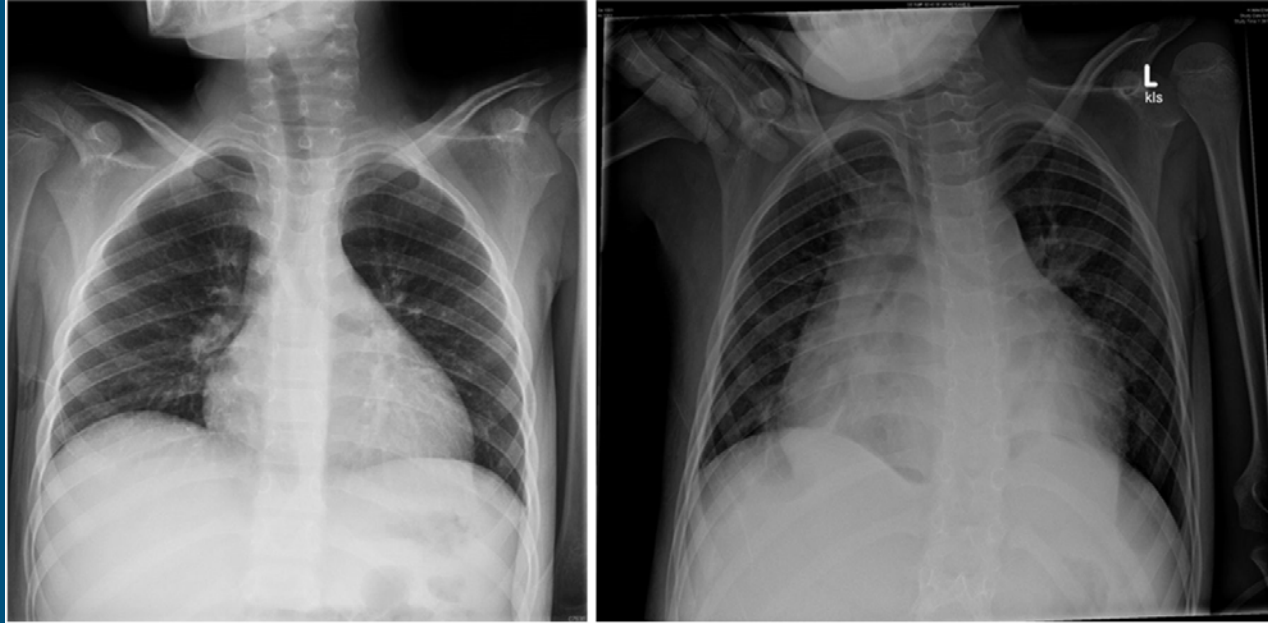
Diagnosis

- Clinical diagnosis can be challenging especially in pediatric patients
 - Hypotension – develops late in children
 - Venous distention of neck veins – hard to see
 - Diminished heart sounds – hard to hear in a irritable child
 - Tachycardia & tachypnea are non-specific

Imaging

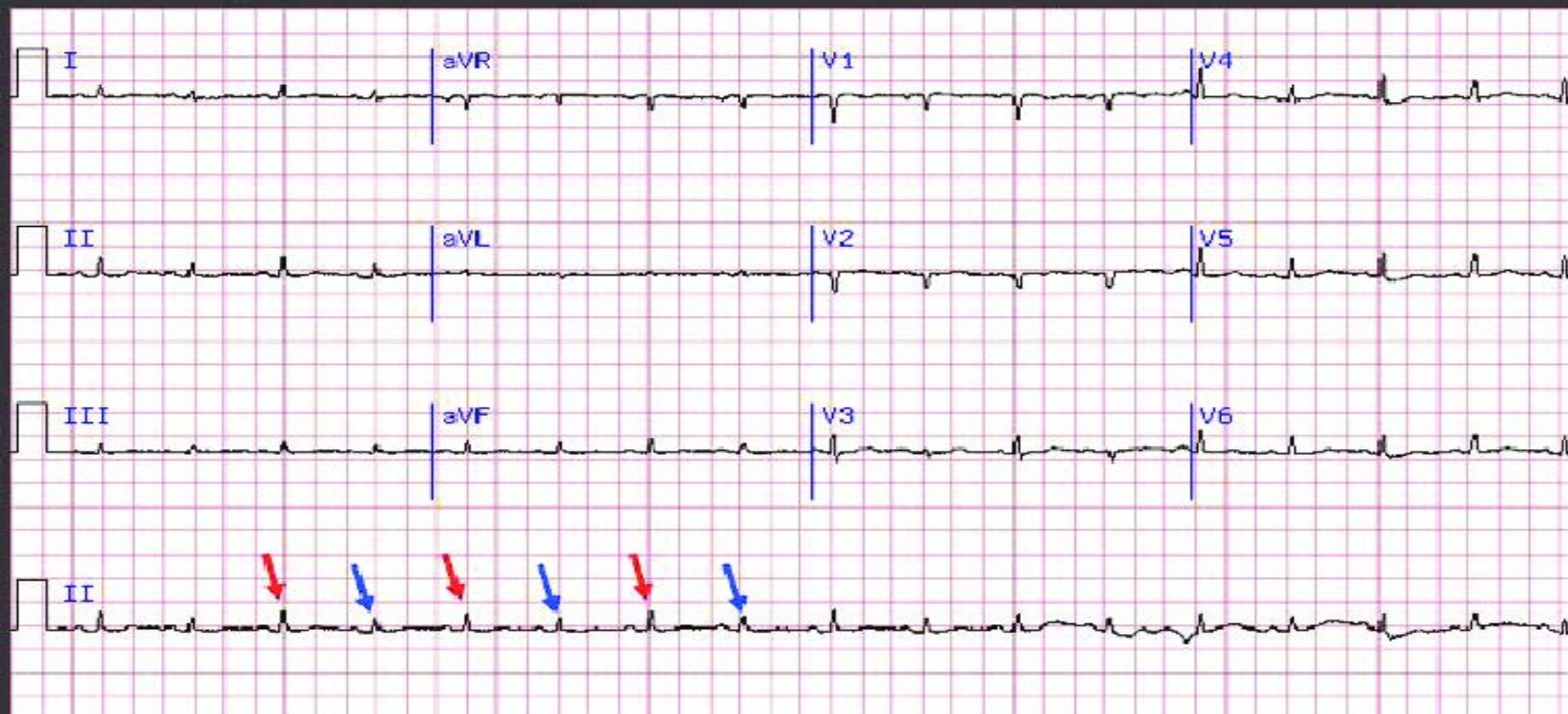
- Chest XR
 - Cardiomegaly (d/t pericardium effusion)
 - Late finding
 - Might not be appreciable if <200 ml effusion
 - Normal cardiac silhouette does NOT rule out tamponade
- ECG
 - Low voltage complex (QRS)
 - Electrical Alternans (beat-to-beat voltage and polarity alteration)
 - Sinus Tachycardia

CXR



Cardiac tamponade →

- Sinus tachycardia
- Electrical alternans
- Low qrs voltage

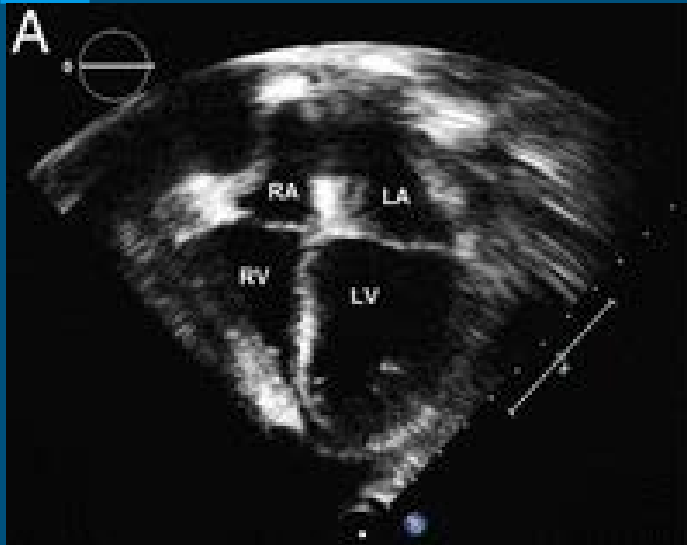


Echo

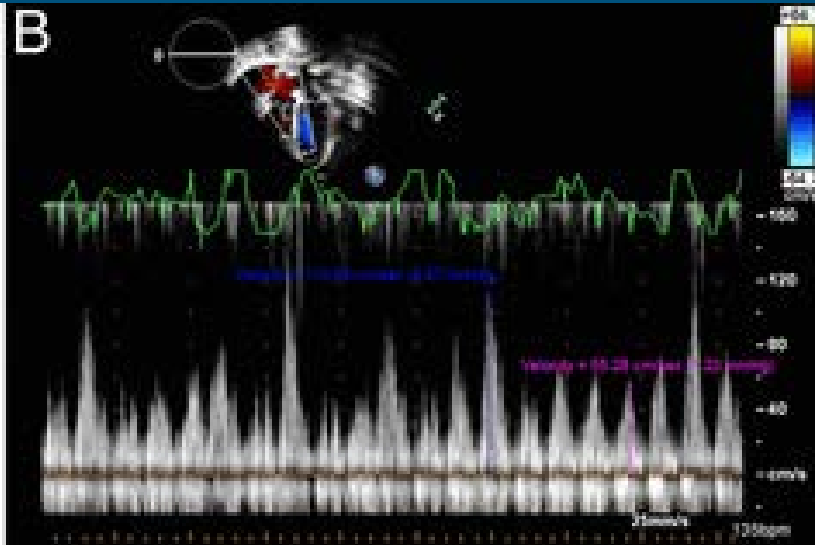
- Primary tool to confirm pericardium effusion
- Findings:
 - Chamber collapse
 - 90% sensitivity and 65% specificity for any chamber *
 - Increased atrioventricular valve inflow respiratory variation
 - Inferior Vena Cava plethora

* If right atrial collapse occur for > 1/3 cardiac cycle, sensitivity increase to 94% and specificity 100%

Echo



A) Right Atrium Collapse.



B) increased Tricuspid Valve inflow

Treatment

- Pericardiocentesis
 - Studies on fluid to determine etiology

- Volume Resuscitation
 - Volume expander with crystalloid if Hypotensive
 - Caution must be used in normovolemic or hypervolemic patients because aggressive fluid resuscitation can precipitate tamponade

- Treat underlying cause

Summary

Although rare, pericardial tamponade can affect pediatric patients

Beck's triad has poor sensitivity and might not be present

Echo is the best tool to help in the diagnosis

Resources

- Susan S, Li. “Cardiac Tamponade in a Child With Fever of Unknown”. Hospital Pediatrics, Nov 1, 2017.
<https://hosppeds.aappublications.org/content/7/11/692/tab-article-info>
- Hoit, Brian D. “Cardiac Tamponade” Uptodate.
https://www.uptodate.com/contents/cardiac-tamponade?search=cardiac%20tamponade&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1#references