Infectious heart diseases

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Infectious diseases of the heart

- Infective endocarditis
- Myocarditis
- Pericarditis

Infective endocarditis

Epidemiology

- IE is a relatively rare but serious disease with high mortality despite the improvement in dg. and th.
- Estimated annual incidence 3-10/100 000
- The profile of patients and pathogens has changed over time (rheumatic fever x PM/ICD)
- Predisposing factors:
  - prosthetic valves
  - elderly patients with degenerated valves
  - i.v. drug users
  - i.v. catheters, pacemaker electrodes

Classification

- (Acute x subacute/ lenta)

- **NVE** - native valve endocarditis
- **PVE** - prosthetic valve endocarditis
- **IVDU** - intravenous drug users
- IE on **PM / ICD** electrodes

Classification

- **Relapse** - repeat IE within 6 months and proven identical pathogen
- **Reinfection, -** new microorganism, or the same species but > 6 months

- **Early PVE** - within 1 year (usually aggressive nosocomial infection of sewing material)
- **Late PVE** - > 1 year after surgery/implantation

Pathophysiology

- IE is **rare in healthy individuals** despite common bacteremia (dental procedures, toothbrushing…)

x

- Any injury to endocardial surface (degenerative changes, impact of catheters, electrodes, prosthetic materials…) → endocardial damage, exposing EC matrix → factor III, platelet activation, fibrin-platelet (sterile) vegetation → increase risk of bacterial seeding

NVE

- **Rheumatic valvular disease** – usually mitral valve followed by the aortic valve
- **Congenital heart disease** - patent ductus arteriosus, ventricular septal defect, tetralogy of Fallot (TOF), *any native or surgical high-flow lesion*
- **Mitral valve prolapse**
- **Degenerative heart disease**
  - aortic stenosis in elderly ,bicuspid valve, Marfan syndrome, rarely syphilitic disease
  - mitral regurgitation

Clinical presentation

- **Variable!**
- Fever (95%), signs of systemic disease (nausea, weight loss….)
- Heart murmur (85%)
- Septic embolization (20-50%)
  - brain, kidneys, spleen
  - pulmonary
- Peripheral microembolization less common

Diagnostic testing

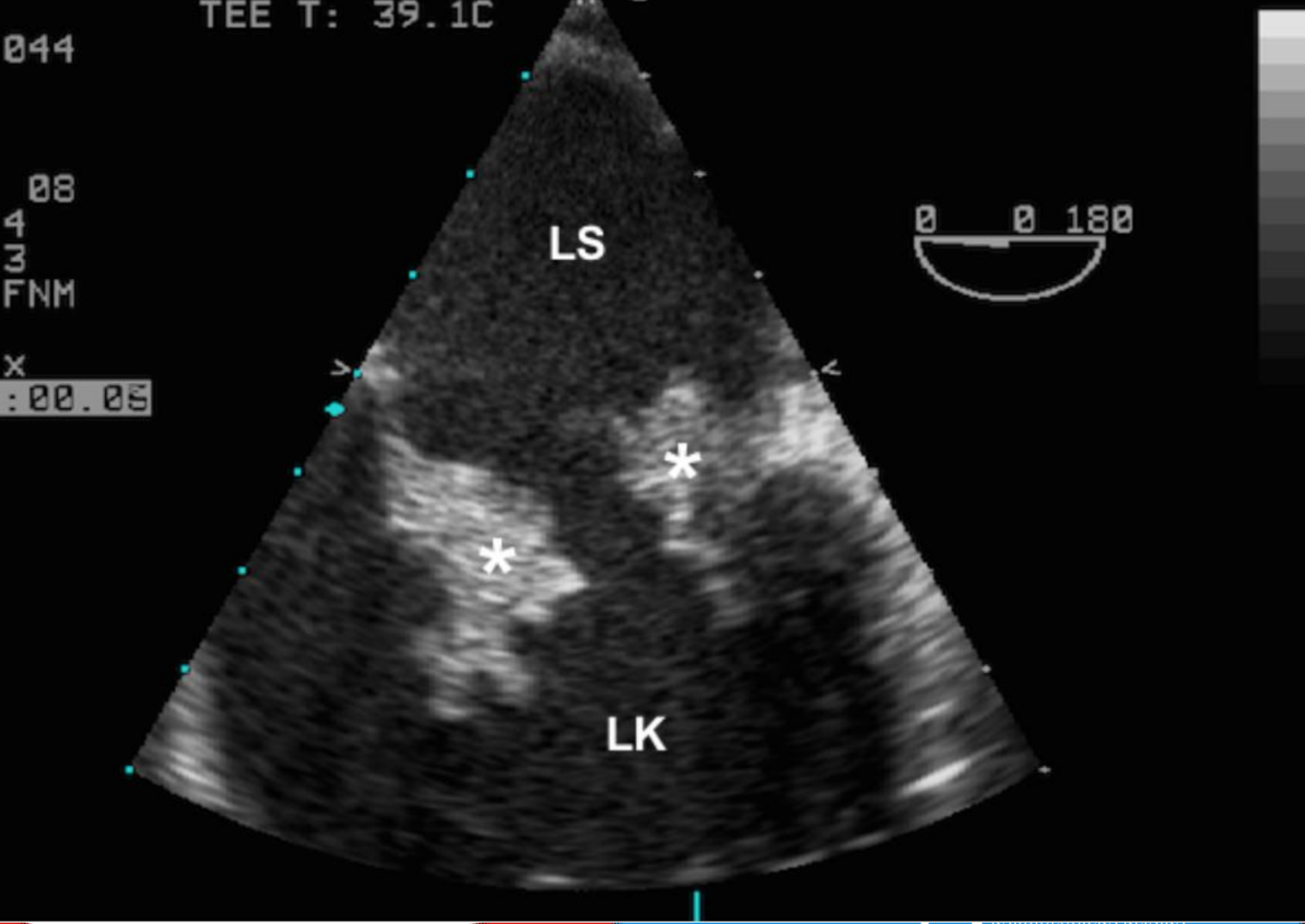
Blood cultures

- 3 sets (aero + anaerobe) at different times + from diff. sites
- 85-90% - **streptococci, staphylococci, enterococci**
- 10% culture negative
  - (usually due to previous ATB th.)
  - less commonly HACEK (*Haemophilus, Actinobacillus, Cardiobacterium, Eikenella, Kingella)*
  - Fungi – Candida, Aspergillus
  - Intracellular pathogens: Coxiella, Bartonella, Chlamydia, Mycoplasma, Legionella, Trephonema

Diagnostic testing

Echocardiography

- TTE - low sensitivity (40-60%)
- TEE - sensitivity 90 - 100%
- vegetations / abscess / new prosthetic valve dehiscence = specific
- new regurgitation / obstruction = not specific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Definite IE

Pathological criteria

- Microorganisms demonstrated by culture or on histological examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or
- Pathological lesions; vegetation or intracardiac abscess confirmed by histological examination showing active endocarditis

Clinical criteria

- 2 major criteria; or
- 1 major criterion and 3 minor criteria; or
- 5 minor criteria

Possible IE

- 1 major criterion and 1 minor criterion; or
- 3 minor criteria

Rejected IE

- Firm alternate diagnosis; or
- Resolution of symptoms suggesting IE with antibiotic therapy for ≤4 days; or
- No pathological evidence of IE at surgery or autopsy, with antibiotic therapy for ≤4 days; or
- Does not meet criteria for possible IE, as above

Duke criteria

(IE probability)

ESC guidelines 2015

Major criteria

1. Blood cultues positive for IE

a. Typical microorganisms consistent with IE from 2 separate blood cultures:
   - *Viridans streptococci, Streptococcus gallolyticus (Streptococcus bovis), HACEK group, Staphylococcus aureus;* or
   - Community-acquired enterococci, in the absence of a primary focus; or

b. Microorganisms consistent with IE from persistently positive blood cultures:
   - ≥2 positive blood cultures of blood samples drawn >12 h apart; or
   - All of 3 or a majority of ≥4 separate cultures of blood (with first and last samples drawn ≥1 h apart); or

c. Single positive blood culture for Coxiella burnetii or phase I IgG antibody titre >1:800

2. Imaging positive for IE

a. Echocardiogram positive for IE:
   - Vegetation;
   - Abscess, pseudoaneurysm, intracardiac fistula;
   - Valvular perforation or aneurysm;
   - New partial dehiscence of prosthetic valve.

b. Abnormal activity around the site of prosthetic valve implantation detected by ^{18}F-FDG PET/CT (only if the prosthesis was implanted for >3 months) or radiolabelled leukocytes SPECT/CT.

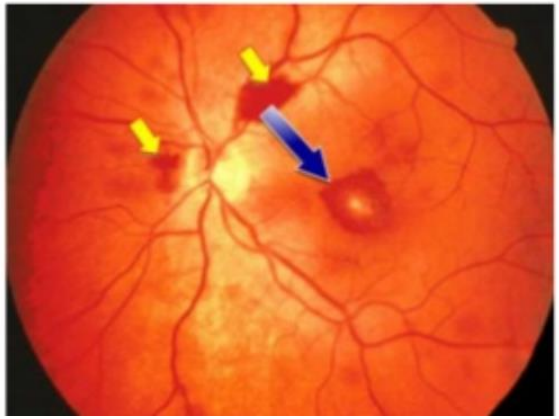
c. Definite paravalvular lesions by cardiac CT.

Minor criteria

1. Predisposition such as predisposing heart condition, or injection drug use.
2. Fever defined as temperature >38°C.
3. Vascular phenomena (including those detected by imaging only): major arterial emboli, septic pulmonary infarcts, infectious (mycotic) aneurysm, intracranial haemorrhage, conjunctival haemorrhages, and Janeway's lesions.
4. Immunological phenomena: glomerulonephritis, Osler's nodes, Roth's spots, and rheumatoid factor.
5. Microbiological evidence: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.

Splinter hemorrhage

Osler node



Roth's spot

Janeway lesion

Treatment

- **ATB therapy**

- **Surgery** - performed in high-risk patients
  - Age/comorbidities/PVE/DM
  - Complicated IE (heart failure, shock…)
  - High-risk agents (S.aureus, fungi…), ATB failure
  - TTE/TEE high-risk morphology parameters – risk of embolisation

Antibiotics

- **beta-lactam** (penicillin, cefalosporin)

- **glykopeptide** (vancomycine)
- **aminoglykosides** (gentamicin)
- **rifampicin** in PVE

Fungi – ATB centre expert consult

Antibiotics

- Streptococci: PEN/CEF + GENTA, (VANCO)
- Enterococci: like streptococci, PEN resist. common
- Staphylococci: MET/OXA + GENTA
- **Empiric therapy** - should focus on S. aureus
- HACEK/early PVE/fungi - require expert ATB consult
- PVE - prolonged (min. 6w) + RIFAMPIN

Antibiotics

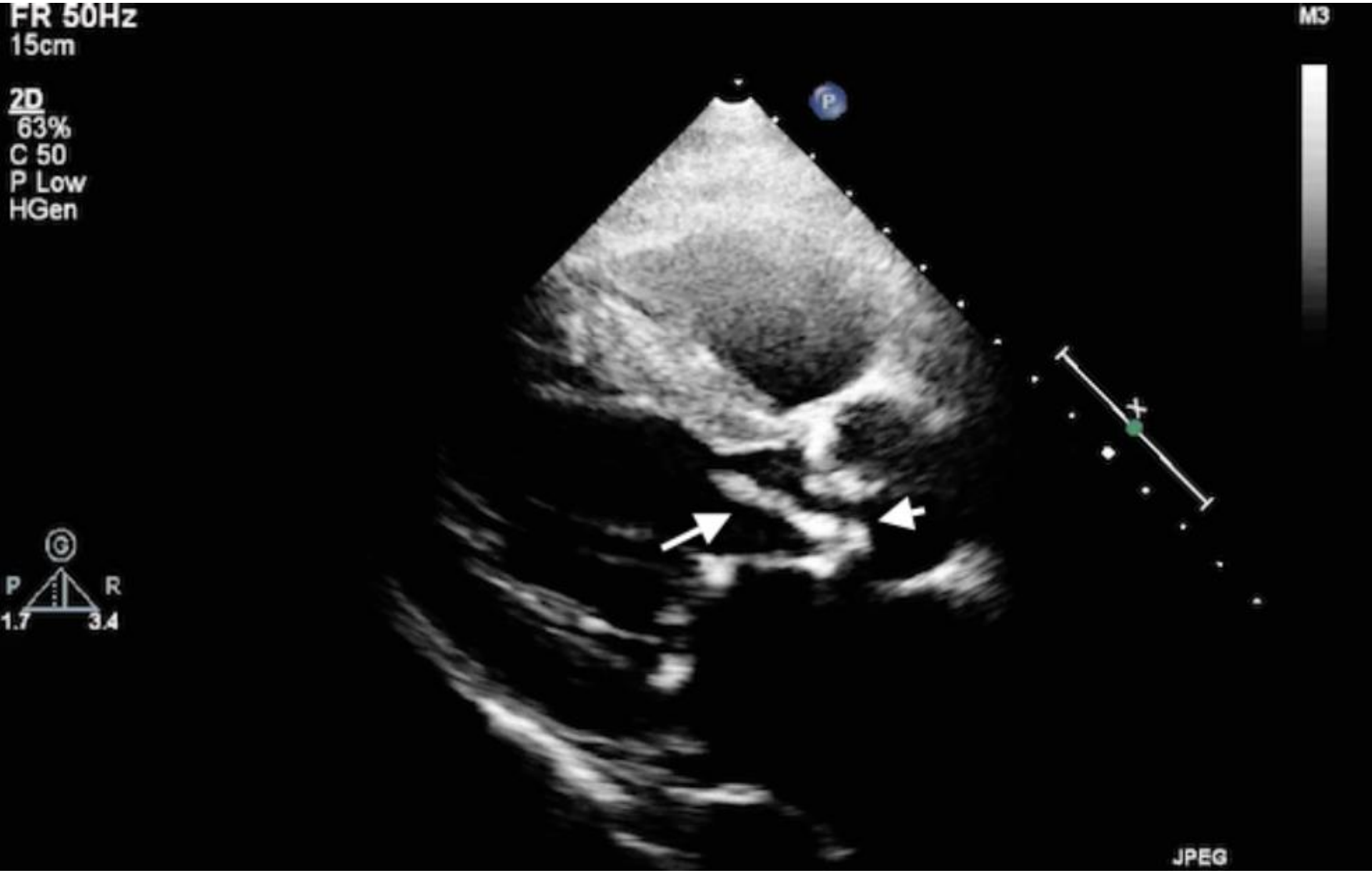
- Usually **4-6 weeks** (regardless of surgery)
- No fever and decrease in CRP are good markers

of th. success, TTE follow-up (< 2weeks) necessary

- <u>Cessation of therapy in case of:</u>
  - normal CRP (1w), favourable TTE, no embolisation (2w), absence of focus for potential reinfection

Surgery

- **progressive heart failure** (emergency in shock)
- **signs of ATB th. failure** - continuous fever, abscess, vegetation, valve dehiscence…
- **embolization potential** (> 10 mm)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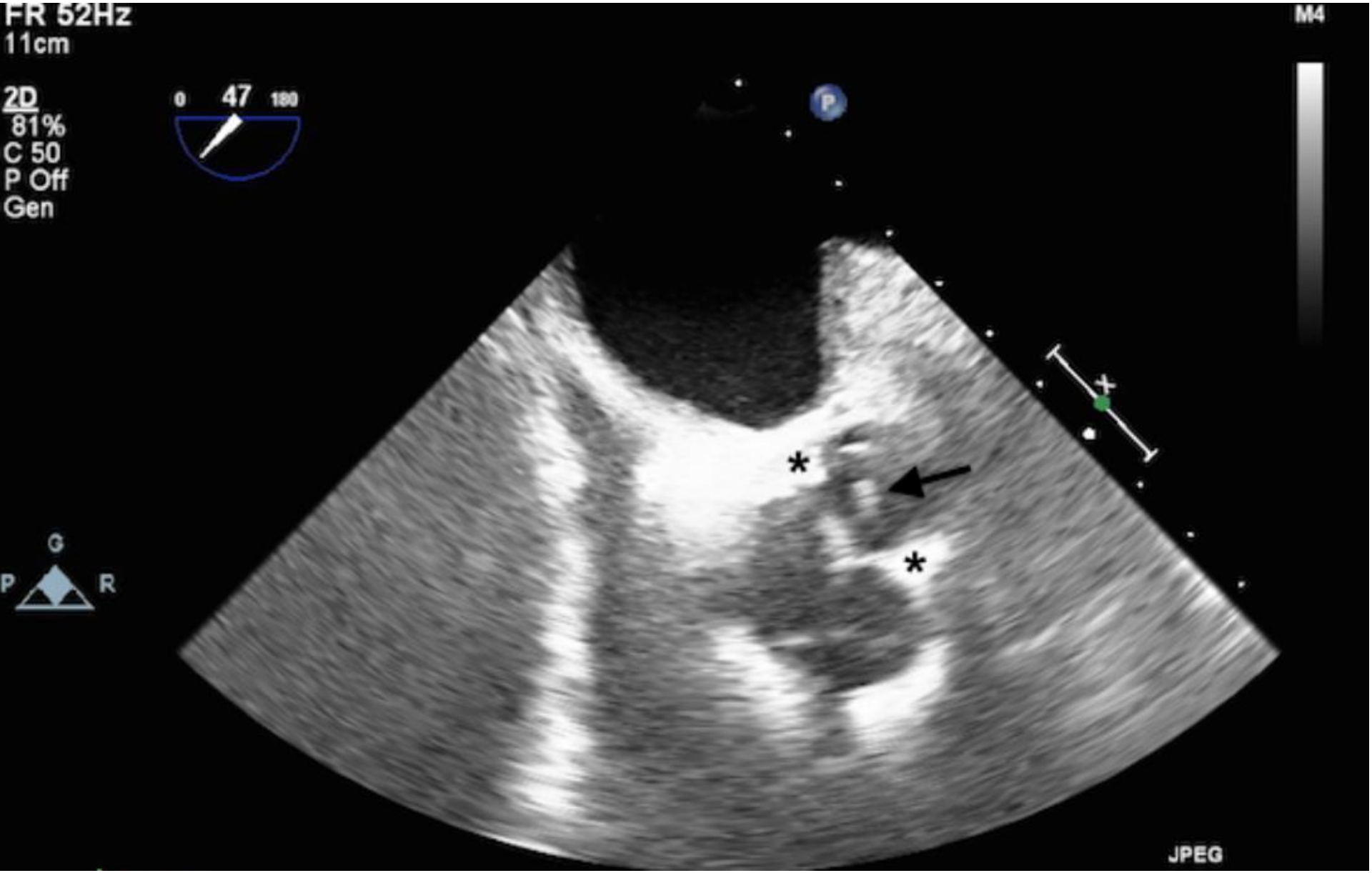
PVE

- 1% / 1 yr / patient
- risk: mechanical similar to biological (later!)
- most common manifestation – valve regurgitation
- long-term sterilisation rare - surgery likely !!!

- early PVE = aggressive pathogens in sewing material, rapidly spreading into surroundings
- late PVE = NVE like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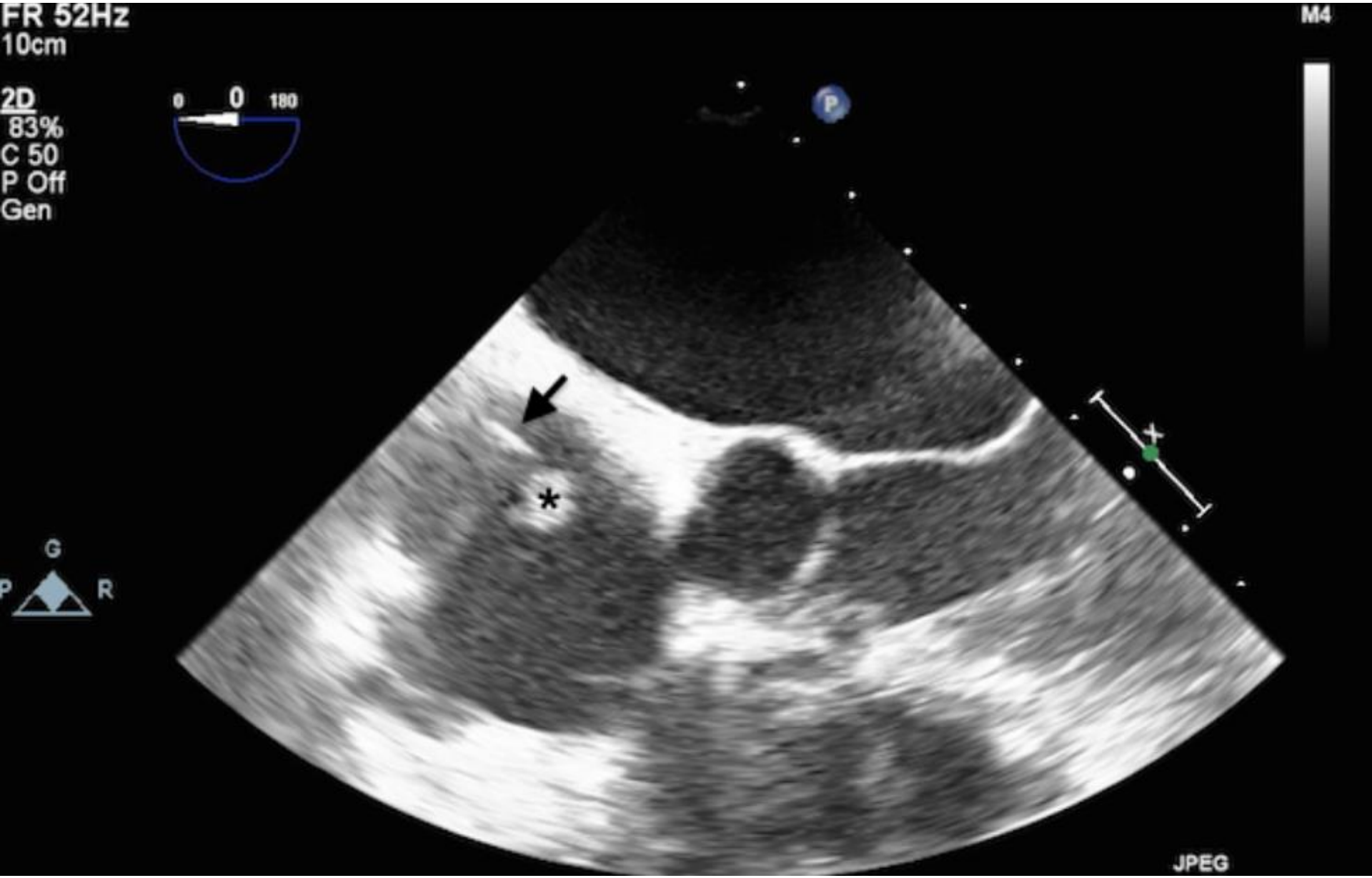
PM/ICD IE

- IE anywhere on/close to electrodes
- S. aureus most likely
- Electrode withdrawal necessary (embolisation during withdrawal common, rarely clinically significant)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IVDU

- Most commonly Tricuspid valve
- S. aureus, pseudomonas, G-, fungi, polymicrobial
- Fever, septic pulmonary embolisation (cough, hemoptysis, pulmonary abscesses, …)
- Mortality < 10% , but high likelihood of recurrence, surgery common

Prevention

- Restrictive approach
- High risk patients only
  - Prosthetic valve implant
  - Previous IE
  - Congenital Heart Disease patients
- High-risk procedures (dental)

Recommendations	Class[a]	Level[b]
Antibiotic prophylaxis should be considered for patients at highest risk for IE: (1) Patients with any prosthetic valve, including a transcatheter valve, or those in whom any prosthetic material was used for cardiac valve repair. (2) Patients with a previous episode of IE. (3) Patients with CHD: (a) Any type of cyanotic CHD. (b) Any type of CHD repaired with a prosthetic material, whether placed surgically or by percutaneous techniques, up to 6 months after the procedure or lifelong if residual shunt or valvular regurgitation remains.	IIa	C
Antibiotic prophylaxis is not recommended in other forms of valvular or CHD.	III	C

Table 6 Recommended prophylaxis for high-risk dental procedures in high-risk patients

Situation	Antibiotic	Single-dose 30–60 minutes before procedure	
		Adults	Children
No allergy to penicillin or ampicillin	Amoxicillin or ampicillin[a]	2 g orally or i.v.	50 mg/kg orally or i.v.
Allergy to penicillin or ampicillin	Clindamycin	600 mg orally or i.v.	20 mg/kg orally or i.v.

[a]Alternatively, cephalexin 2 g i.v. for adults or 50 mg/kg i.v. for children, cefazolin or ceftriaxone 1 g i.v. for adults or 50 mg/kg i.v. for children.
Cephalosporins should not be used in patients with anaphylaxis, angio-oedema, or urticaria after intake of penicillin or ampicillin due to cross-sensitivity.

Myocarditis

Overview

- Inflammatory disease of the myocardium with a wide range of clinical presentations, from subtle to devastating
- Usually manifests in otherwise healthy person
- Wide variety of infectious organisms, autoimmune disorders and exogenous agents

- Acute phase (0-2wks): direct cytotoxic effect + cell mediated cytotoxicity
- Chronic phase (>2wks): mainly autoimmune

Etiology

- "**Idiopathic**" **in 50% of cases**
- Viruses - Enterovirus, Coxsackie A,B, Adenovirus, Parvovirus B19, Influenza, CMV,EBV, HCV, HIV…
- Bacterial - streptococci, TBC, diptheria, Borrelia, Chlamydia, Mycoplasma
- Fungi – Aspergillus, Candida
- Protozoa – Trypanosoma cruzii
- Drugs - anthracyclines, cocaine
- Rheumatic fever
- Autoimmune disorders – SLE, Sarcoidosis, Sjögren sy, Churg-Strauss sy, Wegeners granulomatosis, „giant-cell" myocarditis

Clinical presentation

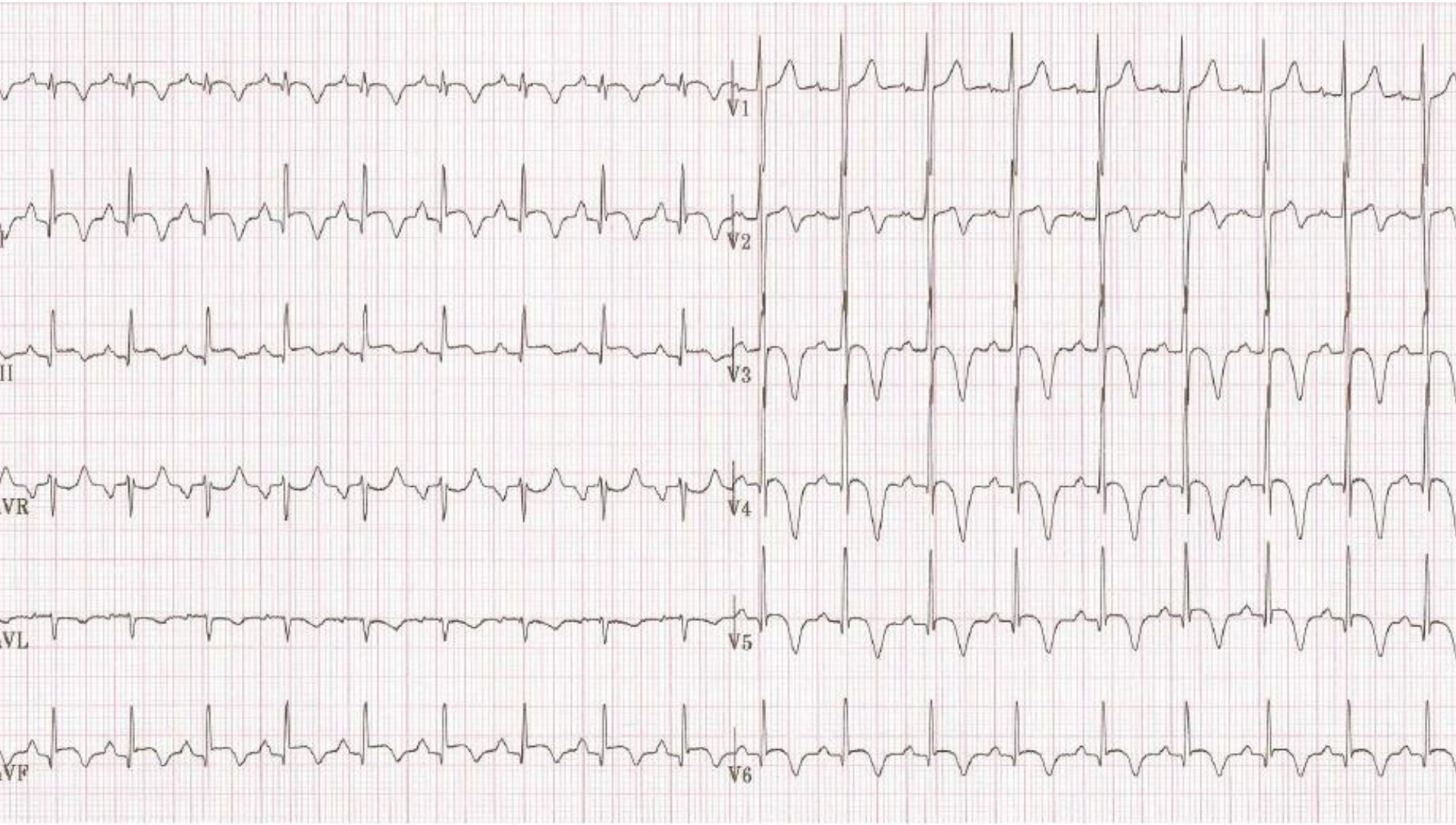
- flu-like symptomes, arthralgias, malaise, fever
- pharyngitis, tonsillitis, upper respiratory tract infection
- Chest pain, sweats, dyspnea, palpitations
- Signs of heart failure, cardiogenic shock
- Syncope or sudden cardiac death due to underlying ventricular arrhythmias or AV block)

Diagnostic workup

- Complete blood count, erythrocyte sedimentation rate level, CRP, rheumatologic screening, **cardiac biomarkers (TnI, TnT)**
- Viral antibody titers - *rarely indicated*, low specificity and delayed rising, no impact on therapeutic decisions
- **ECG** - nonspecific - sinus tachycardia, ST-T changes, AV blocks
- **Echocardiography (TTE)** - to estimate dysfunction and rule-out other causes

Diagnostic workup

- **CAG** (coronary angiography)- rule-out CAD
- **MRI** (late gadolinium enhancement) - extent of inflammation and cellular edema, nonspecific
- **EMB** (endomyocardial biopsy) - routine use rarely helpful, mandatory in rapidly progressive HF to rule-out giant-cell myocarditis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Treatment

- Standard HF treatment (ACEi, BB, ARB, diuretics, inotropics,…IABP, LVAD in shock)
- Avoid physical stress (several months)
- Routine use of immunosuppression not recommended
- Immunosuppression used in giant-cell myocarditis or in systemic autoimmune disease (SLE, RA…)

Follow-up

- Ongoing, chronic inflammation may cause DCM (dilated cardiomyopathy) and subsequent HF
- Patients with a history of myocarditis should be monitored at 1-3 months interval initially, with gradual return of physical activity
- Any evidence of residual cardiac dysfunction should be treated in the same manner as for chronic HF

Prognosis

- Patients who survive fulminant myocarditis generally have good prognosis
- Most patients with mild symptoms recover completely without any residual cardiac dysfunction, although up to 30% develop DCM
- 90% of patients with giant-cell myocarditis die or undergo Tx in 6 months

Pericarditis

Acute pericarditis

- is an inflammation of the pericardium characterized by **chest pain, pericardial friction rub**, and serial **ECG changes**
- **<u>Pain</u>**
  - usually precordial or retrosternal with referral to the trapezius ridge, neck, left shoulder, or arm
  - quality is usually pleuritic, range from sharp, dull, aching, burning, or pressing,
  - intensity varies, is worse during inspiration, when lying flat, or during swallowing and with body motion, it may be relieved by leaning forward while seated

Clinical presentation

- Intermittent fever
- dyspnea/tachypnea (!myocarditis, pericarditis, and cardiac tamponade)
- cough, dysphagia
- **Any** form of pericardial inflammation may cause effusion

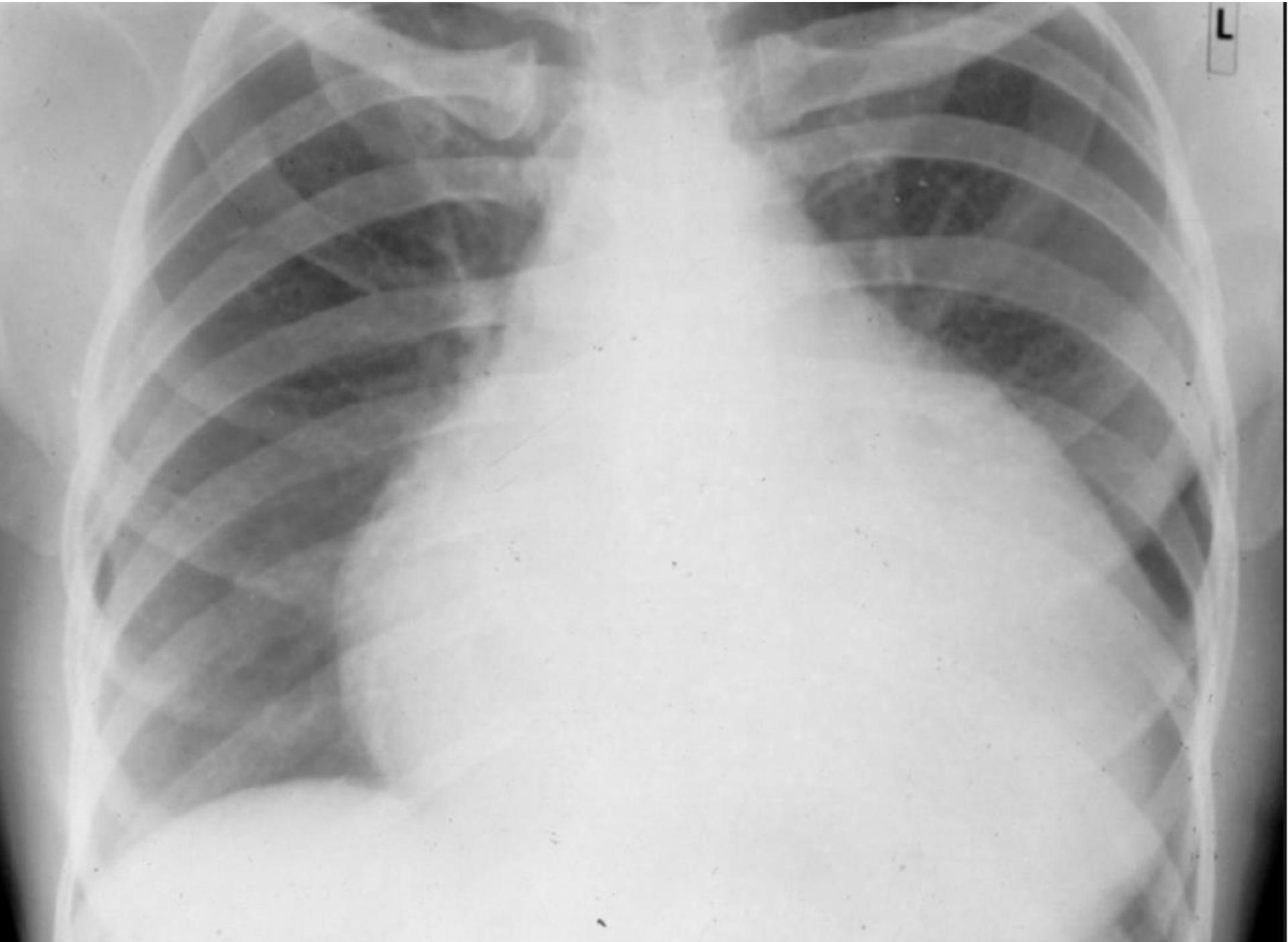
Myocarditis ↔ myopericarditis
Pericarditis ↔ perimyocarditis

Etiology

- Idiopathic causes - about 50%, likely viral
- Infectious
  - Viral – enterovirus,echovirus, parvovirus, EBV, HIV…
  - bacterial, TBC, mycotic (Candida)
- Inflammatory disorders - RA, SLE, scleroderma, rheumatic fever, Reiter sy, dermatomyositis
- Metabolic – renal failure, hypothyroidism,
- Cardiovascular disorders - acute MI, Dressler syndrome,
- Iatrogenic – postpericardiotomic sy, catheterization
- Neoplasms – adjacent / secondary / paraneoplastic
- Drugs, Irradiation
- Trauma, Pneumonia, Pulmonary infarction…

Diagnostic workup

- **ECG** changes
- **chest radiograph** (enlarged if effusion >250ml)
- **TTE** (effusion), CT (calcification), MRI
- **Laboratory studies** (Complete blood count, ESR, CRP, cardiac TnI/TnT, electrolytes, BUN, creatinine, thyroid hormones + specific (RF...))
- **CAG ?**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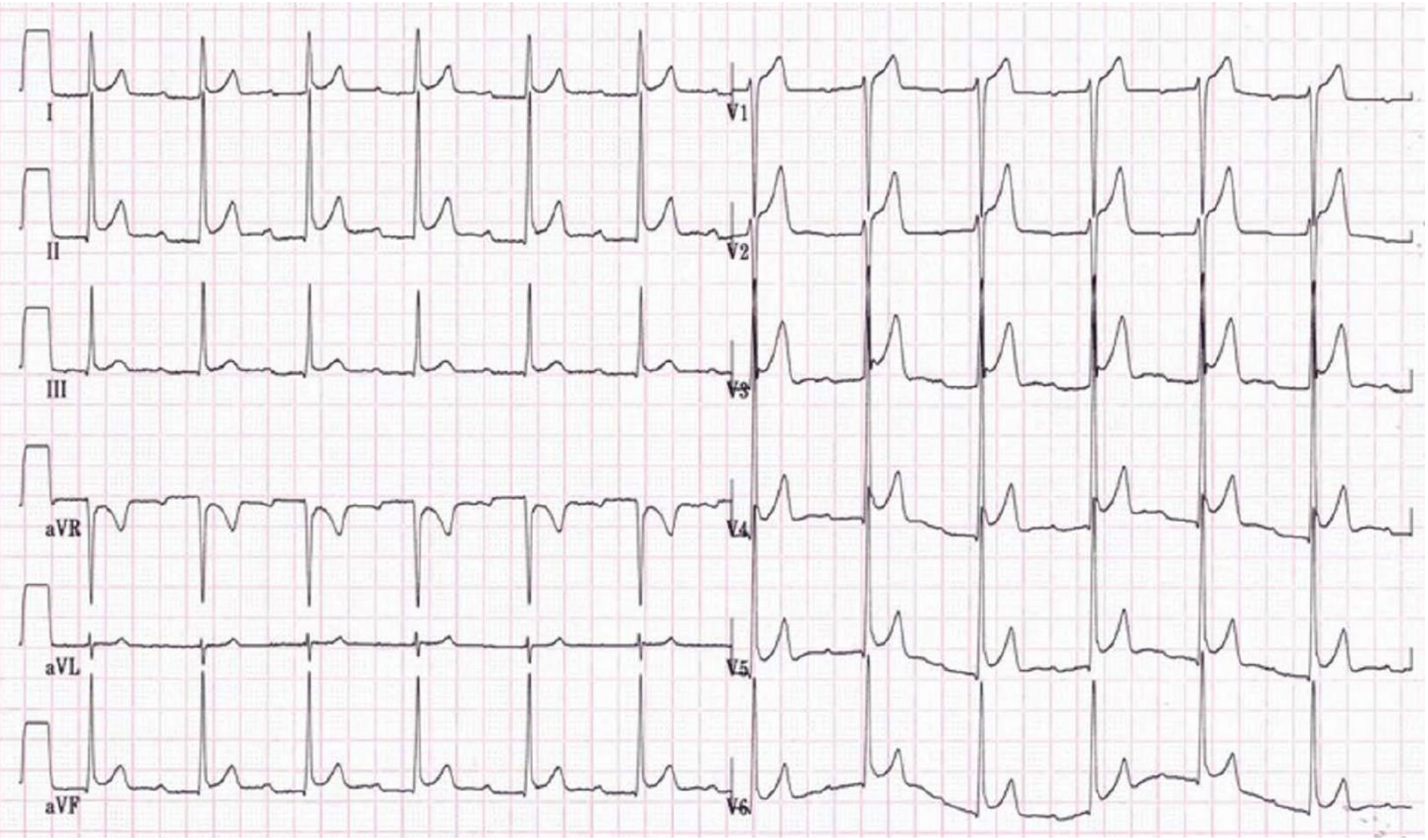
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Treatment

- If specific cause revealed, treat accordingly **(ATB**)
- Idiopathic or viral treated for **symptom relief**
  - **NSAIDs** in full dose for 7-14 days (600-800 mg ibuprofen /day), consider **PPI** as gastric protection
  - **Colchicine** (recurrence or beyond 14 days, 1 mg/day)
  - Corticosteroids - not for initial therapy, unless specific therapy (autoimmune) or no response to NSAIDs + colchicine
- **Pericardiocentesis** – large effusions, cardiac tamponade

Treatment

Surgical therapy

- usually when recurrence or large effusions
- pericardial window
- pericardectomy - in constrictive pericarditis

Complications

- The most common complication of idiopathic acute pericarditis is **recurrence, 15 -30 %**

Constrictive pericarditis

- Acute and subacute forms of pericarditis may deposit fibrin → pericardial effusion → further pericardial inflammation, chronic fibrotic scarring, calcification, and restricted cardiac filling

Complications

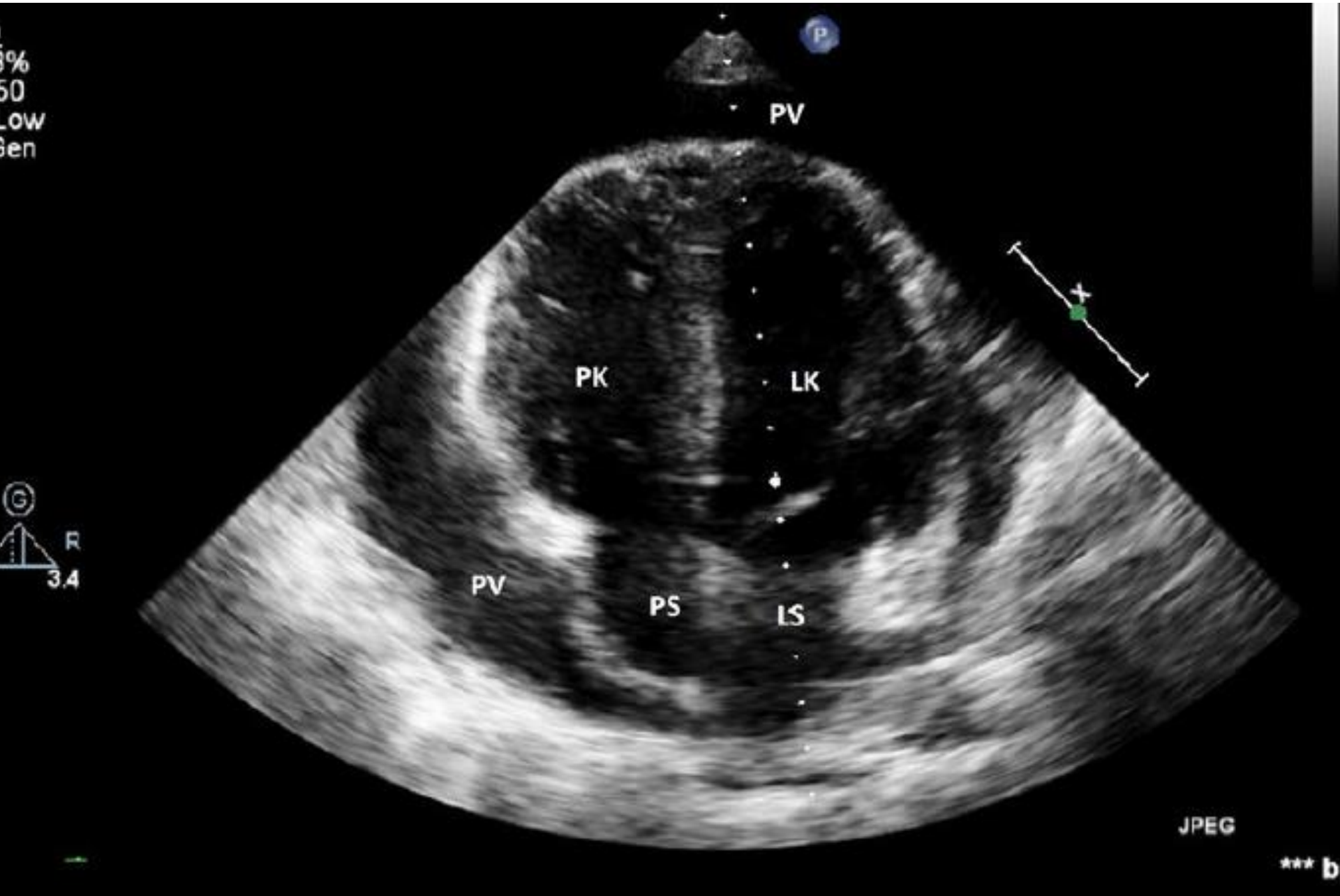
Cardiac tamponade

- especially in acute pericardial hemorrhage or large chronic malignant effusions
- accumulation of fluid in the pericardial space
- resulting in reduced ventricular filling and subsequent hemodynamic compromise
- medical emergency

Complications

Cardiac tamponade

- Symptoms vary with the acuteness and underlying cause
- **Dyspnea, tachycardia, tachypnea, hypotension**
- **Elevated jugular venous pressure**
- **Pulsus paradoxus**
- chest pain, fever, dysphoria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Thank You.