INFECTIVE ENDOCARDITIS

أسباب العدوى ،،

❄دى عدوى ميكروبيه تصيب ال endocardium فى ال heart ،، وغالبا فى ال valves سواء كانت على الناحيه اليسرى left sided ،، زى ال Mitral وال aortic ،، او على الناحيه اليمنى زى ال Tricuspid

❄الناحيه ال left side واللى فيها ال mitral وال Aortic ،، دى لا تصاب بالعدوى الا اذا كان احد هذة الصمامات "diseased" وبه مشكله سابقة زى مثلا ال stenosis وال regurge نتيجة RHD او غيره من الاسباب ..... كمان بتصيب ال valve ده سواء كان هو الاصلى (لم يستبدل جراحيا) وده بنسميه Native valve ،، او كان مستبدل جراحيا وده بنسميه (Prosthetic valve) المريض مغير الصمام

❄اما بالنسبه للناحيه اليمنى ،، العدوى بتصيب ال tricuspid valve غالبا وهو Native وكمان كان healthy سابقا بمعنى انه لا يوجد به (Stenosis or Regurge)

ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ

طيب ايه هيا الميكروبات المسببه ل Infective Endocarditis IE

الموضوع بيختلف حسب ال affected valve ده ،، هل هو Native ولا هو!!! prosthetic

- لو **Native valve** يبقى اشهر بكتيريا مسببه ليه هيا

ال *Strept.Viridans* ودى species من ال Strept ،، وهى بكتريا غير شرسه بنسميها low virulent

ودى↙↙↙↙↙↙↙↙↙↙↙↙↙↙↙

Has tendency to affect left sided native diseased valves in sub-acute form of infection

{Subacute Infective Endocarditis}

وغالبا ما تدخل ال blood stream عن طريق ال Dental route وتوصل احد

ال. left sided valves

- وهناك بكتريا اخرى مسببه لل IE مثل *Enterococci*
- و مجموعة ال Gram negative [HACEK bacteria]

H: Hemophilus Species

A: Actinobacillus A.

C: Cardiobacterium H.

E: Eikenella C.

K: Kingella K.

- و هناك بكتريا لا تصيب ال endocardium الا فى حالة وجود Colorectal cancer ودى اسمها *Strept. Bovis*

- و هناك بكتريا من الممكن ان تسبب Endocarditis كجزء من ال Multi-Organ affection بتاعها زى

▸*Brucella* (Brucellosis)

▸*Coxiella Burnetti* (Q fever)

▸*Bartonella* (Bartonellosis & Cat scratch disease)

▸*Mycoplasma pneumonia* (Atypical)

▸ *Legionella pneumophilia* (Atypical)

- اما لو المريض مغير صمام **Prosthetic valve**

البكتريا المسببه لل IE اكيد هتبقى مختلفه !!!

- اول شهرين بعد العمليه ،، لو اصيب المريض بال IE ،، غالبا هتبقى بكتريا اسمها *Staph . Epidermidis*

ودى species من ال Staph وبتبقى low virulent

- لكن بعد مرور شهرين ،، لو اصيب المريض ب IE هتبقى غالبا *Staph aureus* ودى بكتريا شرسه جدااا Virulent bacteria والعدوى بتبقى شديده وخطيره.

- اما المرضى المدمنين IVDU ،، فهم معرضون للاصابه بال bacterial Endocarditis بشكل كبير والبكتريا المسببه هيا ال *Virulent Staph Aureus*ودى بتدخل عن طريق الابر الملوثه من مكان دخول الابر فى الاورده وبتوصل ال heart عن طريق ال venous side الى ال right atrium ثم تصيب ال Tricuspid valve وتسبب عدوى شديده من النوع ال Acute

{Acute infective endocarditis}

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ملحوظة :

من الممكن ان تحدث عدوى ال IE نتيجة فطريات زى ال *Candida & Aspergillus*

ودى غالبا فى ال Prosthetic valve

وبتبقى خطيره ،، لكنها اقل فى معدل الحدوث من ال. Bacterial IE

PATHOGENESIS ؟ كيف تحدث العدوى

- النظريه الاشهر فى تفسير حدوث ال IE

هو وجود Endothelial injury of the valve وده غالبا نتيجه وجود مرض سابق فى ال valve مثل

Rheumatic heart disease (الاشهر)

Or Mitral valve prolapse

Or congenital heart disease

Or Aortic Valve disease

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Enhancement of platelets aggregation

⬇⬇⬇⬇⬇⬇⬇⬇⬇⬇⬇⬇⬇⬇

Formation of platelets - fibrin clots

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Formation of Sterile micro thrombi attached to the valve

- Occurrence of bacteremia with the bacteria entering the circulation through certain route e.g ↴↴↴

Dental procedure /poor dentition/interventional procedure as in

Strept.viridans IE

infected needles as in Staph. aureus IE in IVDU patients

Intra-vascular catheters (indwelling catheters (CVC & hemodialysis catheter

Prescence of intra-cardiac Foreign body: Prosthetic valve (common, devices e.g pacemakers, LVAD : uncommon)

⬇⬇⬇⬇⬇⬇⬇⬇⬇⬇⬇⬇

- Adherence of the bacteria to the sterile microthrombi , then Colonization forming " Infected thrombi attached to the cusp called " VEGETATIONS "

Vegetations = the hallmark of IE

⬇⬇⬇⬇⬇

Local destructive effects in the valves and paravalvular structures and Prosthetic valves

⬇⬇⬇⬇⬇

I. Valves: perforation of the cusps and acute damage leading to

"ACUTE VALVE REGURGE"

- Mitral valve: new mitral Regurge

- Aortic valve: new Aortic Regurge

- Tricuspid valve: new Tricuspid Regurge .

➲ If the patient has Prosthetic Valve
Vegetations --> new partial dehiscence

II. Para-valvular structures: formation of abscesses especially if {IE} caused by STAPH infection ::--

- perivalvular abscess

- Aortic root abscess

Systemic effects /complications Of Infective Endocarditis (IE)

↘↘↘↘↙↙↙

- Vascular phenomena

- Immunologic phenomena

➢ Vascular phenomena include ↴

A. If Left - sided { IE }

1) Embolic complications >>> Ischemic stroke (infarction)/TIA
2) Mycotic aneurysms in the Cerebral blood vessels, if rupture >>> Intracerebral hemorrhage
3) septic emboli to↴

- Brain: Brain abscess
- Spleen: Splenic abscess
- Kidney: Kidney abscess

B. If Right sided { IE }

➲ septic pulmonary infarcts

↘↘↘↙↙↙

Multiple cavitary lesions & abscesses in the lungs

C. other vascular phenomena (occur in both Left and Right IE)

1) Splinter Hemorrhages (nails of the hands' fingers)
2) Conjunctival hemorrhages
3) Janway lesions (palms)

➢ Immunologic phenomena { reaction of the immune system to the infection }

⬇⬇⬇⬇⬇

- Glomerulonephritis
- Osler's nodes (pulps of fingers)
- Roth's spots in the retina

Risk Factors for IE

الشخص السليم لا يصاب بال IE ولابد من وجود عوامل خطوره Risk factors ، تجعل الشخص عرضه لل IE مثل :

A. Pre-existig cardiac disease:

- Rheumatic heart disease
- Mitral valve prolapse
- Congenital heart disease
- Aortic valve disease e.g. Bicuspid aortic valve
- Hypertrophic cardiomyopathy HCM

➲ In such patients, The bacteria enter the body after high risk procedures:

Most important: Dental procedure

Upper & lower resp. tract procedures : e.g bronchoscopy

endoscopy

B. Previous IE
C. Prothetic valve
D. IV drug users
E. Indwelling catheters (e.g CVC)
F. Intracardiac devices (e.g pacemaker and LVAD.

❋ أعراض المرض ❋

- The presentation may be acute
  (Onset within 2 weeks with Prominent marked symptoms and deterioration (e.g Acute IE)

Or

- It may be sub-acute
  (Onset within 2 - 4 weeks with less marked Symptoms)

Symptoms related to bacteremia :

e.g:

Fever ≥ 38 °c

Constitutional e.g, myalgia, malaise, anorexia, weight loss

N.B:

The patient might present with fever Of Unknown origin {FUO}.eg

Fever ≥ 2 - 3 weeks without obvious Cause!!

Symptoms & Signs related to vegetations:

A) Features related to their local destructive effect

⬇

Acute valve regurge

- Symptoms of Left sided IE (MR & AR)

  Dyspnea, orthopnea, palpitation

- Signs of left sided heart failur may be evident in severe MR or AR

  Bilateral basal crepitations on the back, S3 gallop, increased JVP

- Signs of

  - Acute mitral regurge due to IE

  New murmer {Pansystolic murmer heard on the apex} مختلفه عن زى قبل

  - Acute aortic regurge due to IE

  New murmer {early diastolic murmer heard on the second aortic area on leaning forward}

- Right sided IE (Tricuspid) Features: -

  Pansystolic murmer on the left Lower sternal area

B) Systemic features related to vegetations :

➢ **Embolic features :**

I. Left sided IE:

▸ Ischemic infarction: sudden onset of focal neurological deficit (motor ± Sensory ± CN ± cerebellar)

E.g.: unilateral weakness, etc.

▸ TIA may occur

▸ Hemorrhagic stroke: sudden Focal deficit ± headache ± deterioration in the conscious level

▸ Septic emboli ↴↴↴

Brain abscess: features similar to strokes (differentiated by imaging)

Splenic abscess: Vague left hypochondrial pain in the setting of features of IE (U/S & CT are diagnostic)

Kidney abscess (rare): Vague loin pain + evidence of Pyuria in the setting of features of IE

II. Right Sided IE :

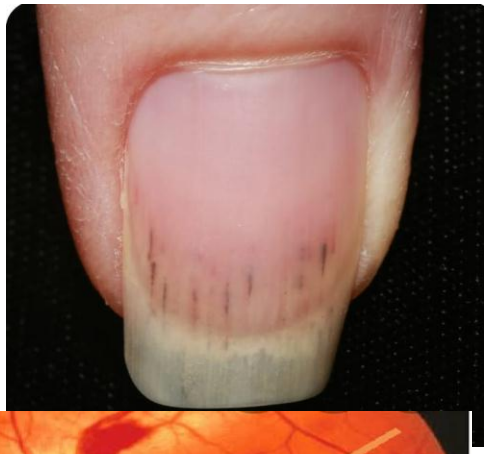
➲ Septic emboli to the lungs --> cavitary lesions: features similar to pneumonia (productive cough with purulent sputum not necessarily related to posture, chest pain)

- In the setting of features suggesting Right Sided IE/Tricuspid often in IVDU patients ---> Imaging is helpful

➢ **Features of Glomerulonephrtis**:

- (Hematuria ± proteinuria ± oliguria) in the setting of IE, Acute kidney injury may occur.

Peripheral Stigmata of Infective Endocarditis



I. Hand signs :

Osler nodules: pea -sized tender nodules in the pads of the fingers

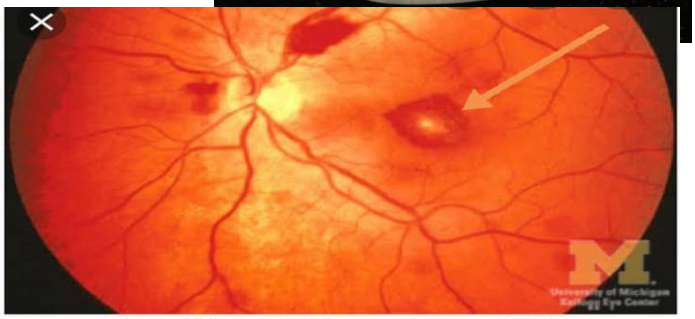
Splinter hemorrhages (tiny blood spots seen underneath the nails

Janway macules: non tender small erythematous macules seen the palms and/ or soles

II. EYES ::-

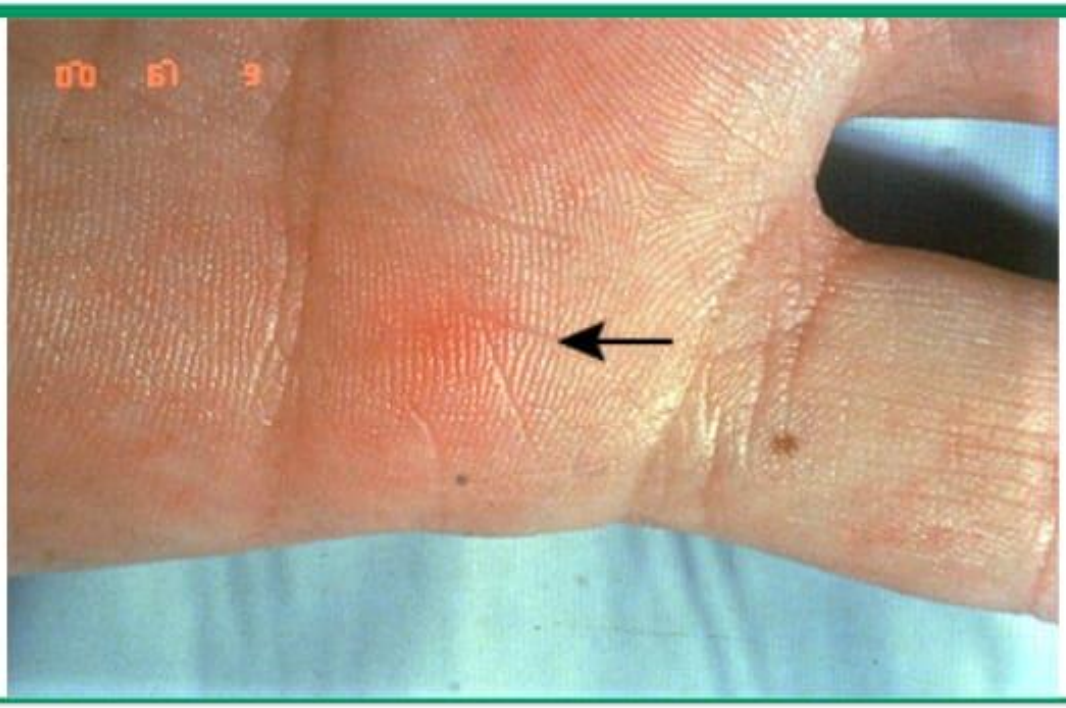
▸ Conjunctival hemorrhage

▸ Roth spots ➡ red spots with white Centers seen on fundoscopy



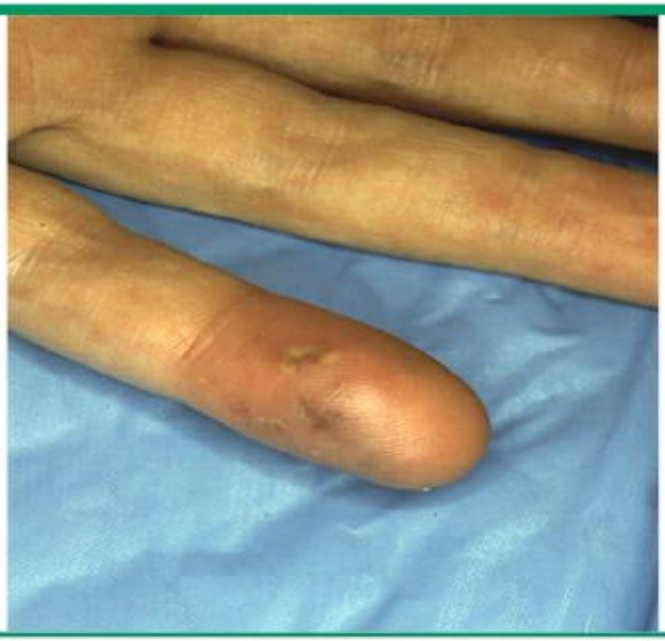
(Roth's spot in endocarditis)

Janeway lesion in infective endocarditis



A Janeway lesion (arrow) occurred on the palm in this patient with bacterial endocarditis due to *Streptococcus bovis*. These lesions are macular, nonpainful, and erythematous; they are located on the palms and soles.

Osler nodes in infective endocarditis



Osler nodes are tender papulopustules located on the pulp of the finger in a patient with bacterial endocarditis caused by *Staphylococcus aureus*.

كيف تشخص حالة Infective Endocarditis ؟

ايه هيا الفحوصات اللى هتعملها عشان تشخص IE ؟

IE = Bacteremia + vegetations + Complications

- عشان تشخص ال bacteremia

لازم تعمل مزرعة دم (blood culture) ،، عينتين او يفضل ٣ عينات مسحوبين بفاصل نصف ساعه ،، ويتعمل مزرعة عشان نعرف نوع البكتريا المسببه ،، هل هيا بكتريا معروفه انها بتسبب ال IE ولا لا

ملحوظه : لو طلعت المزرعة سلبيه دى بنسميها Culture negative endocarditis

Causes ↴↴↴↴ وأسبابها

Most common: prior antibiotic use

HACEK group

Brucella, Coxiella, Bartonella,

Fungal IE

Non-infective IE: caused by libman

Sack endocarditis in SLE,

Anti-phospholipid syndrome,

Marantic (malignancy) related endocarditis.

- عشان نشوف ال Vegetations ، لازم نعمل ايكو لتشخيصها ،، مبدائيا بنعمل

Transthoracic ECHO {TTE}

عشان نشوف↙↙↙↙↙↙

Oscillating mass attached to valve cusps

وممكن نشوف مضاعفات زى Abscess

وفى حالة ال Prosthetic valve هندور على

Partial dehiscence

ولو الحاجات دى مش واضحه فى ال TTE هنعمل Trans-Esophageal ECHO(TEE) لو الحاله ما زال مشتبه فيها بقوه

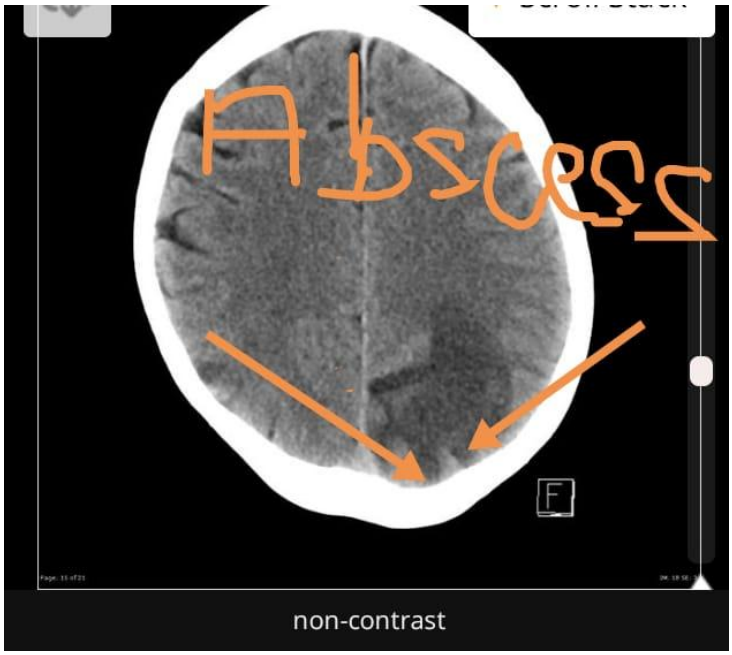
كمان الايكو هيعمل

Assessment of valve lesion

وخصوصا اذا كان المريض يعانى من

Pre-existing cardiac disease

➢ فحوصات هتعملها بس فى حالة المضاعفات



- If lateralizations (focal deficits)

هتعمل مقطعيه على المخ عشان تشوف ده

(هيبان من اول لحظه) Hemorrhage

بيبان كتجمع دموى لونه ابيض غير منتظم الشكل داخل المخ hyperdense hematoma

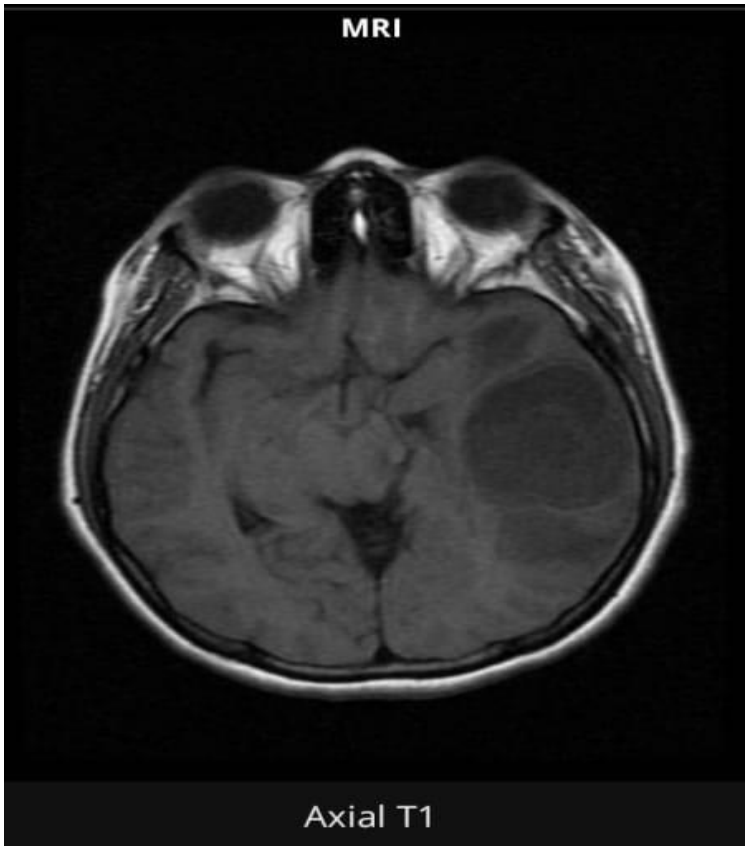
او

Infarction

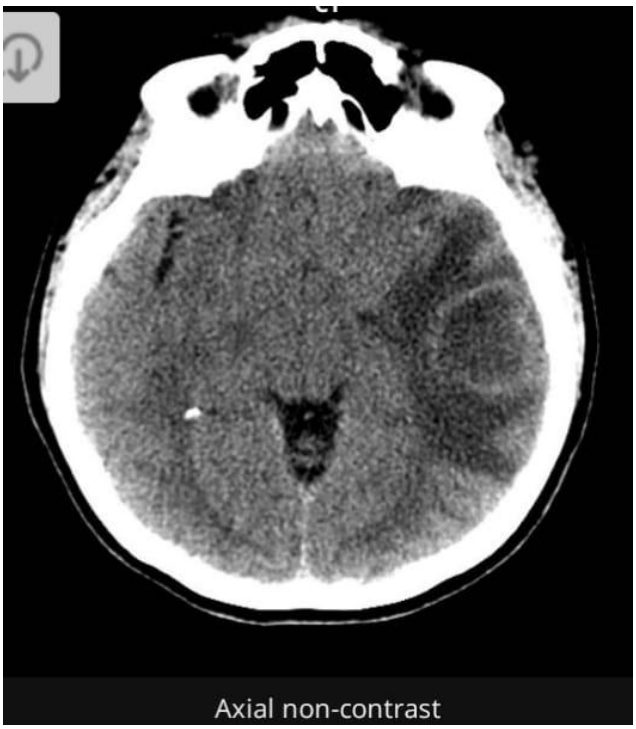
(بيظهر بعد ٢٤ - ٤٨ ساعه من الاعراض)

لما يبان هيظهر لونه رمادى متجانس بدرجة اغمق من ال normal brain tissueالمحيط بيه Hypodense area

اما لو Brain abscess هيظهر كده



يظهر لون رمادى ولكنه دائرى او بيضاوى الى حد ما ،، مش كله لون واحد متجانس ،، ولكن جواه اماكن فاتحه تمثل ال edema(الاسهم فى الصوره) ويشبه ال brain tumor من غير صبغه ،،، لكن فى المقطعيه او الرنين بالصبغه بيبنان ring enhanced lesion واضح .

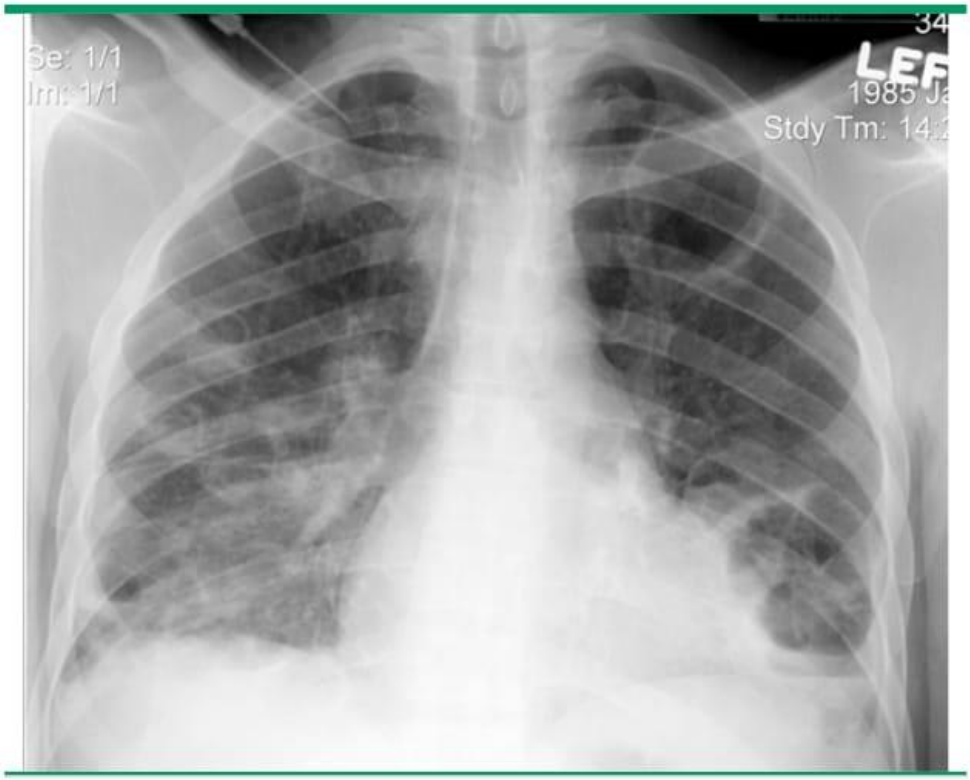


- if vague left hypochondrial pain

اعمل سونار او يفضل مقطعية على البطن والحوض عشان ال splenic abscess

- if pulmonary symptoms similar to pneumonia or the patient known to be IVDU --> ↴↴↴↴

Chest radiograph of a patient with tricuspid valve endocarditis due to *Staphylococcus aureus*



Note multiple cavitating lung nodules due to septic pulmonary emboli.

اعمل

CXR or better CT chest

عشان ال septic pulmonary emboli هتشوف

Cavitary lesions

+

Consolidations

- اخيرا هتعمل Basic labs + acute phase reactants

ESR: elevated

CRP: high

CBC: leucocytosis ± mild anemia

Urine analysis: search hematuria ± proteinuria to exclude GN.

RFTs

هل هناك معايير حاسمه للتشخيص ؟

يوجد معايير تشخيصيه حاسمه اسمها

[[DUKE CRITERIA]]

بتجمع وتلخص الحاجات اللى ذكرناها فوق

MAJOR CRITERIA:

A) positive blood culture for IE (one of the following)

→ Typical micro-organisms consistent with IE from 2 separate blood cultures

- Staph .aureus
- Strept.Viridans
- strept .bovis
- HACEK - group
- Enterococci

→ persistently positive blood culture for organisms that are typical causes of IE (at least 2 positive blood cultures)

B) Evidence of endocardial involvement (One of the following) ↴↴↴

1} ECHO positive for IE:

Vegetations (oscillating intra-cardiac mass on a valve or on supporting structures in the path of regurgitant jets or on implanted material, in the absence of an alternative anatomic explanation

Or **abscess**

Or new partial dehiscence of prosthetic valve

2} new valve regurgitation

MINOR CRITERIA:

1) Predisposing factors
   - IVDU
   - Presence of a predisposing heart condition (prosthetic heart valve , valve lesion associates with significant Regurge or turbulence of blood flow)

2) Fever > 38 ° c

3) vascular phenomena: (one or more)

- Major arterial emboli (e.g stroke)
- mycotic aneurysm
- intracerebral hemorrhage
- conjunctival hemorrhage
- Janway lesions

4) Immunologic phenomena :

- Glomerulonephritis
- osler's nodules
- Rose spots
- Positive Rheumatoid factor

5) Microbiological evidence: positive blood culture that don't meet major criteria.

عشان تشخص ال IE عن طريق الDUKE CRITERIA

عايز اما

2 major criteria

Or

1 major and 3 minor

Or

5 minor criteria

اما لو عندى↙↙↙↙↙

1 major + 1 minor

Or

3 minor criteria

يبقى ده نسميه

Possible infective endocarditis

وغالبا هيتعالج Empirical برضه

متى نشك ان المريض عنده IE ؟

فى احد الحالات الاتيه :

➡ Patient with fever, and he is known to have pre-existing cardiac disease e g RHD, congenital HD, etc

➡ Patient with fever + new murmer consistent with Valve regurgitation e.g Mitral R , Aortic R , Tricuspid R..

➡ Patient with fever and laterlizations (strokes) especially in pre-existing heart conditions

➡ Patient with ununsual abscesses without clear cause!!

E.g Brain abscess, splenic abscess, and renal abscess

➡ Patient with fever of unknown origin (FUO) especially if known to have cardiac problem or has intra-cardiac device

➡ Patient with fever & deterioration in patient having central lines (catheters)

E.g. CVC & hemodialysis catheters

➡ Patient with IVDU presented with Fever or FUO or having fever + pulmonary symptoms or having cavitary lesions in the lungs.

كيف نعالج مريض ال IE ؟

- Summary of ttt :

Proper antibiotics ± surgical interference if needed ± ttt of complications if present.

- طبقا للجايدلاينز: تعطى المضادات الحيويه بشكل Empirical بعد سحب ٢ عينه او يفضل ٣ عينات من الدم لعمل المزرعه ، بحيث تكون العينات مسحوبه من اماكن مختلفه وبفاصل زمنى من نصف ساعه الى ساعه .
- تعطى المضادات الحيويه مباشره بدون تأخير بعد سحب عينات المزرعه ،، فى حالة

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Acutely ill patients with signs and symptoms strongly suggestive of IE

- اما فى حالة الاشتباه فقط قبل ظهور نتايج المزرعه ،، مع استقرار الحاله ،، من الممكن تأجيل المضادات الحيويه لحين ظهور نتيجة المزرعه و استكمال معايير التشخيص الاخرى بالايكو ،، ،، اما فى حالة الخوف من امكانية تدهور الحاله ،، ابدأ مضادات حيويه بعد سحب العينات (لا تعطى المضادات الحيويه قبل سحب عينات المزرعه ابداا)

بروتوكول العلاج طبقا للجمعيه الاوروبيه لامراض القلب :::: ESC Guidelines

❖ **Empirical therapy (antibiotic regimen) in IE:--**

I. In Native valve left sided IE or late prosthetic valve (≥ 12 months post-surgery)

Give ↴↴↴

- Ampicillin (Eipicocillin 1 gm vials)

12 gm /day in 4 - 6 divided doses

3 gm every 6hours or 2 gm every 4 hours IV

N.B: Ampicillin covers Strept Viridans

- Flucloxacillin (Flumox 1 gm vial)

12 gm /day in 4 - 6 divided doses

3 gm every 6hours or 2 gm every 4 hours IV

N.B: Flucloxacillin covers staph .aureus & Epidermidis

- Gentamycin amp (Garamycin /Gentamicin amps)

3 mg /kg /day in one dose IM or IV

If Pt. is 80 kg --> 3 amp 80 mg

N.B: Gentamycin covers gram negative bacteria causing IE like Enterococci & HACEK group

لو المريض عنده حساسيه من البنسيللين

Give ↴↴↴

- Vancomycin 30 - 60 mg /kg /day IV in 2 - 3 divided doses (vancocin 500 mg amp)

If pt is 80 kg --> dose 2400 - 4800 mg in divided doses (2 and 1/2 vials /12 hrs. if severe --> 5 vials /12 hrs)

N.B: Vancomycin covers both Strept Viridans and STAPH species

- Gentamycin amp (Garamycin /Gentamicin amps)

3 mg /kg /day in one dose IM or IV

If Pt is 80 kg --> 3 amp 80 mg /day

II. In early Prosthetic Valve IE (≤ 12 months after operation)

Give ↴↴↴

- Vancomycin 30 mg /kg /day IV in 2 - 3 divided doses (vancocin 500 mg amp)

If pt is 80 kg --> dose 2400 mg in divided doses (2 and 1/2 vials /12 hrs)

- Gentamycin amp (Garamycin /Gentamicin amps)

3 mg /kg /day in one dose IM or IV

If Pt is 80 kg --> 3 amp 80 mg /day

- Rifampicin (900 - 1200 IV or oral in 2 - 3 divided doses)

Rimactane 300 (1 × 3 or 1 × 4 in severe cases)

➢ **Duration of ttt :**

2 - 4 weeks (preferrably 4 Wks in Native valve IE even if rapid improvement)

4-6 weeks in prosthetic valve IE (preferabally 6 weeks)

المتابعه :

بعد بدء المضادات الحيويه ،،هنعمل follow up لمزرعة الدم كل ٤٨ الى ٧٢ ساعه ثم يكرر بعد ذلك كل يومين الى تلاتة ايام لحد ما تبقى المزرعة negative والعيان بيتحسن

هل العلاج medical ttt فقط ؟ وامتى يبقى فيه تدخل جراحى ؟

يعرض المريض على جراح القلب والصدر لامكانية التدخل الجراحى فى الحالات الاتيه :-

a) Heart failure :

▸ Development of heart failure symptoms and Signs or cardiogenic shock with severe aortic or mitral regurge

b) Uncontrolled infection:

▸ Locally uncontrolled infection

(Abscess, false aneurysm, fistula, enlarging vegetations)

▸ Infection caused by fungi or multi -resistant organisms

▸ Positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci.

▸prosthetic IE caused by Staphylococci or Non- HACEK organisms.

c) Prevention of embolism

▸ Aortic & mitral native & prosthetic IE with persistent vegetations > 10 mm after one or more Embolic episodes despite use of appropriate antibiotic therapy

▸aortic or mitral native valve Endocarditis with vegetations > 10 mm associated with severe valve stenosis or Regurge.

▸Aortic or mitral native or prosthetic valve Endocarditis with isolated very large vegetations > 30 mm

▸Aortic or mitral native or prosthetic valve Endocarditis with isolated large vegetations > 15 mm

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III. In Right sided native valve Endocarditis (ACC guidelines)

- if uncomplicated infection give ↴↴↴
  - Flucloxacillin 2 gm every 4 - 6 hours for 2- 4 weeks.

- If penicillin allergic give ↴↴↴
  - Vancomycin 30 mg /kg /day IV in 2 - 3 divided doses (vancocin 500 mg amp)
    If pt is 80 kg --> dose 2400 mg in divided doses (2 and 1/2 vials /12 hrs) For 2 - 4 weeks

➢ هنحتاج عرض جراحة قلب وصدر فى الحالات الاتيه :

- Very large vegetations > 20 mm.
- Recurrent septic pulmonary emboli.
- Presence of highly resistant organism and or persistent bacteremia due to Staph aureus & pseudomonas aeroginosa > 7 days despite antibiotic use.
- development of right sided heart failure secondary to tricuspid Regurge and unresponsive to diuretics

وماذا عن ال prophylaxis ؟

- prophylaxis of IE is indicated only in **Dental procedures** in the following situations:-

➡ Dental procedures requiring manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa

➡ Other procedures including bronchoscopy, endoscopy, ureteroscopy etc are not indicated for prophylaxis

- For prophylaxis give ↴↴↴

Hibiotic 2 gm (1/2- 1 hour before the operation)

- If penicillin allergy give ↴↴

Clindamycin (Dalacin 600 mg cap 1×1) or 2 cap 300 mg .