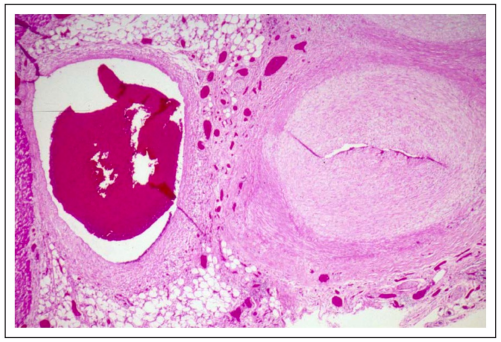
Cardiopathies acquises



Dr Daniela Laux

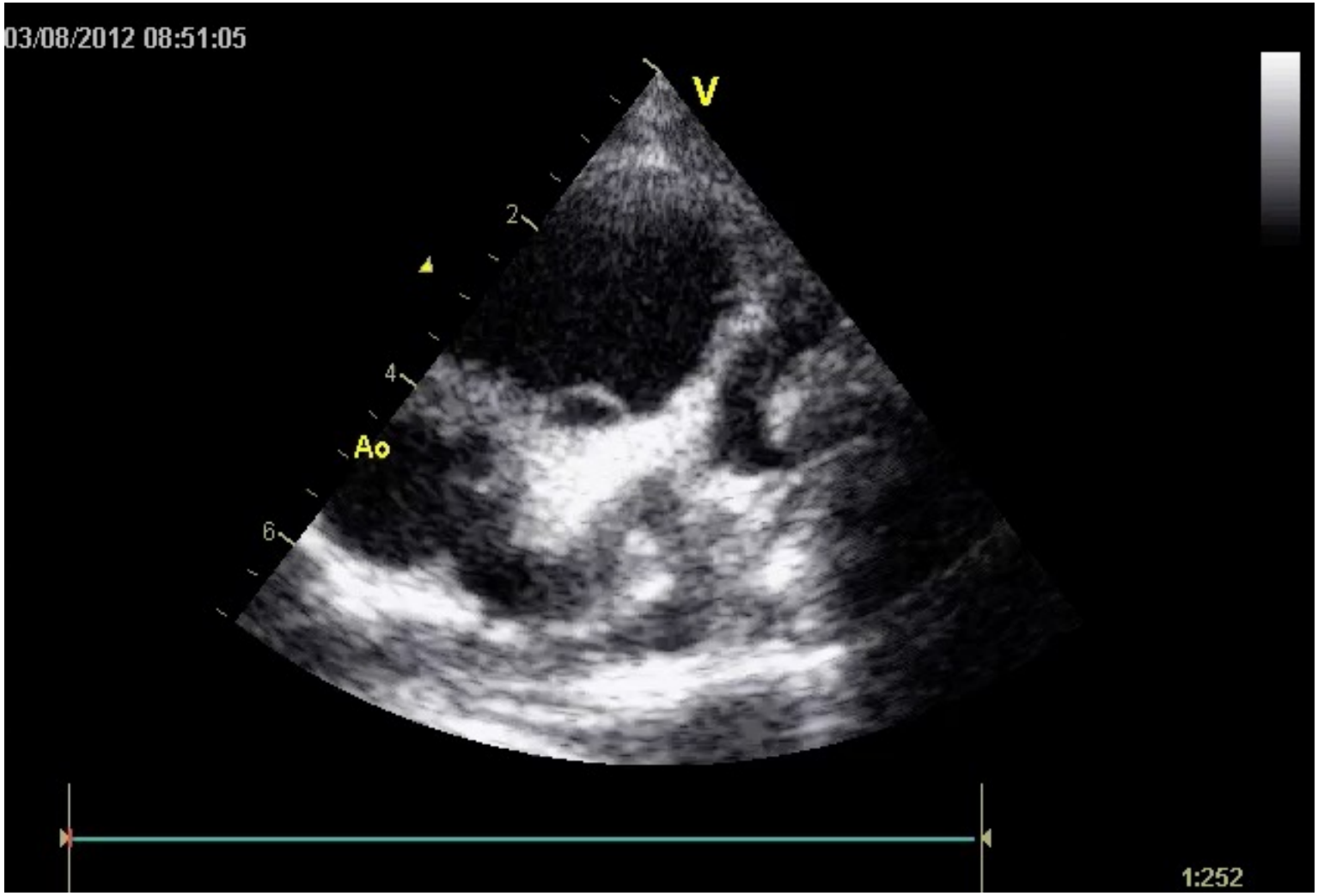
Cardiopédiatre associée – UE3C –Paris

Médecin hospitalier temps partiel
Centre Chirurgical Marie Lannelongue
Le Plessis Robinson

Plan du cours

- Maladie de Kawasaki
- Endocardite infectieuse
- Myocardite

Maladie de Kawasaki



Kawasaki – Les points clés

- Maladie décrite en 1967 – à peine 60 ans de recul !
- **Vascularite systémique** qui touche essentiellement **les artères de moyen calibre** avec un tropisme électif pour **les artères coronaires** (gravité de la maladie)
- Les complications coronaires surviennent dans **15 à 25 %** des cas chez les enfants non traités
- L'administration précoce d'immunoglobulines humaines par voie intraveineuse a transformé le pronostic **en diminuant par 5** le risque d'anévrisme coronaire
- **Risque de mortalité 0,015 %** (Japon), surtout entre le 15-45eme jour (thrombocytose concomittante avec la vascularite)

Epidémiologie

- **Première cause de cardiopathie acquise de l'enfant dans les pays développés**

- **Tous les âges pédiatriques (80 % des cas avant 5 ans)**
- Les patients de **moins de 1 an** ou **de plus de 8 ans** sont rares mais ont un risque plus élevé d'anévrisme coronaire

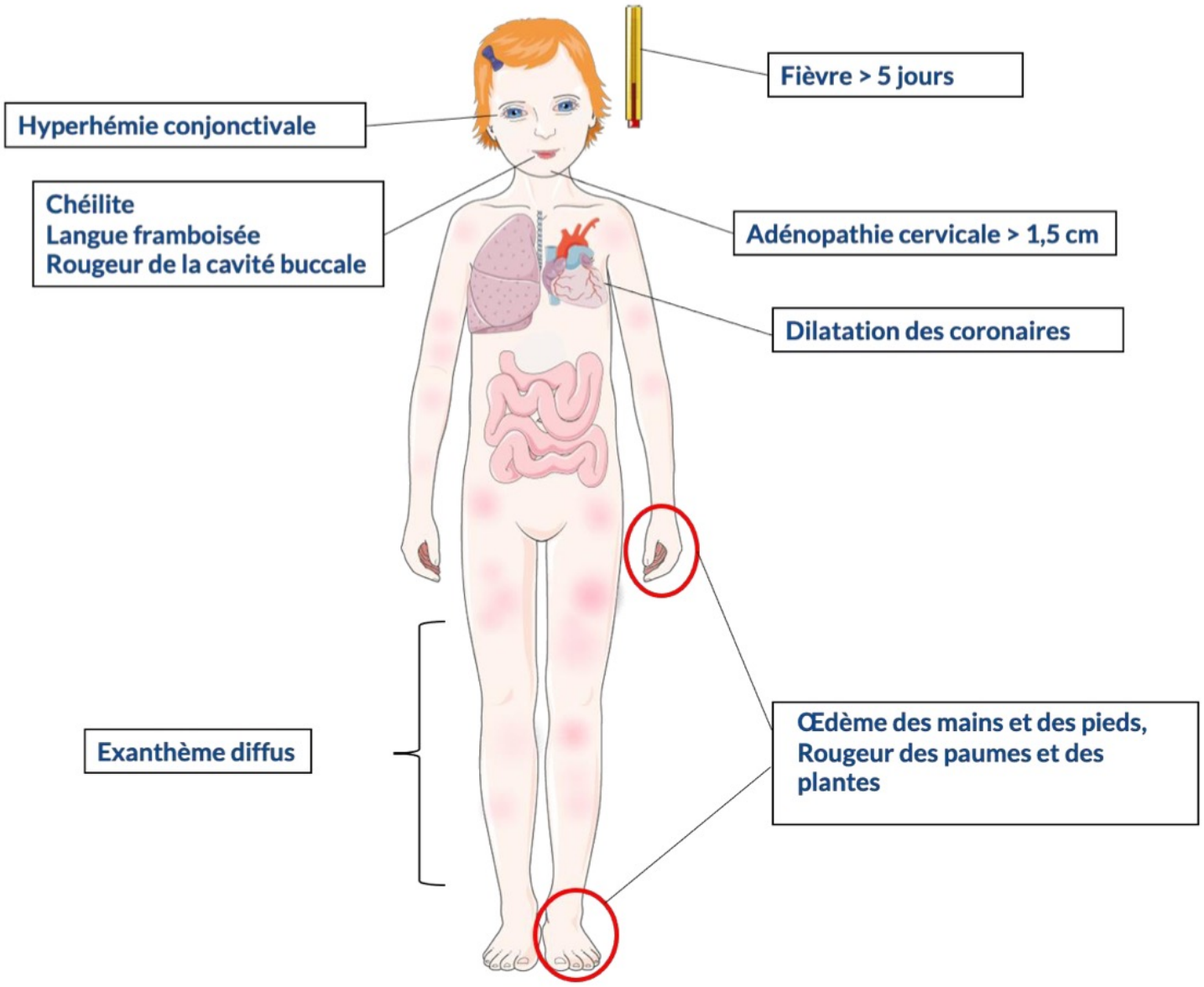
- **Formes de l'adulte:** première fois décrite en 1977
- Symptômes majeurs décrits identiques

- **Kawasaki atteint chaque année:**
  - 265/100.00 enfants < 5 ans au Japon
  - extrapolation française: 600 nouveaux cas par an en France

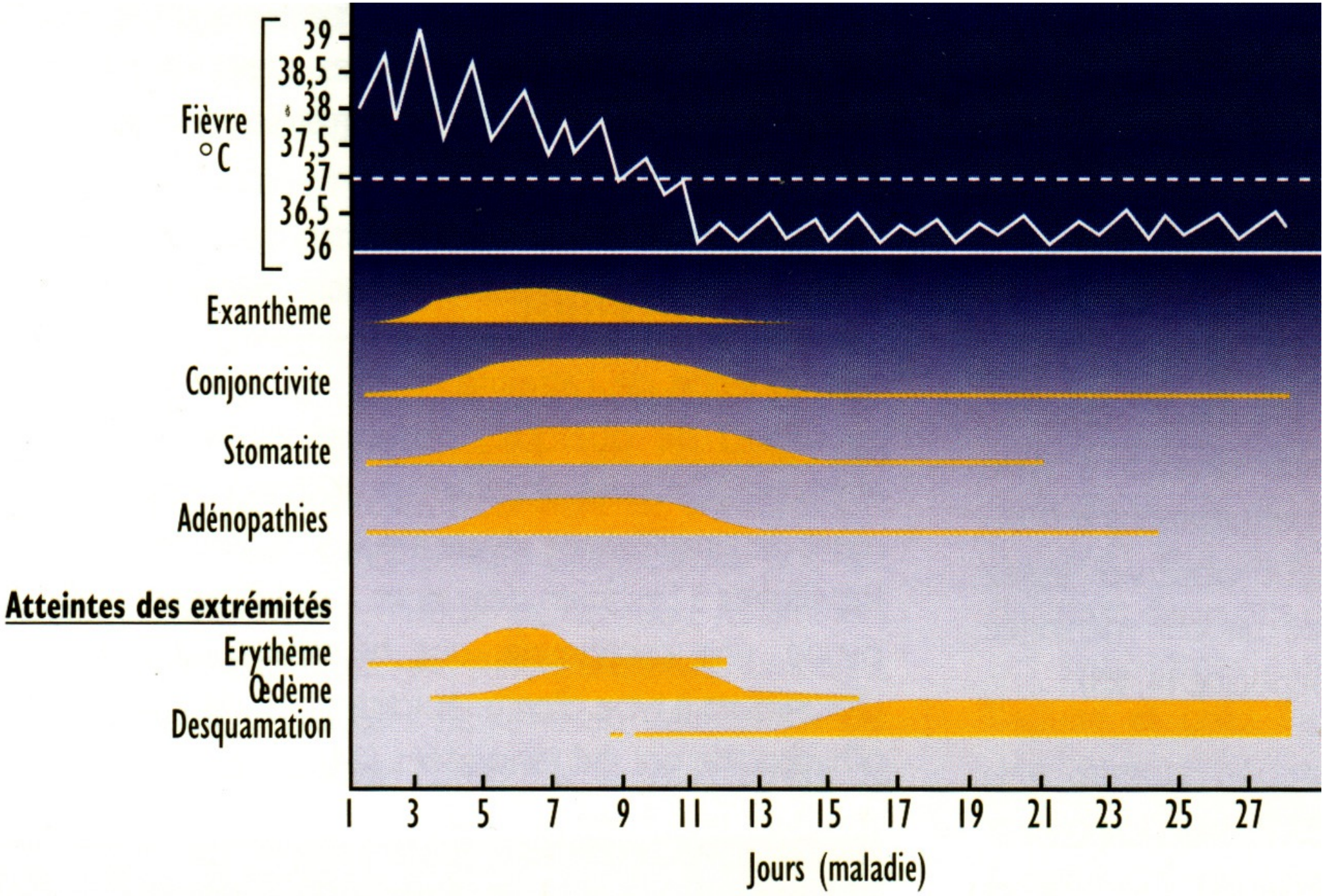
Newburger JACC 2016

Caractéristiques cliniques: critères majeurs

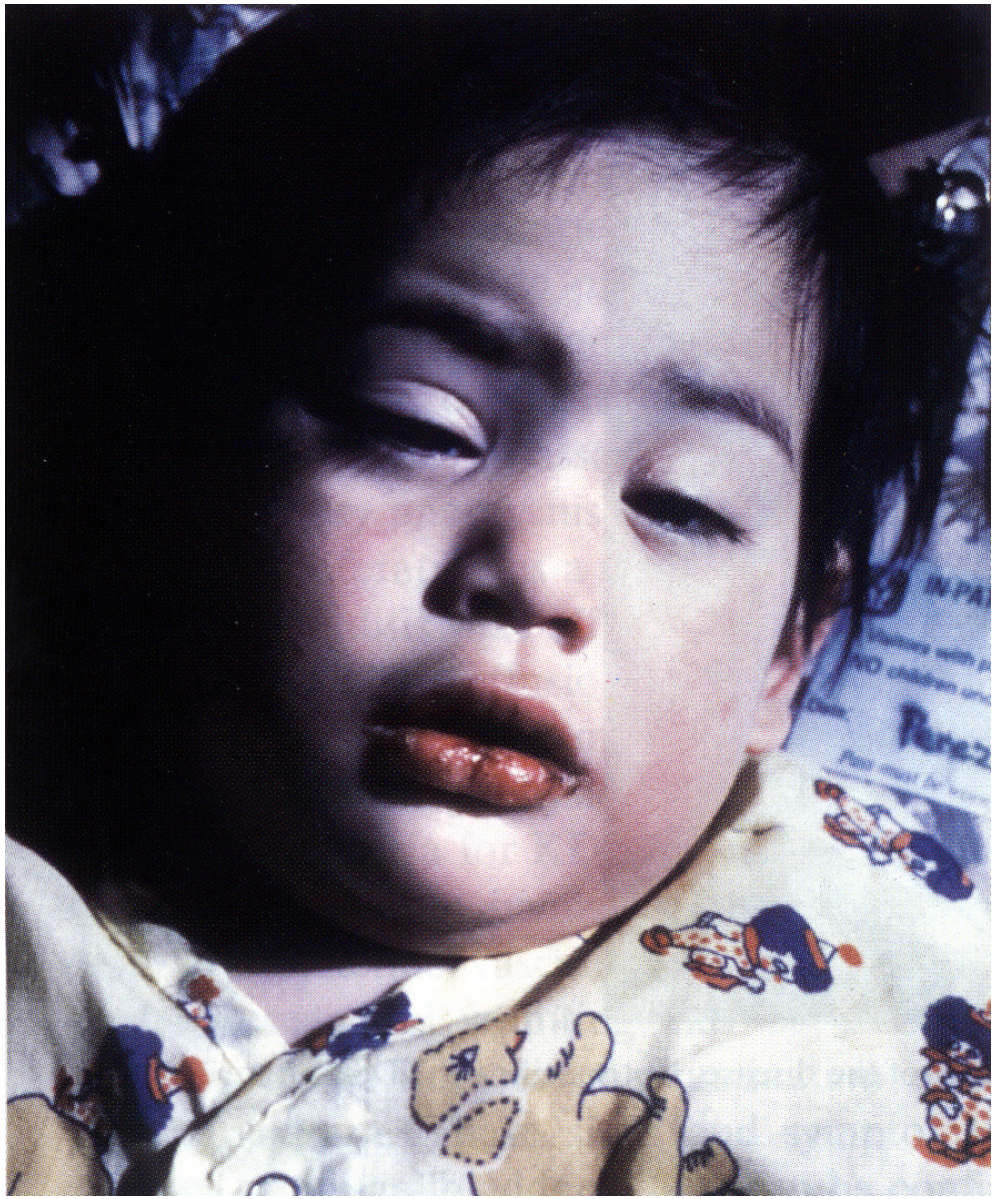
Figure 2. Critères diagnostiques de la maladie de Kawasaki



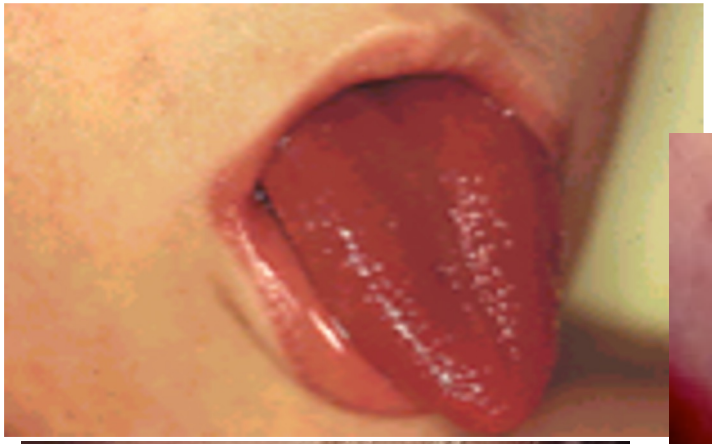
PNDS 2022

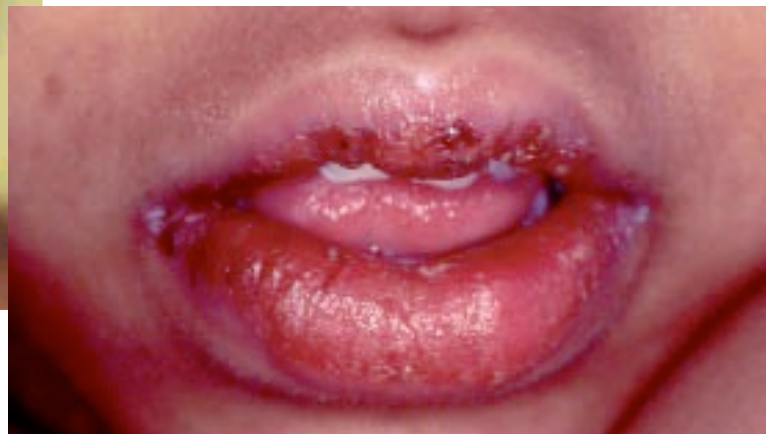

Fièvre °C
39
38,5
38
37,5
37
36,5
36
Exanthème
Conjonctivite
Stomatite
Adénopathies
Atteintes des extrémités
Erythème
Œdème
Desquamation
1
3
5
7
9
11
13
15
17
19
21
23
25
27
Jours (maladie)

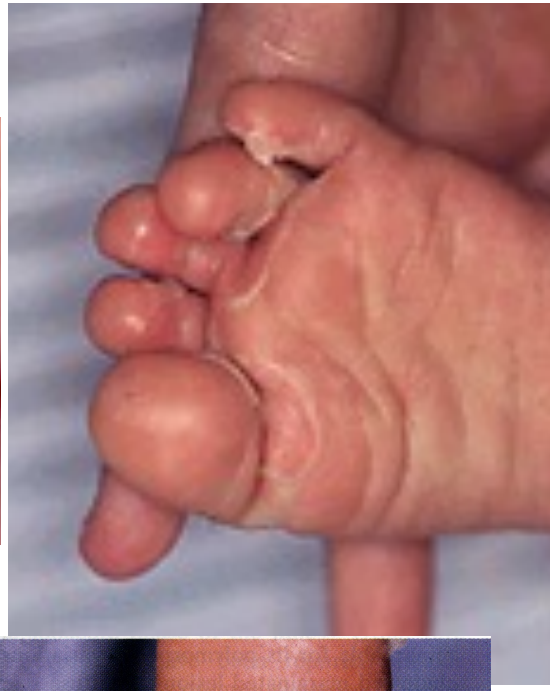
Faciès typique d’un enfant avec Kawasaki

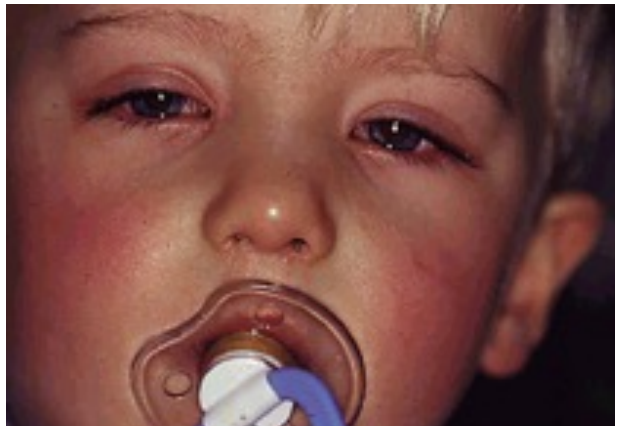


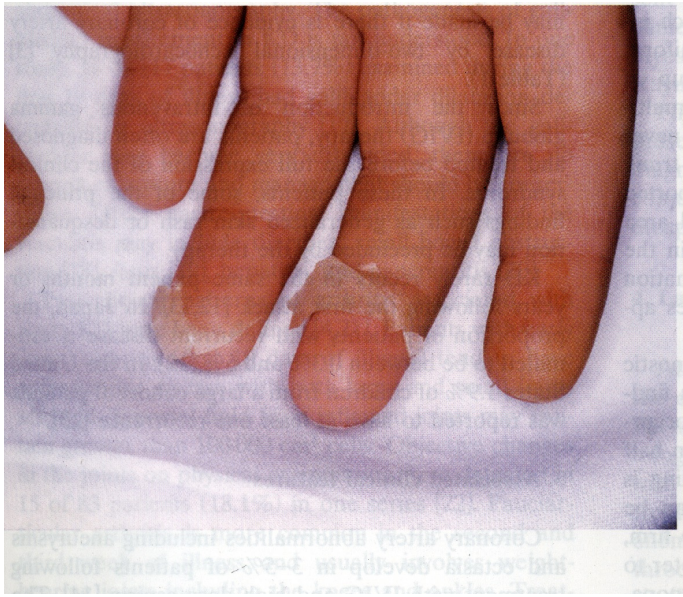
Atteinte muqueuse et desquamation palmo-plantaire

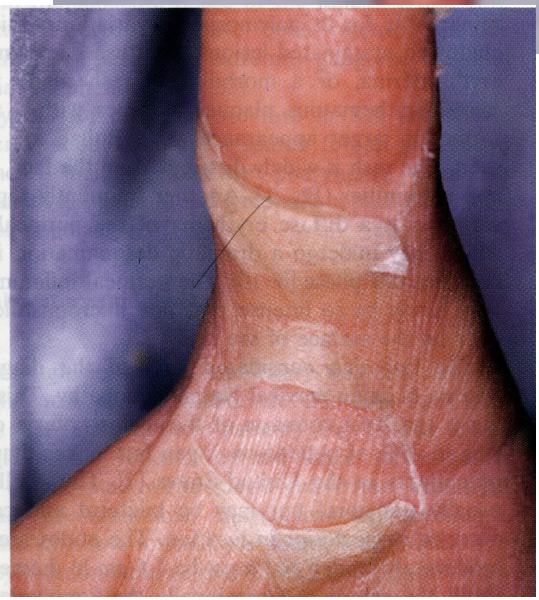


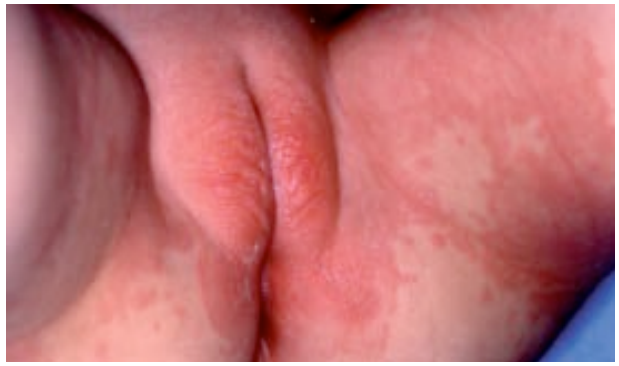




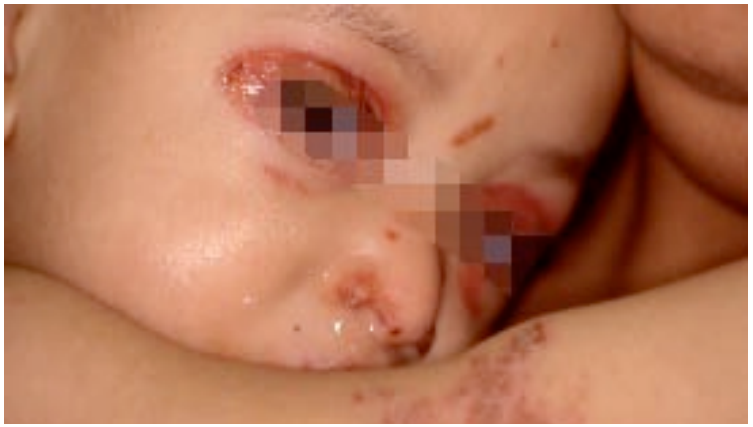


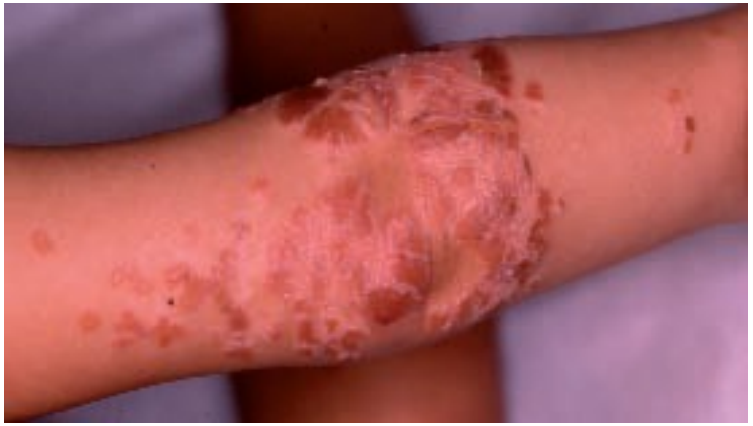


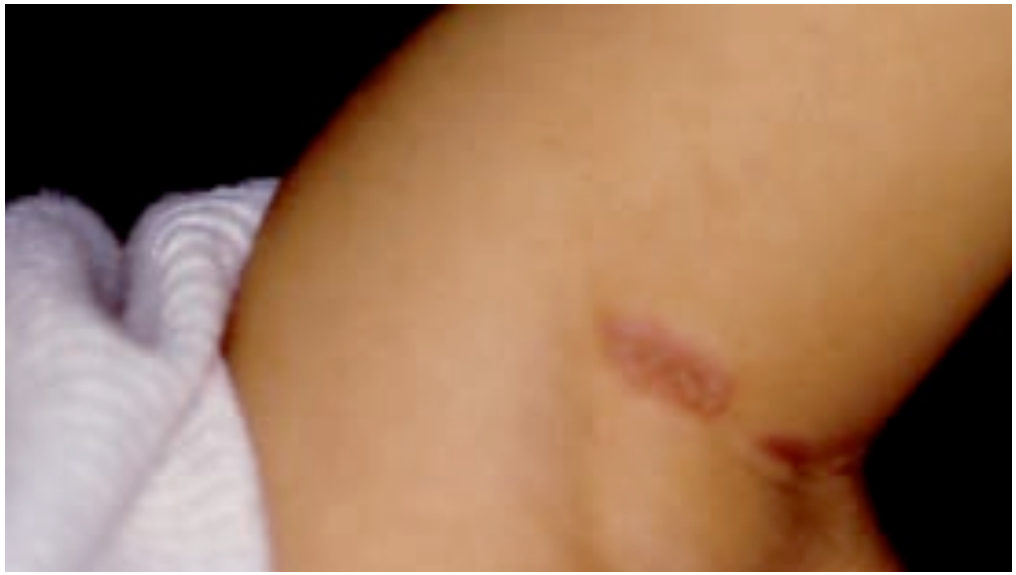


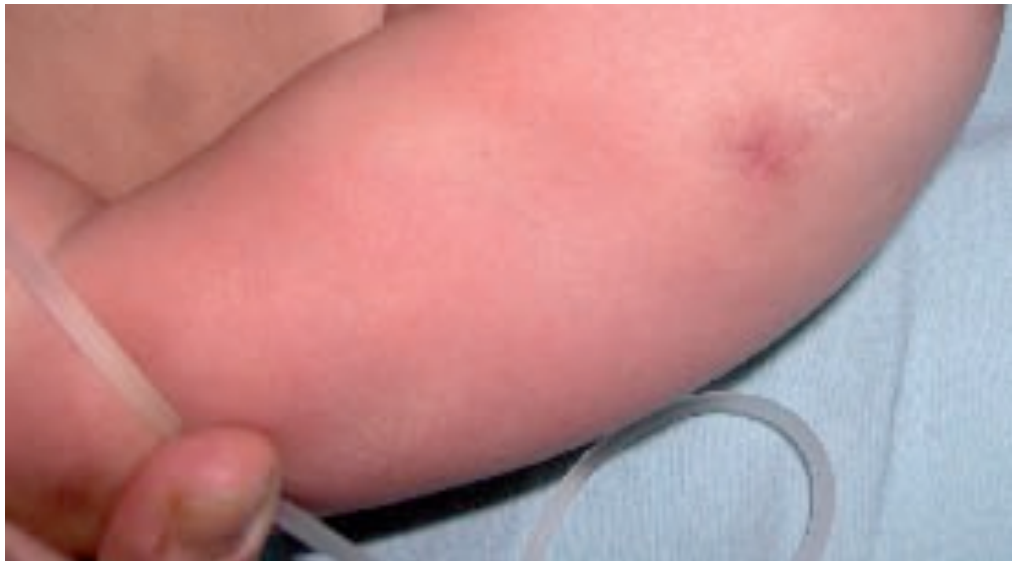


Formes rares: forme psoriasiforme/ BCGite









Atteinte cardiovasculaire

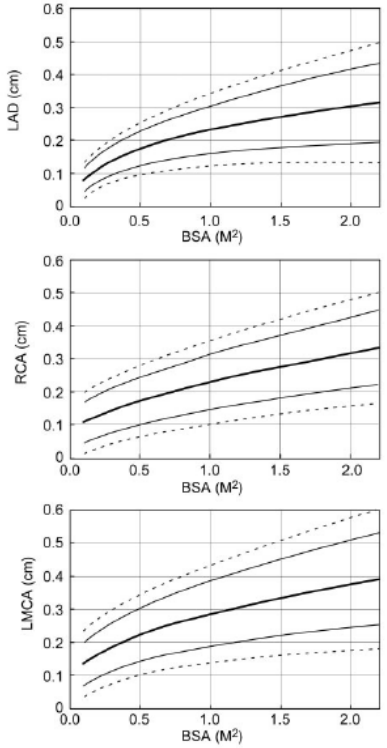
- **Pas d'atteinte coronaire dans 75% des cas !**
- **Anomalie ECG ou échocardiographique:**
  - **Dilatation des artères coronaires (20%)**
  - Anévrismes coronaires
  - Infarctus
  - Myocardite avec possible insuffisance ventriculaire gauche sévère
  - Péricardite, épanchement péricardique
  - Fuites valvulaires par inflammation des valves cardiaques et particulièrement la valve mitrale (1 %)
  - Troubles conductifs et troubles du rythme par inflammation du tissu de conduction

Les anévrismes coronaires

- **Entre le 10ème et le 25ème jour d'évolution**
- 5 % lorsque le traitement est fait précocement

  = < 10 jours du début des symptômes
- Souvent multiples et siègent habituellement dans la partie proximale des artères coronaires

- **Pronostic cardiaque dépend essentiellement de leur taille.**
- Depuis presque 10 ans: plus la taille en mm mais le **Z score** !



Selon les guideslines américaines:

Dilatation coronaire	**Z score > 2 < 2,5**
Petit anévrysme coronaire	**Z score > 2,5 <5**
Anévrysme coronaire moyen	**Z score 5-10**
Anévrysme géant	**Z score > 10 ou > 8 mm**

Newburger JACC 2016

Formes atypiques

Tableau clinique dominé par un symptôme inhabituel:

« convulsions, œdème pulmonaire, diarrhée sanglante, ascite, obstruction des voies aériennes supérieures, épiglottite, adénopathies cervicales compressives ou hémolyse et défaillance multi-viscérale, syndrome néphrotique, hyponatrémie…. »

Formes de l'adulte

- Troubles digestifs, atteinte hépatique, signes articulaires et encéphalites sont plus fréquent

Les formes incomplètes

Patients ayant eu une fièvre depuis **au moins 5 jours** et
au **moins deux critères cliniques de Kawasaki**, sans cause évidente,
et des critères biologiques en faveur d'une inflammation systémique

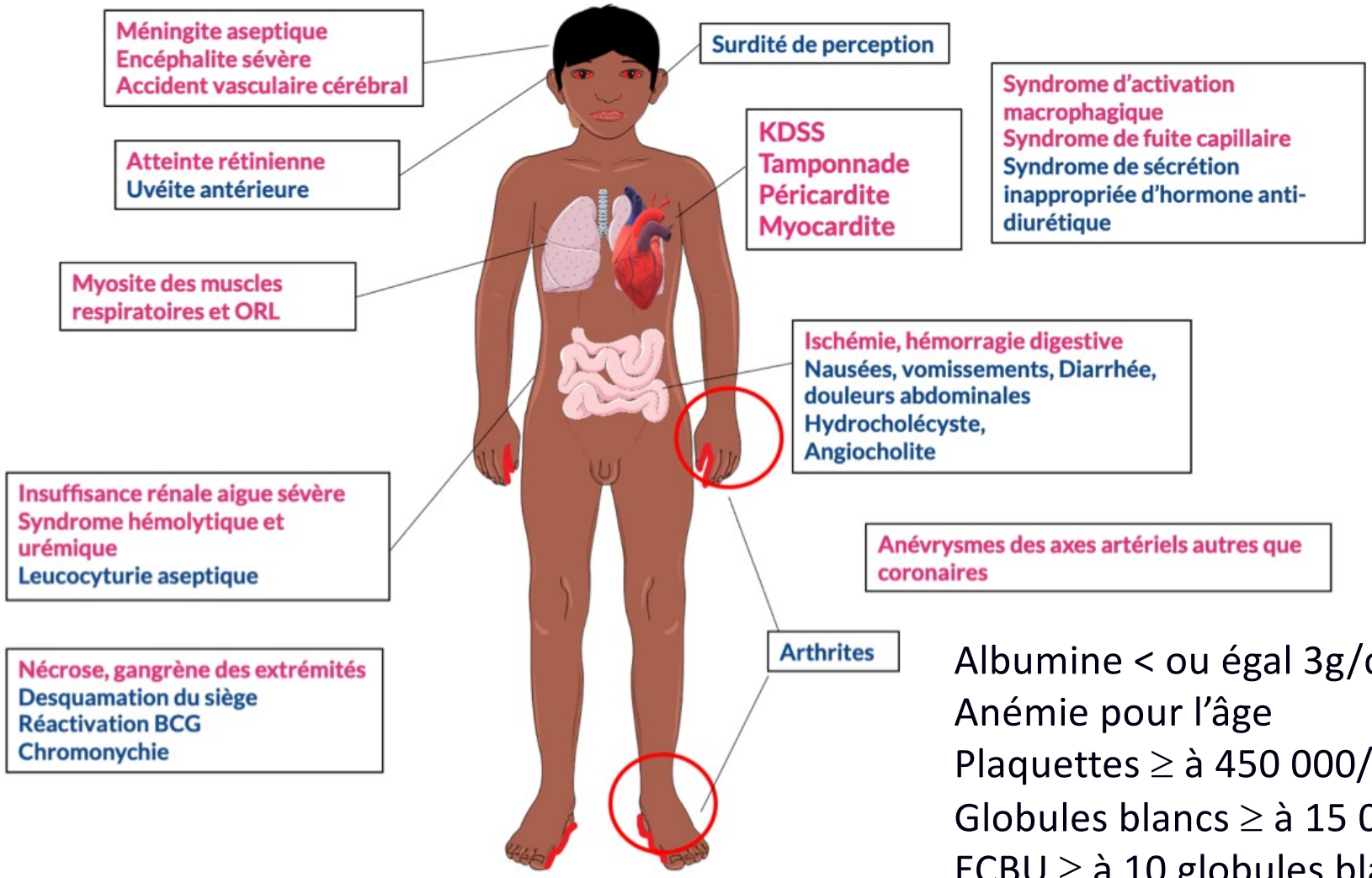
- **Différent de la « forme atypique »**
- Manque **un** ou **plusieurs des cinq critères** diagnostiques majeurs
- **Plus fréquentes chez les enfants les plus jeunes, à risque d'anomalies coronaires**

Diagramme décisionnel proposé par l'American Academy of Paediatrics pour aider à la prescription d'IgG dans les formes incomplètes

Newburger JW et al., Circulation. 2004

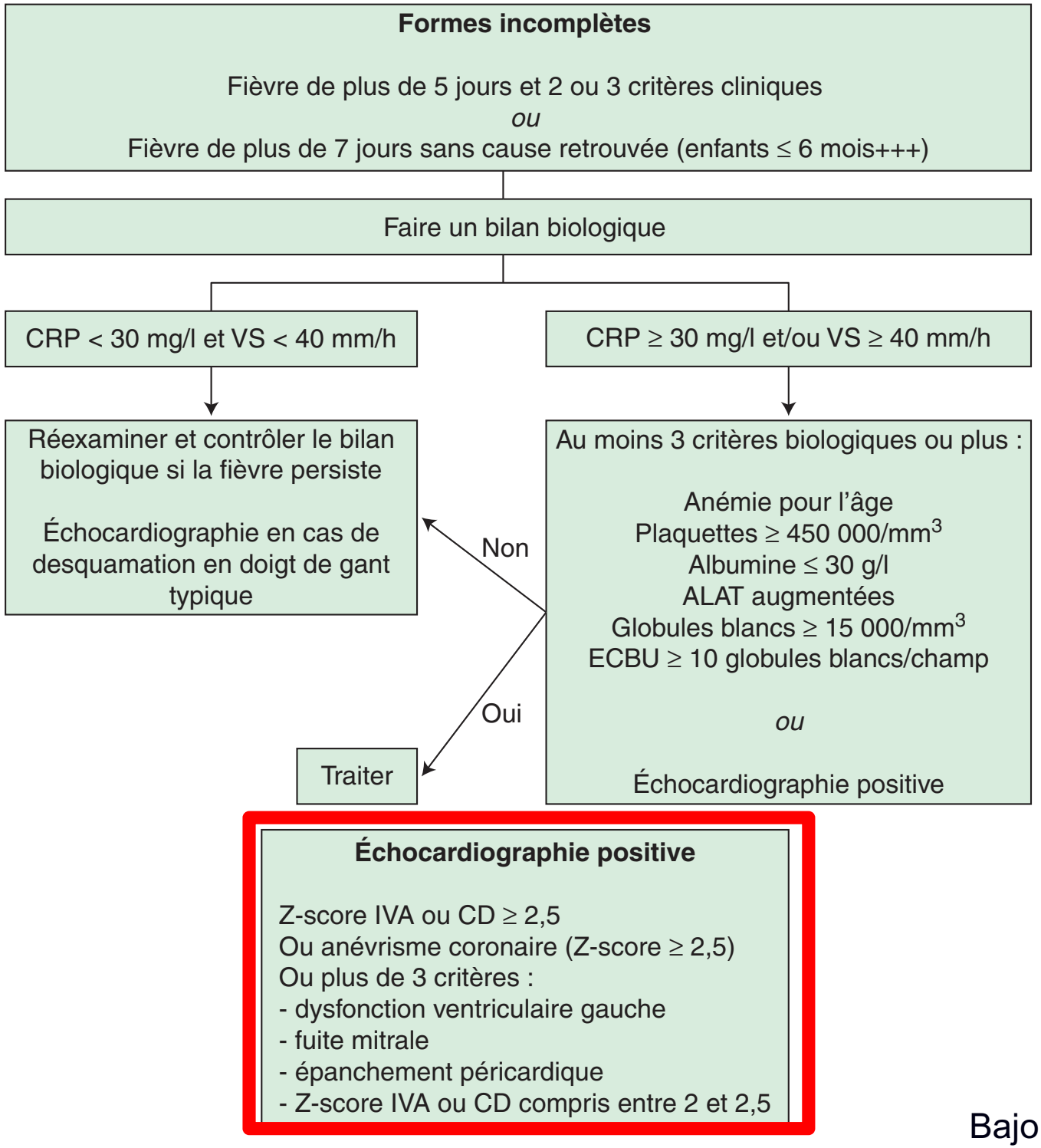
Critères cliniques et biologiques supplémentaires

Figure 3 : Autres manifestations de la maladie de Kawasaki (en rose : complications graves)



Albumine < ou égal 3g/dl
Anémie pour l'âge
Plaquettes ≥ à 450 000/ mm³ à J7
Globules blancs ≥ à 15 000 / mm³
ECBU ≥ à 10 globules blancs/ champ

PNDS 2022



Bajolle et al. 2018 EMC

Evolution naturelle

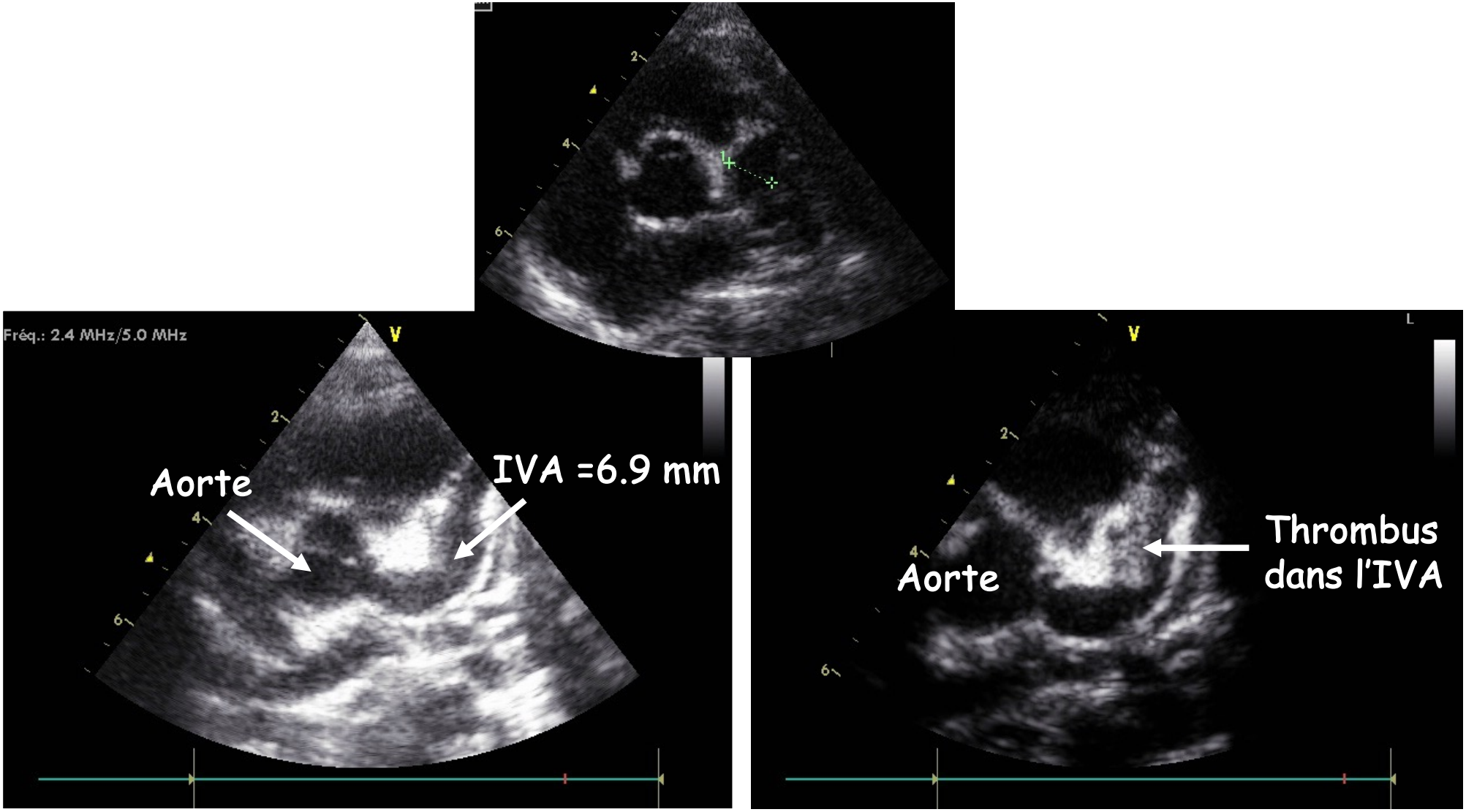
1°) La phase aiguë (J0-J10) : **atteinte cardiaque rare**

2°) La phase subaiguë (J10-J20) : **diagnostic de complication coronaire**

3°) La phase de convalescence (J20-J70) : **constatation d'anévrysmes et de sténoses cicatricielles** en cas de complication coronaire à la deuxième phase

Exemples d’atteinte coronaires

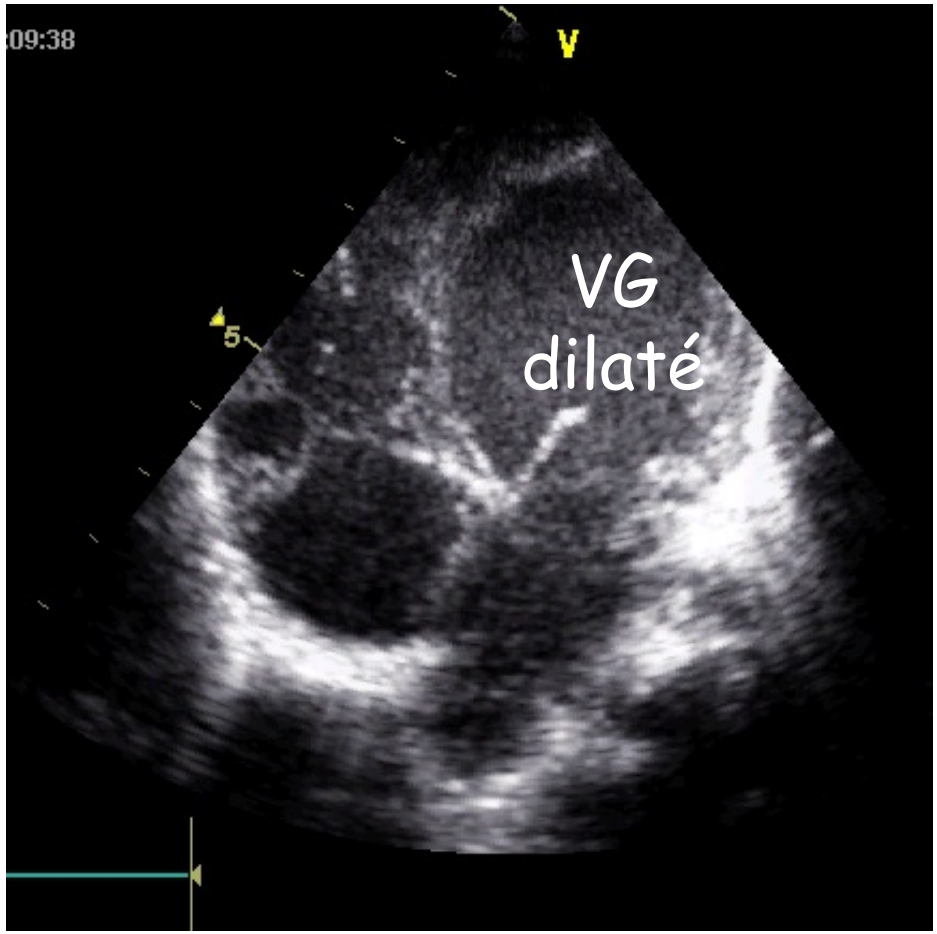
Dilatation anévrysmale des artères coronaires

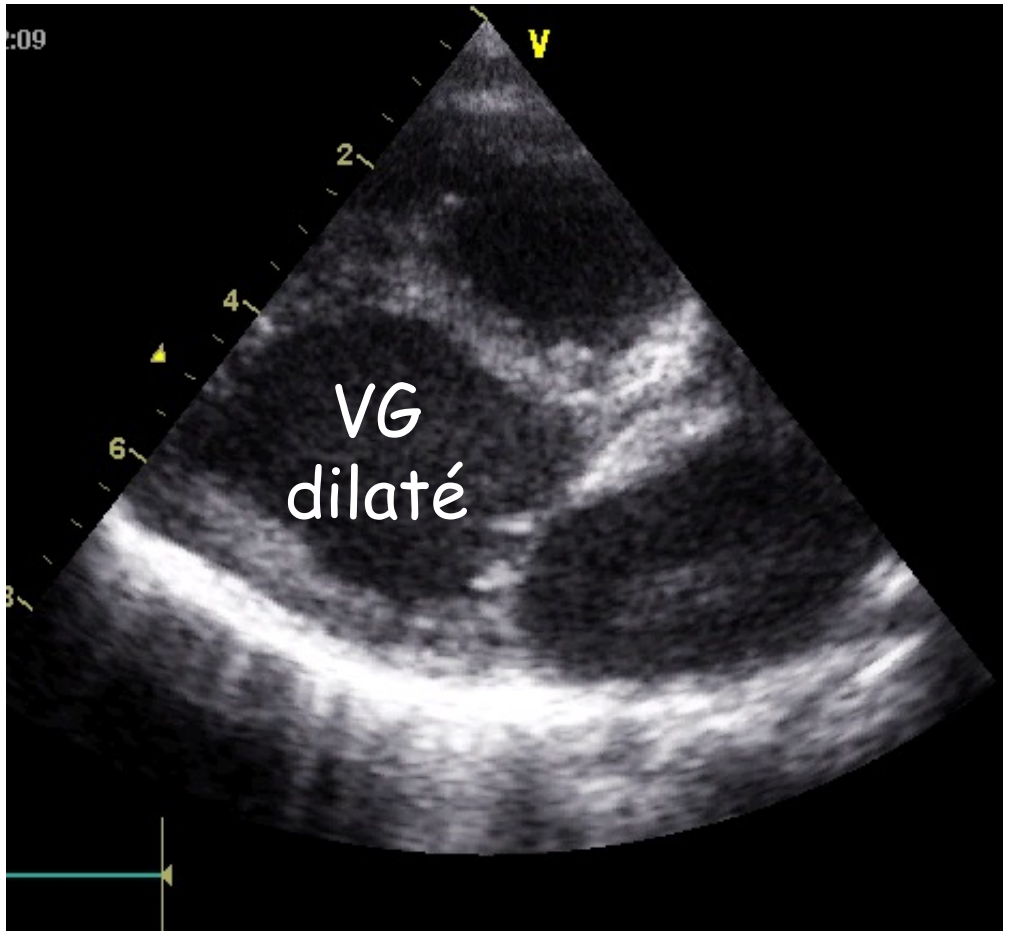


(A) IVA=interventriculaire antérieure
(B) thrombus dans l'IVA

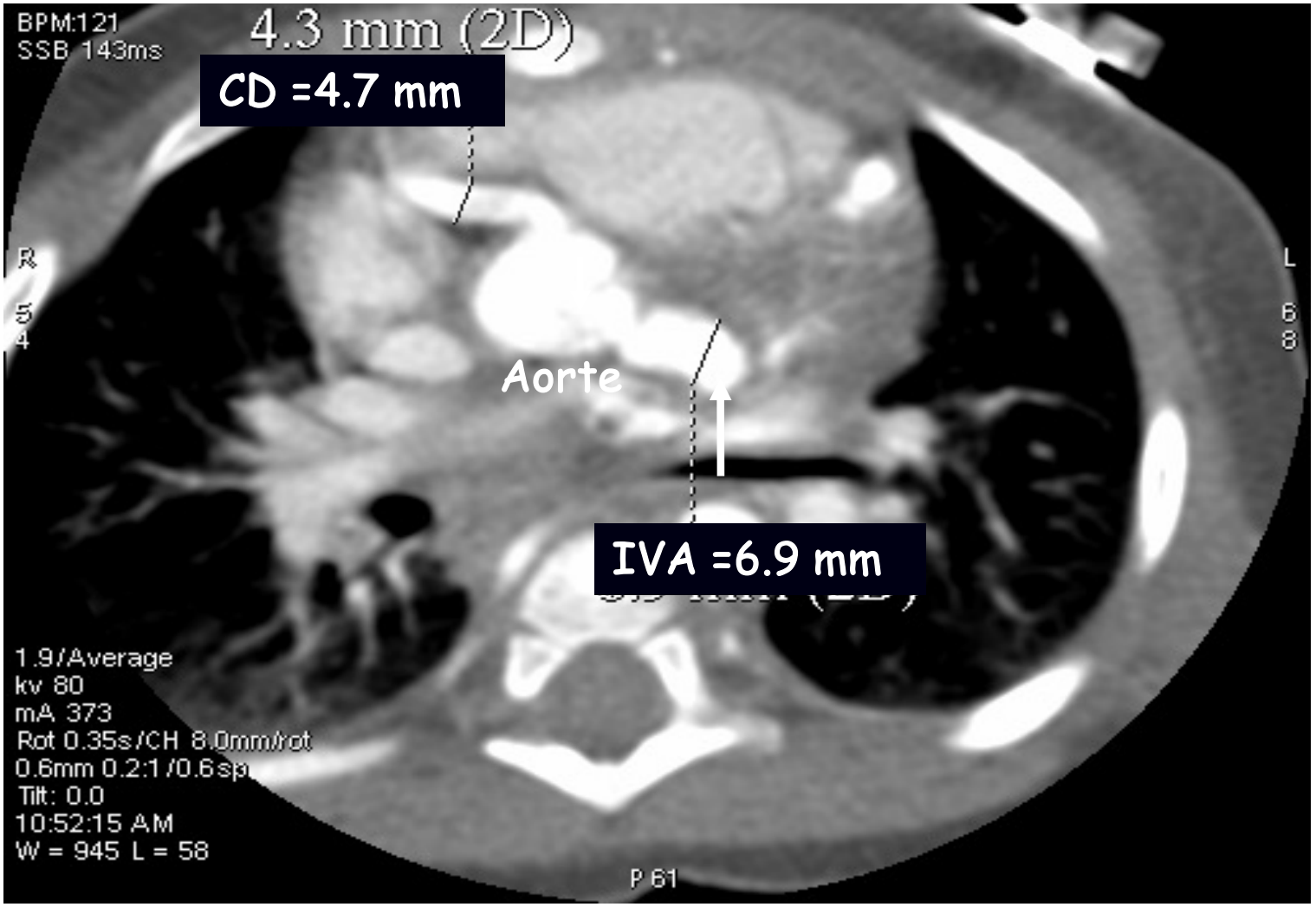
Dysfonction ventriculaire gauche sévère en échographie

Etat de choc dans 7% des cas de maladie de Kawasaki

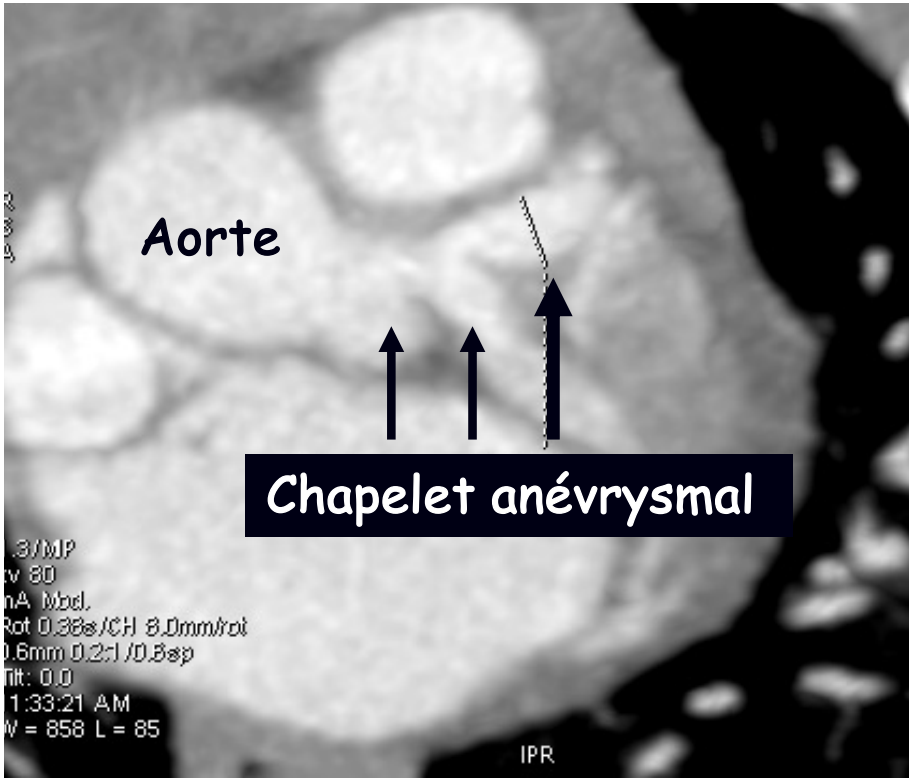


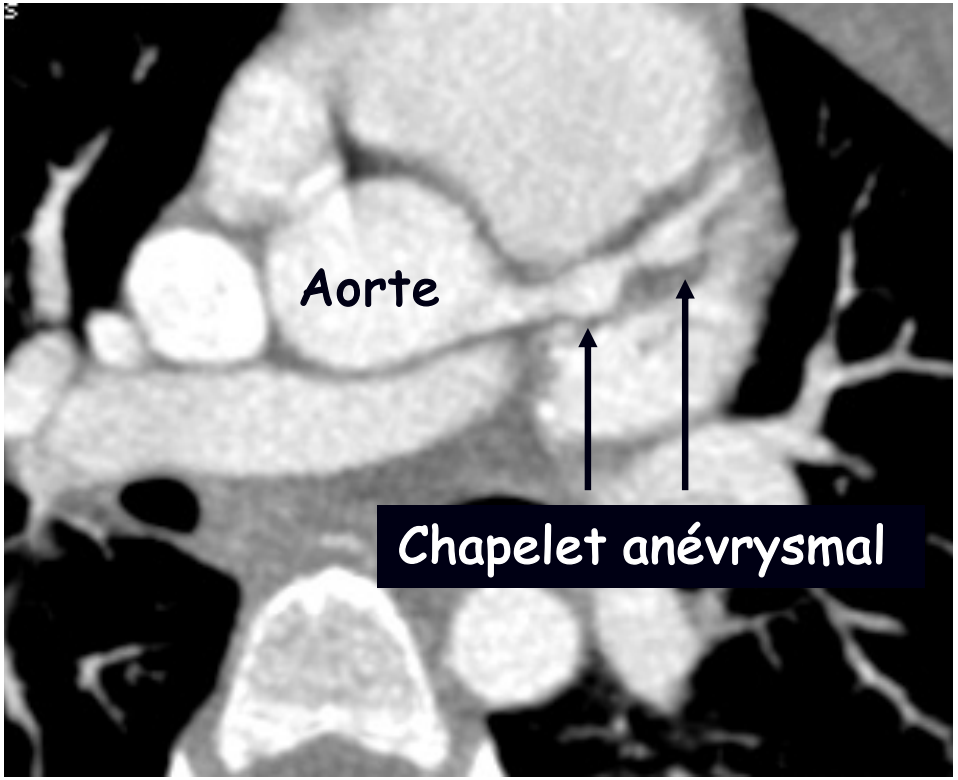


Dilatation anévrysmale des artères coronaires au scanner

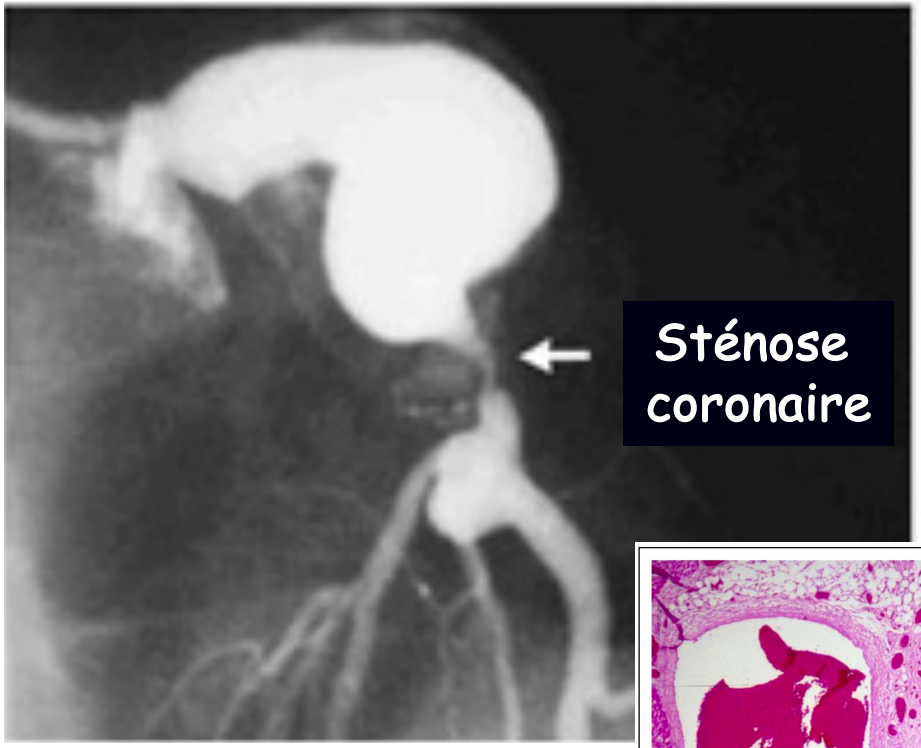


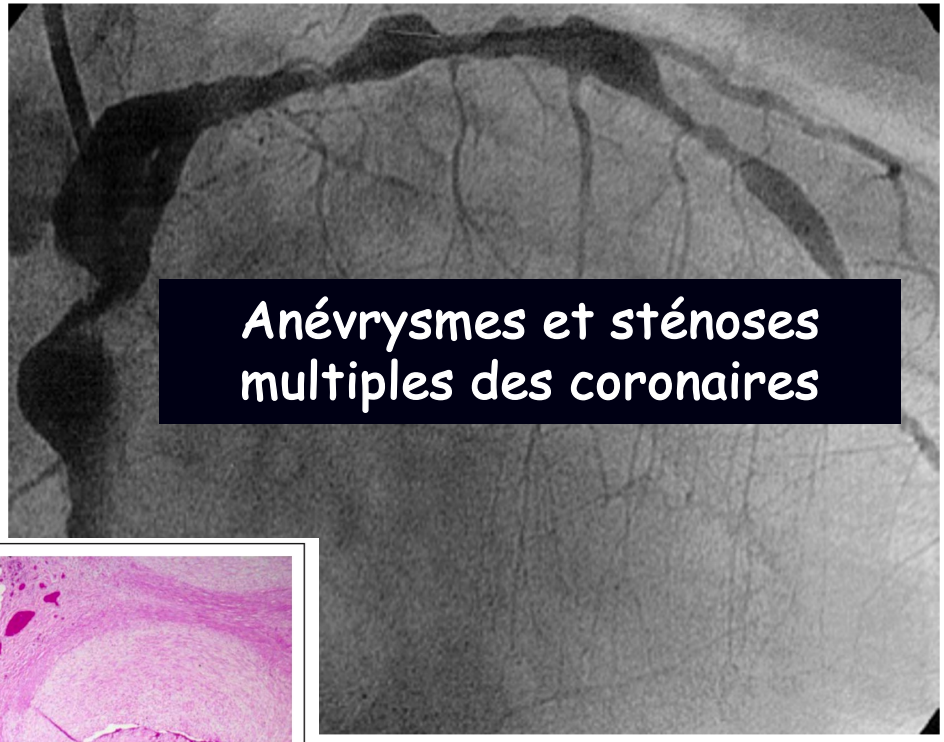
Dilatation anévrysmale de l'IVA en chapelet au scanner

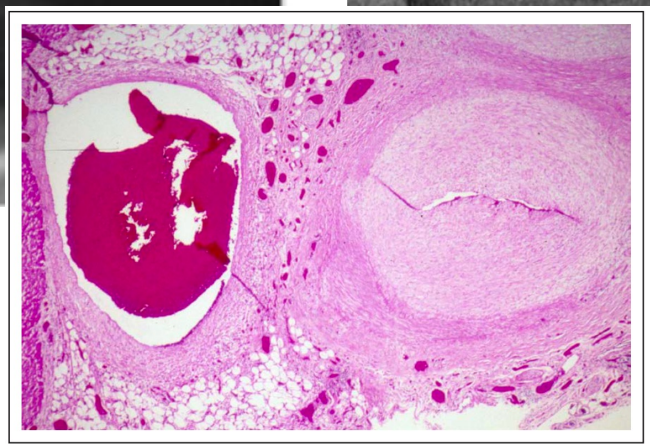




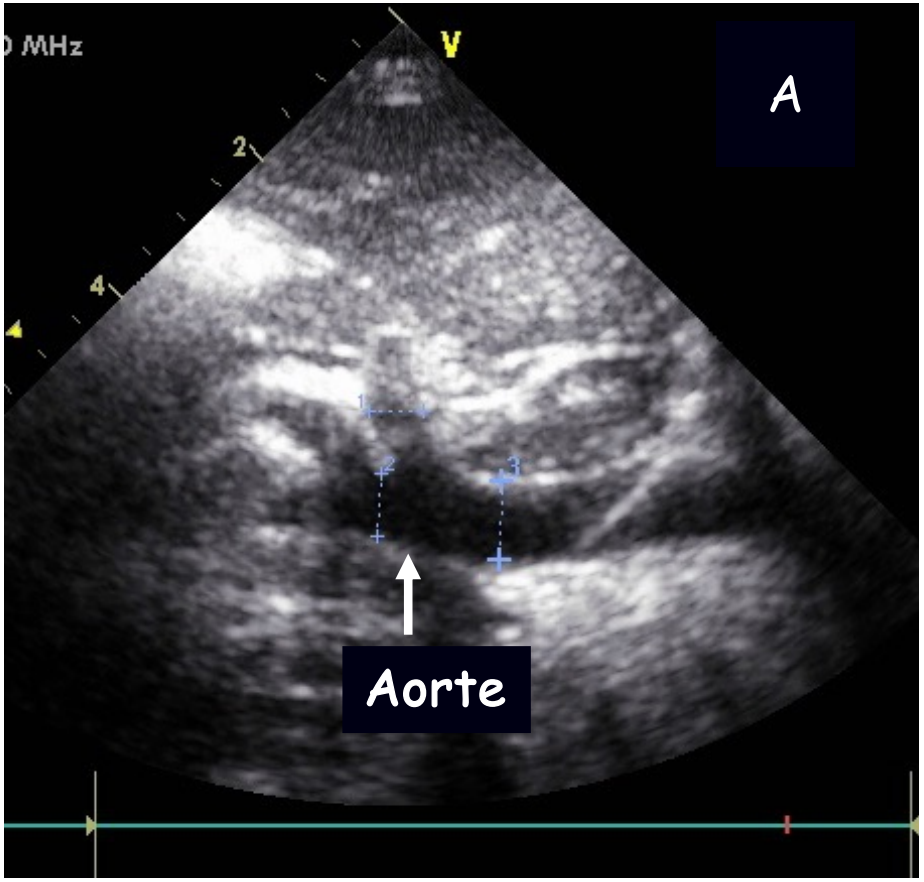
Anévrysme coronaire avec sténose coronaire au cathétérisme cardiaque

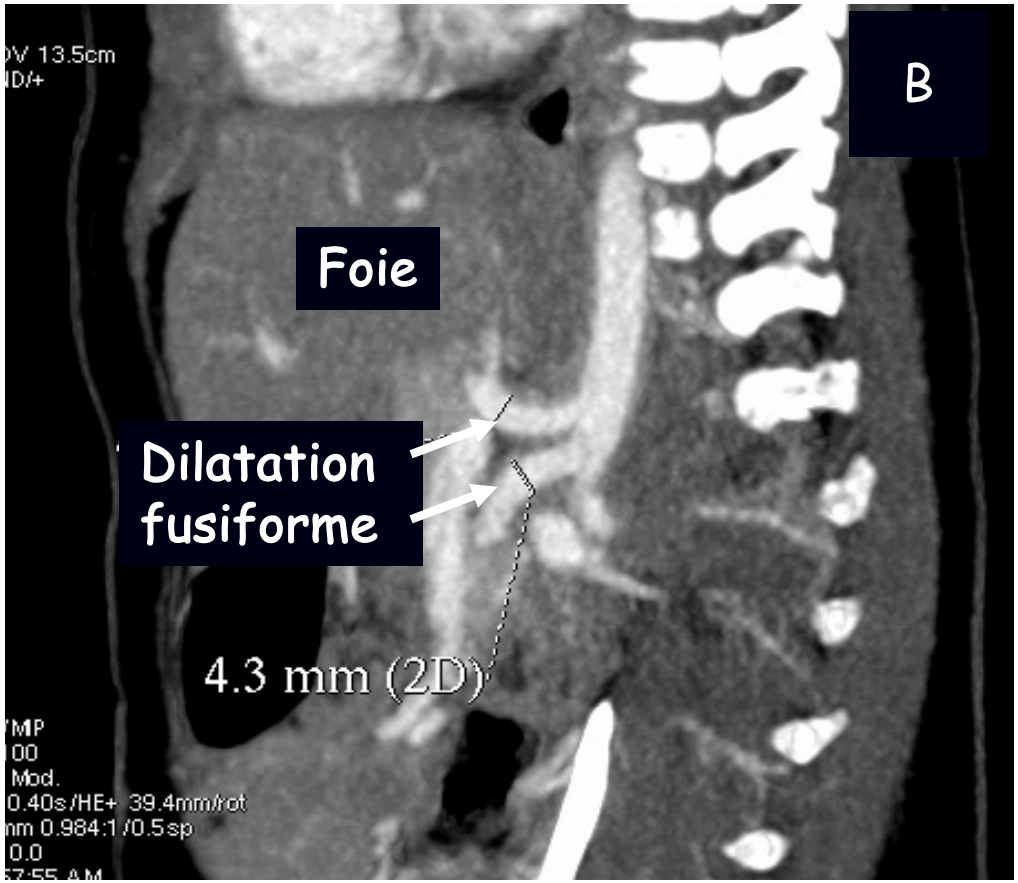






Atteinte diffuse des axes vasculaires





(A) épaississement pariétal hyperéchogène de l'aorte, de l'artère mésentérique supérieure et du tronc cœliaque en échographie

(B) dilatation fusiforme de l'artère mésentérique supérieure, du tronc caeliaque au scanner

Le traitement de 1ère intention

Immunoglobulines intraveineuses:

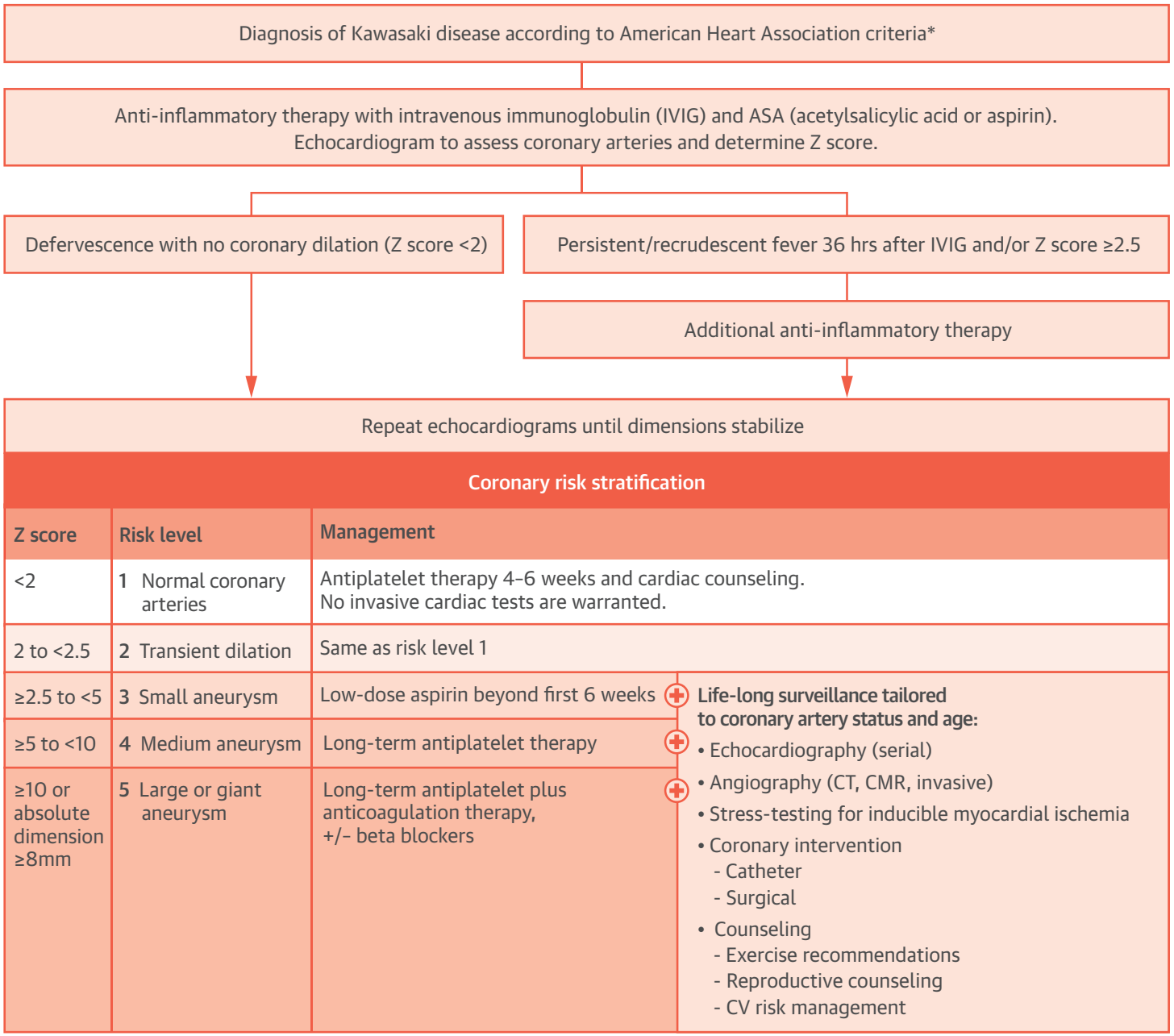
- 2g/kg en 8 à 12 heures, à posologie progressive

En association à de **l'acide acétylsalicylique (AAS) :**

- à fortes doses pour ses effets anti-inflammatoires et anti-thrombotiques **(30-50 mg/kg/j en 4 fois)** à la phase aiguë
- puis à **dose anti-aggrégante plaquettaire** rapidement 48-72 h après l'apyrexie (3-5 mg/kg/jour)

De Graeff et al 2019, Newburger 2016

CENTRAL ILLUSTRATION Management of Kawasaki Disease



Newburger, J.W. et al. J Am Coll Cardiol. 2016;67(14):1738–49.

Recommandations américaines

TABLE 1 Principles in Acute Management of KD

1. The goal of therapy is to reduce systemic and tissue-level inflammation as rapidly as possible. For this reason, patients should be treated as soon as diagnosis can be confidently established.
2. All patients within the first 10 days of fever onset should be treated with IVIG. Patients diagnosed after 10 days should receive IVIG treatment if they are still febrile, have markedly elevated inflammatory parameters, or have coronary artery dilation.
3. Recrudescent fever at least 36 h after the end of IVIG infusion without other explanation is a marker for persistent inflammation and should prompt immediate and aggressive anti-inflammatory therapy
   a. Antibody-mediated hemolysis has become common in KD patients who have received IVIG retreatment and have type A or B blood; rescue therapies other than IVIG (e.g., infliximab, corticosteroids) should be considered.
4. Patients with coronary artery dilation (*z*-score >2.0) should be followed with a repeat echocardiogram at least twice a week until dimensions stabilize; additional anti-inflammatory therapy should be considered.
5. Patients with giant aneurysms should have frequent echocardiograms in the first 3 months of illness for thrombus surveillance, even after dimensions stabilize.
6. Infants under 6 months of age are at extremely high risk of aneurysm formation, even with timely therapy. They require echocardiograms every few days until dimensions have stabilized.
7. Patients with giant CAA (*z*-score ≥10) are at highest risk for thrombosis during the first 3 months after fever onset
   a. Systemic anticoagulation together with an antiplatelet agent should be administered until coronary dimensions improve.
   b. Low-molecular-weight heparin is easier to regulate than warfarin in infants, as well as in patients of any age, during the acute phase of illness or until hsCRP normalizes.

CAA = coronary artery aneurysm; hsCRP = high-sensitivity C-reactive protein; IVIG = intravenous immunoglobulin; KD = Kawasaki disease.

Newburger JACC 2016

Surveillance à court terme

Pour les patients sans complication coronaire:

- 1 echo entre 1-2 semaines et 1 echo entre 4-6 semaines (Classe 1)

Pour les patients avec Z score coronaire > 2,0 à la phase aigue:

- 2 echos par semaines jusqu'à l'arrêt de la progression

Pour les patients avec anévrismes géants:

- 2 échos par semaine tant que les lésions progressent
- 1 écho/sem pdt 45 jours puis
- 1 écho/mois pendant 3 mois (Classe IIA)

Newburger JACC 2016

Antiagrégation et anticoagulation

Patients sans atteinte coronaire:

- Aspirine pendant 6 semaines (Cl 1)

Patients avec atteinte coronaire d'aggravation rapide:

- Hospitalisation pour mise sous héparine (AntiXa 0,5-1)
- Arrêt si stabilisation; Z score < 10 ou 8 mm
- Aspirine 12 mois

Patients avec anévrysmes géants:

- Hospitalisation pour heparine et relais AVK (INR 2-3)
- Aspirine à vie

Que faire en cas de persistance de la fièvre après une première cure d'IgIV?

- **Résistants:** 15 à 20 % des cas
- Associée à un risque plus élevé d'atteinte coronaire

- Deuxième dose d'IVG
- associée à un bolus de corticoïdes (20-30 mg/kg/jour IV methylprednisolone)

- **Discuter:** prednisolone p.o. plus prolongé 2-3 semaines
- Alternative: infliximab
- En cas d'échec: ciclosporine

Newburger JW et al., Circulation. 2004

Egami K et al., J Pediatr 2006

Comment identifier les résistants ?

Score d'Egami (2006)	Score de Kobayashi (2006)	Score de Sano (2007)
Age ≤ 6 mois (2 points)	Age ≤ 12 mois (1 point)	Bilirubine totale ≥ 0.9mg/dL (1 point)
≤ 4 jours de fièvre (1 point)	Traitement dans les 4 premiers jours de fièvre (2 points)	CRP ≥ 7mg/dL (1 point)
Plaquettes ≤ 300.10^9/L (1 point)	Plaquettes ≤ 300.10^9/L (1 point)	ASAT ≥ 200 U/L (1 point)
CRP ≥ 8mg/dL(1 point)	CRP ≥ 10mg/dL (1 point)	
ALAT > 100 U/L (1 point)	ASAT ≥ 100 U/L (1 point)	
	≥ 80% neutrophiles (2 points)	
	Na+ ≤ 133 mmol/L (2 points)	
Haut risque si ≥ 3 points	Haut risque si ≥ 5 points	Haut risque si ≥ 2 points

Scores issus de la population japonaise, spécifique mais non sensible

European consensus-based recommendations for the diagnosis and treatment of Kawasaki disease – the SHARE initiative

Rheumatology 2019;58:672–682

8. Corticosteroid treatment should be given to patients with severe KD[a]:	1A[b]
(a) Who are IVIG resistant, that is, with ongoing fever and/or persistent inflammation or clinical signs ⩾48 h after receiving IVIG as a single dose of 2 g/kg. A second dose of IVIG is at the discretion of the treating physician.	1A 3 4
(b) Kobayashi score ⩾5 (see Supplementary Table S5, available at *Rheumatology* online)	4
(c) With features of HLH	4
(d) With features of shock	4
(e) Who are under the age of 1 year	
(f) Who present with coronary and/or peripheral aneurysms	
9. If corticosteroids are indicated, the following regimens would be reasonable:	2A

Regimen 1: methylprednisolone 0.8 mg/kg BD i.v. for 5–7 days or until CRP normalizes; then convert to oral prednisone/prednisolone 2 mg/kg/day and wean off over next 2–3 weeks.
Regimen 2: methylprednisolone 10–30 mg/kg (up to maximum of 1g/day) once daily for 3 days followed by oral prednisone/prednisolone 2 mg/kg per day until day 7 or until CRP normalizes; then wean over next 2–3 weeks.

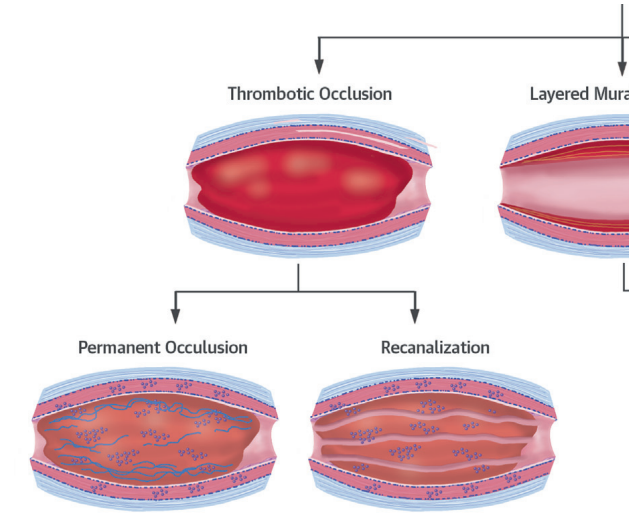
Depuis 2019: corticoïdes IV puis p.o. en phase aigue pour les patients à risque élevé d'emblée ou avec résistance

Quelle est l'histoire naturelle des complications coronaires de la MK?

- Disparition complète dans plus de 50% des cas même en cas d'anévrysme (sauf géant) dans les 2 ans
- Occlusion coronaire; sténoses localisées ou multiples parfois très tardives…
- Gravité des lésions tardives car multiples et chirurgie difficile

Anévrysme géants (1%)

- Mortalité et morbidité +++
- Survie à 30 ans: 88-90%



- Cardiac event free à 30 ans : 30%
- 26% infarctus myocardique
- Risque accru dans les 2 ans après le diagnostic
- 50% de bypass coronaire à 30 ans

Surveillance à long terme

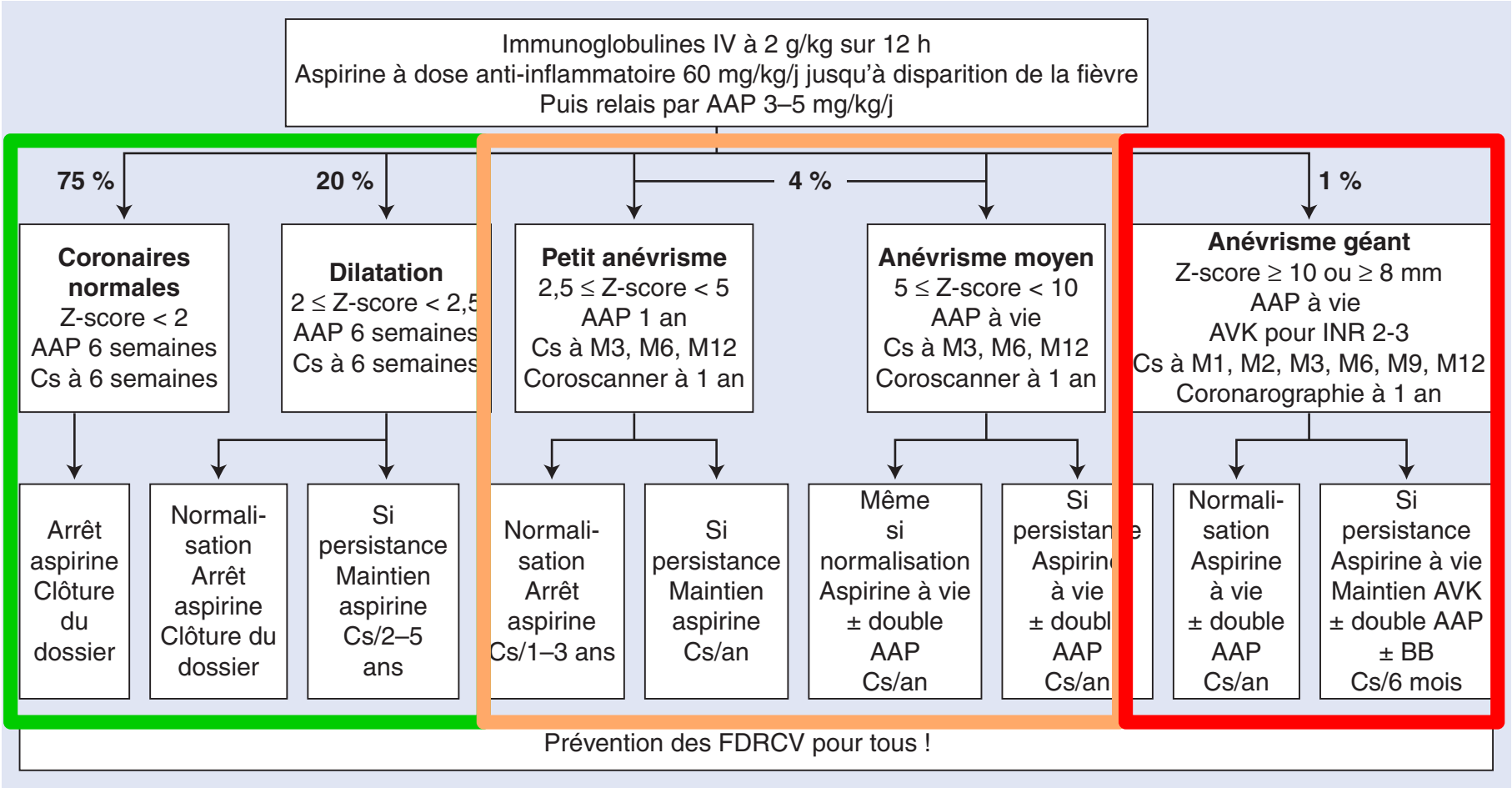


Figure 2. Arbre décisionnel. Prise en charge proposée par le centre de référence Malformations Cardiaques Congénitales Complexes (M3C) Necker. IV : p voie intraveineuse ; AAP : aspirine à dose antiagrégante plaquettaire ; Cs : consultation ; AVK : antivitamine K ; INR : *international normalized ratio* ; FDRCV facteurs de risques cardiovasculaires.

Bajolle et al. 2018 EMC

Devenir à long terme

TABLE 2 Principles in the Long-Term Management of Patients With KD

1. On the basis of available data, patients with no demonstrated coronary artery dilation by echocardiogram with excellent visualization of all arterial segments during the first weeks of illness appear to have normal cardiovascular status in early adulthood.
2. Remodeling (so-called regression) of aneurysms, especially if moderate or large, to normal internal lumen diameter is often accompanied by luminal myofibroblastic proliferation and abnormal vascular reactivity.
3. Patients with persistent CAA are at lifelong risk of progressive coronary artery stenosis or occlusion and worsening ischemia.
4. Patients with CAA documented at any stage require lifelong cardiovascular surveillance tailored to disease severity and age.
5. Testing should minimize exposure to ionizing radiation whenever possible.
6. Sedentary life-style should be avoided.
7. Women with coronary aneurysms can carry pregnancy successfully, but should have reproductive counseling.
8. Monitoring and counseling regarding traditional CV risk factors is appropriate to reduce the likelihood of later atherosclerosis.

Newburger JACC 2016

Protocole National de Diagnostic et de Soins

Maladie de KAWASAKI

MISC ou PIMS

Manifestations Kawasaki-like

Post Covid

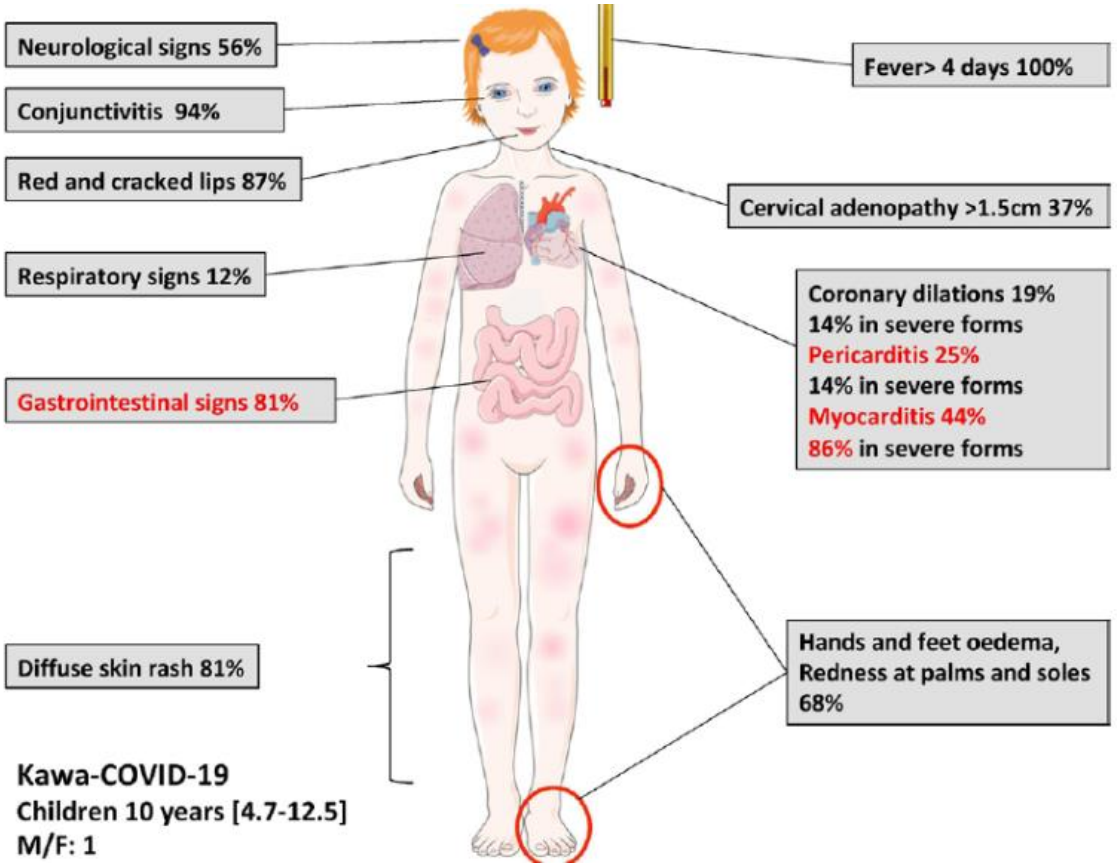
Définition de MIS-C: multisystem inflammatory syndrome in children

Table 1 Case definitions for SARS-CoV-2-associated multisystem inflammatory syndrome in children

Royal College of Paediatrics and Child Health, UK	Centers for Disease Control and Prevention (CDC), USA	World Health Organization (WHO)
A child presenting with persistent fever (> 38.5 °C), inflammation (neutrophilia, elevated CRP, and lymphopenia) and evidence of single or multiorgan dysfunction (shock, cardiac, respiratory, kidney, gastrointestinal, or neurological disorder) with additional features*. This may include children fulfilling full or partial criteria for KD. Exclusion of any other microbial cause, including bacterial sepsis, staphylococcal or streptococcal shock syndromes, infections associated with myocarditis such as enterovirus (waiting for results of these investigations should not delay seeking expert advice). SARS-CoV-2 RT-PCR test results may be positive or negative. *Additional features: Clinical: Most: oxygen requirement, hypotension Some: abdominal pain, confusion, conjunctivitis, cough, diarrhea, headache, lymphadenopathy, mucus membrane changes, neck swelling, rash, respiratory symptoms, sore throat, swollen hands and feet, syncope vomiting; Laboratory: All: abnormal fibrinogen, high D-dimers, high ferritin, hypoalbuminemia; Some: acute kidney injury, anemia, thrombocytopenia, coagulopathy, high IL-10, high IL-6, proteinuria, high CK, high LDH, high TG, high troponin, transaminitis;	An individual aged < 21 years presenting with fever*, laboratory evidence of inflammation**, and evidence of clinically severe illness requiring hospitalization, with multisystem (≥ 2) organ involvement (cardiac, renal, respiratory, hematologic, gastrointestinal, dermatologic or neurological); **AND** No alternative plausible diagnoses; **AND** Positive for current or recent SARS-CoV-2 infection by RT-PCR, serology, or antigen test, or COVID-19 exposure within 4 weeks prior to the onset of symptoms. *Fever ≤ 38 °C for ≥ 24 h, or report of subjective fever lasting ≥ 24 h. **Including, but not limited to, one or more of the following: an elevated CRP, ESR, fibrinogen, procalcitonin, d-dimer, ferritin, LDH, or IL-6, elevated neutrophils, reduced lymphocytes and low albumin. Additional comments: Some individuals may fulfill or partial criteria for KD but should reported if they meet the case definition for MIS-C; Consider MIS-C in any pediatric death with evidence of SARS-Cov-2 infection.	Children and adolescents 0–19 years of age with fever ≥ 3 days; **AND** two of the following: 1. Rash or bilateral non-purulent conjunctivitis or muco-cutaneous inflammation signs (oral, hands or feet). 2. Hypotension or shock. 3. Features of myocardial dysfunction, pericarditis, valvulitis, or coronary abnormalities (including echo findings or elevated troponin/NT-proBNP), 4. Evidence of coagulopathy (by PT, PTT, elevated d-dimers). 5. Acute gastrointestinal problems (diarrhea, vomiting, or abdominal pain). **AND** Elevated markers of inflammation such as ESR, C-reactive protein, or procalcitonin. **AND** No other obvious microbial cause of inflammation, including bacterial sepsis, staphylococcal or streptococcal shock syndromes. **AND** Evidence of COVID-19 **(**RT-PCR, antigen test or serology positive), or likely contact with patients with COVID-19. Consider this syndrome in children with features of typical or atypical KD or toxic shock syndrome

Sperotto et al. 2021 Review

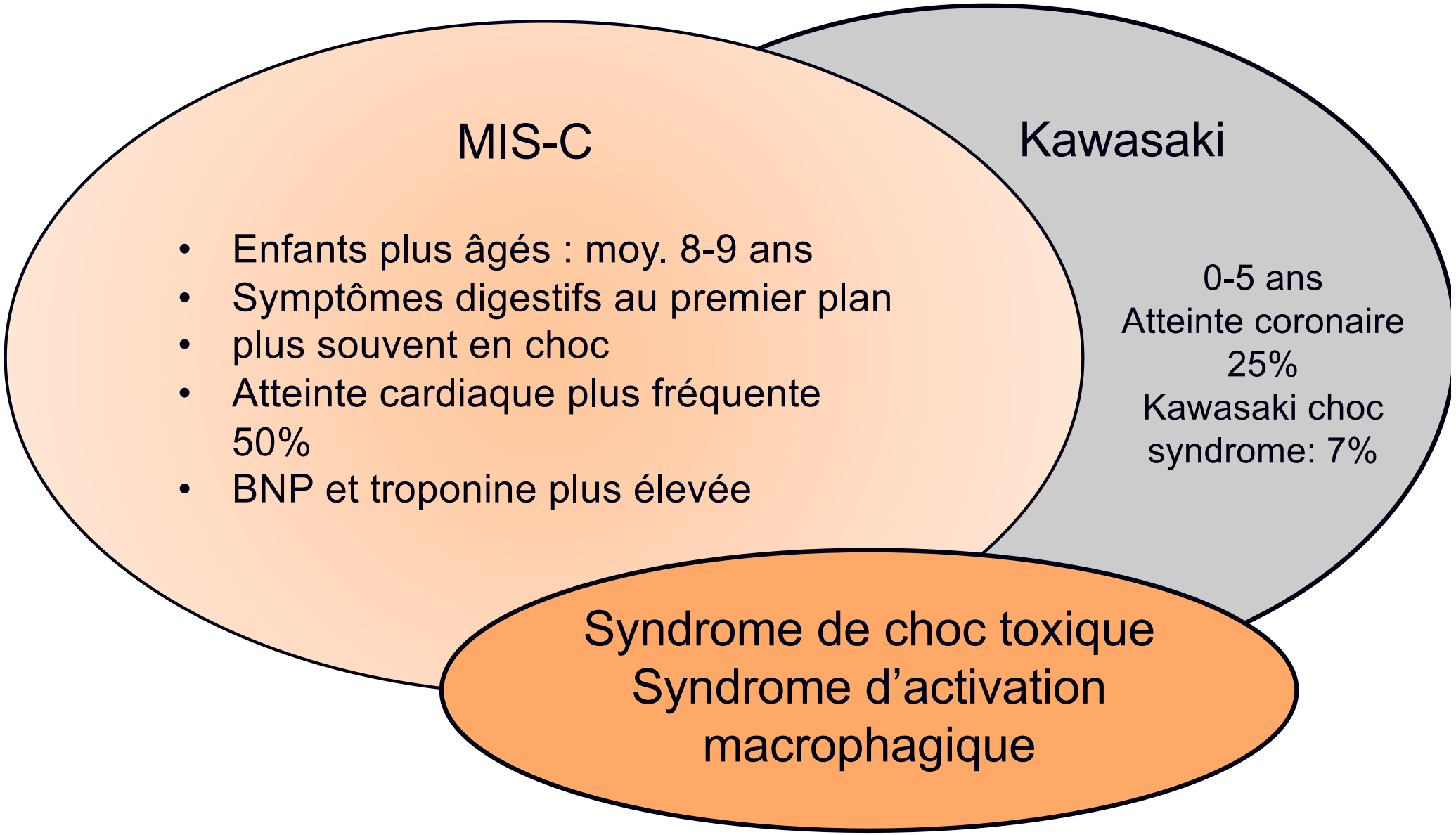
MIS-C



- **Covid-19 +:** PCR (20-50%) ou sérologie ou contact familial -> phénomène immunologique tardif ?
- **Délai infection** Covid- symptômes: 3-5 semaines
- **Biologie:** CRP, VS, PCT, ferritine, IL-6, fibrinogène élevé++, leucocytose, Hb et plaq normal ou diminué
  BNP et troponine très élevée

Sperotto et al. 2021 Review

MIS-C et Kawasaki



Traitement actuel du MIS-C

Immunoglobulines intraveineuses :

- 2 g/kg IV en une dose sur 12 heures, ou en deux doses sur 48h en cas de dysfonction cardiaque. Le débit initial doit être inférieur ou égal à 1 ml/kg/h pendant 30 minutes puis il peut être accéléré progressivement jusqu'à un maximum de 4 ml/kg/h si la tolérance est bonne (pas de dose maximum).

Corticostéroïdes :

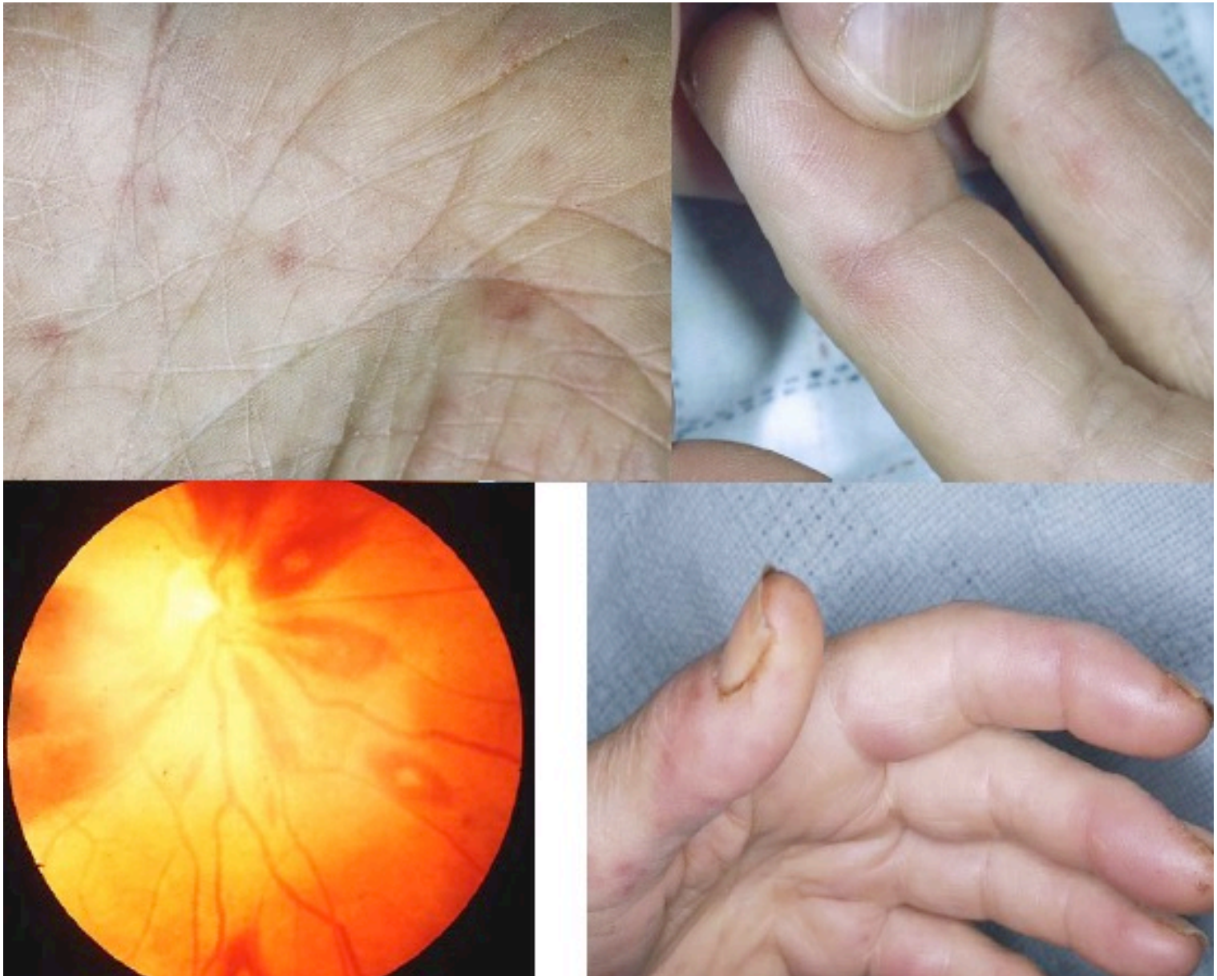
- Méthylprednisone intra-veineux à 1 mg/kg 2 fois par jour pendant 5 jours ou jusqu'à normalisation de la CRP, suivi de prednisone/prednisolone per os à 2 mg/kg/j avec décroissance sur 2 à 3 semaines.

Ou

- Méthylprednisolone intraveineux à 10 à 30 mg/kg 1 fois par jour (maximum 1 g/jour) pendant 3 jours suivi de prednisone/prednisolone per os à 2 mg/kg/j jusqu'au 7ème jour ou jusqu'à normalisation de la CRP, puis décroissance sur 2 à 3 semaines.

Bajolle 2020

Endocardite



Endocardite infectieuse

Def: Infection/inflammation de l'endocarde = valves cardiaques

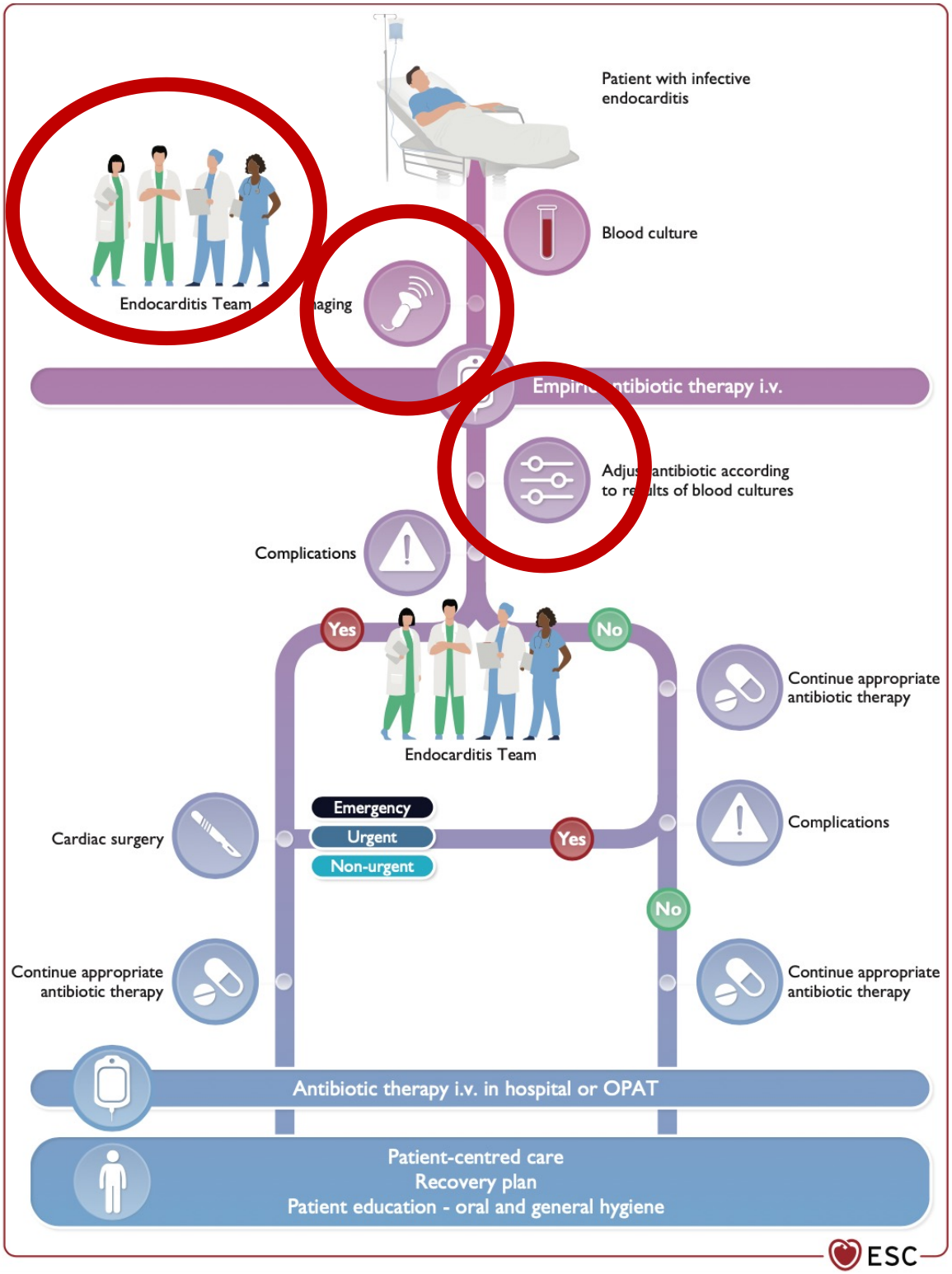
Dg: Echographie trans-thoracique voi

2023 ESC Guidelines for the management of endocarditis

Developed by the task force on the management of endocarditis of the European Society of Cardiology (ESC)

Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS) and the European Association of Nuclear Medicine (EANM)

-
-
- ébral, thoracique et abdominal)
- Examen ophtalmologique, bandelette urinaire
- Recherche porte d'entrée: examen dentaire, ORL, cutané, digestif, urinaire, KTC…



Guidelines ESC 2023

Patients considérés à risque

High risk

- Patients avec ATCD d'endocardite
- Patients avec matériel prothétique
- Patients avec ventricular assist device
- Patients avec CHD notamment
  - Tubes/ valves artificielles
  - Shunt résiduel
  - Fuite résiduelle après chirurgie valvulaire
  - 6 mois post-op

Intermediate risk

- Patients avec anomalies congénitales valvulaires isolées (bicuspidie)
- Patients avec rhumatisme cardiaque
- Patients avec PM ou défibrillateur

Table 10 **Definitions of the 2023 European Society of Cardiology modified diagnostic criteria of infective endocarditis**

Major criteria

(i) Blood cultures positive for IE

(a) Typical microorganisms consistent with IE from two separate blood cultures:
Oral streptococci, *Streptococcus gallolyticus* (formerly *S. bovis*), HACEK group, *S. aureus*, *E. faecalis*

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

(c) Single positive blood culture for *C. burnetii* or phase I IgG antibody titre >1:800.

(ii) Imaging positive for IE:

Valvular, perivalvular/periprosthetic and foreign material anatomic and metabolic lesions characteristic of IE detected by any of the following imaging techniques:
- Echocardiography (TTE and TOE).
- Cardiac CT.
- [18F]-FDG-PET/CT(A).
- WBC SPECT/CT.

Minor criteria

(i) Predisposing conditions (i.e. predisposing heart condition at high or intermediate risk of IE or PWIDs)[a]

(ii) Fever defined as temperature >38°C

(iii) Embolic vascular dissemination (including those asymptomatic detected by imaging only):
- Major systemic and pulmonary emboli/infarcts and abscesses.
- Haematogenous osteoarticular septic complications (i.e. spondylodiscitis).
- Mycotic aneurysms.
- Intracranial ischaemic/haemorrhagic lesions.
- Conjunctival haemorrhages.
- Janeway's lesions.

(IV) Immunological phenomena:
- Glomerulonephritis.
- Osler nodes and Roth spots.
- Rheumatoid factor.

(V) Microbiological evidence:
- Positive blood culture but does not meet a major criterion as noted above.
- Serological evidence of active infection with organism consistent with IE.

IE Classification (at admission and during follow-up)

Definite:
- 2 major criteria.
- 1 major criterion and at least 3 minor criteria.
- 5 minor criteria.

Possible:
- 1 major criterion and 1 or 2 minor criteria.
- 3–4 minor criteria.

Rejected:

Guidelines ESC 2023

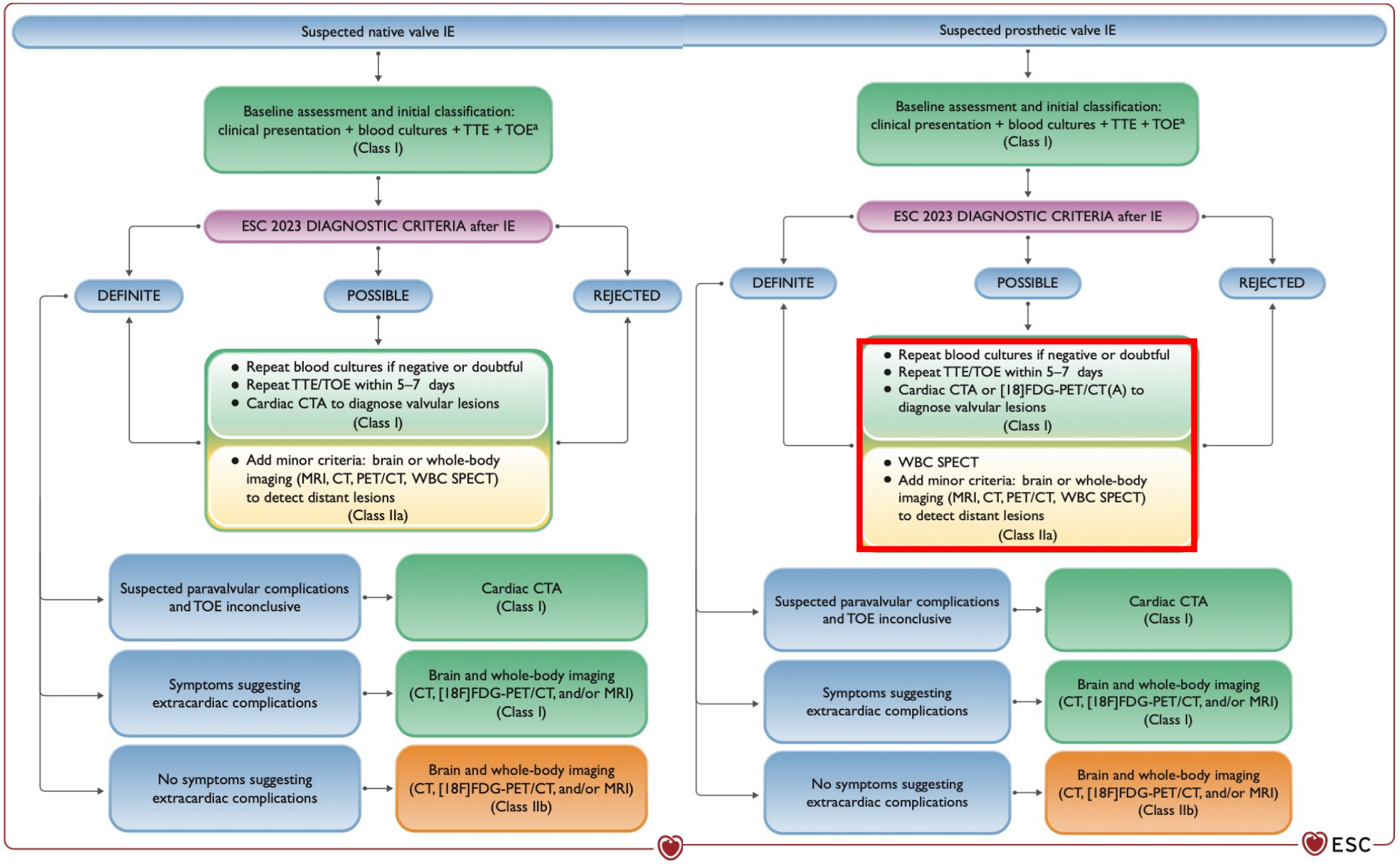


Figure 5 European Society of Cardiology 2023 algorithm for diagnosis of native valve infective endocarditis. [18F]FDG, ^{18}F-fluorodeoxyglucose; CT, computed tomography; CTA, computed tomography angiography; ESC, European Society of Cardiology; IE, infective endocarditis; MRI, magnetic resonance imaging; NVE, native valve endocarditis; PET, photon emission tomography; TOE, transoesophageal echocardiography; TTE, transthoracic echocardiography; WBC SPECT, white blood cell single photon emission tomography. [a]TOE for diagnosis and to detect perivalvular complications in all cases (unless right-sided NVE when TTE is good quality and conclusive).

Endocardite: germes

- Streptocoques ++ 40%
- Staphylocoques 40%
- Autres : 10%
  - Escherichia Coli
  - BGN
  - HACEK
- Hémocultures négatives: 5 à 10%

Endocardite: Traitement médical

- **Principes généraux**
  - Bi-thérapie ATB
  - Bactéricide
  - Intraveineux
  - Prolongé: 4 à 6 semaines
  - Adaptée (antibiogramme)
  - Taux sériques efficaces

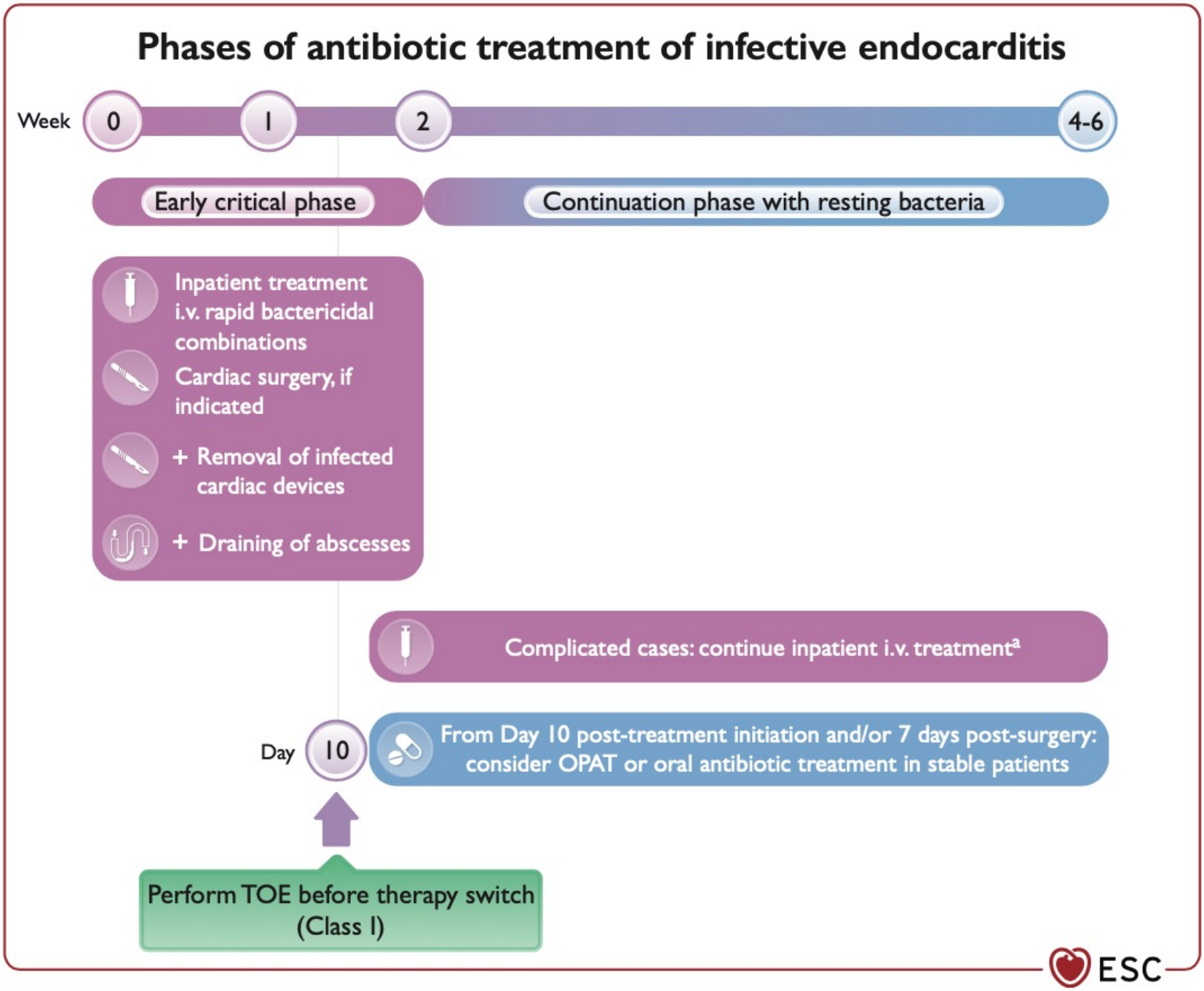
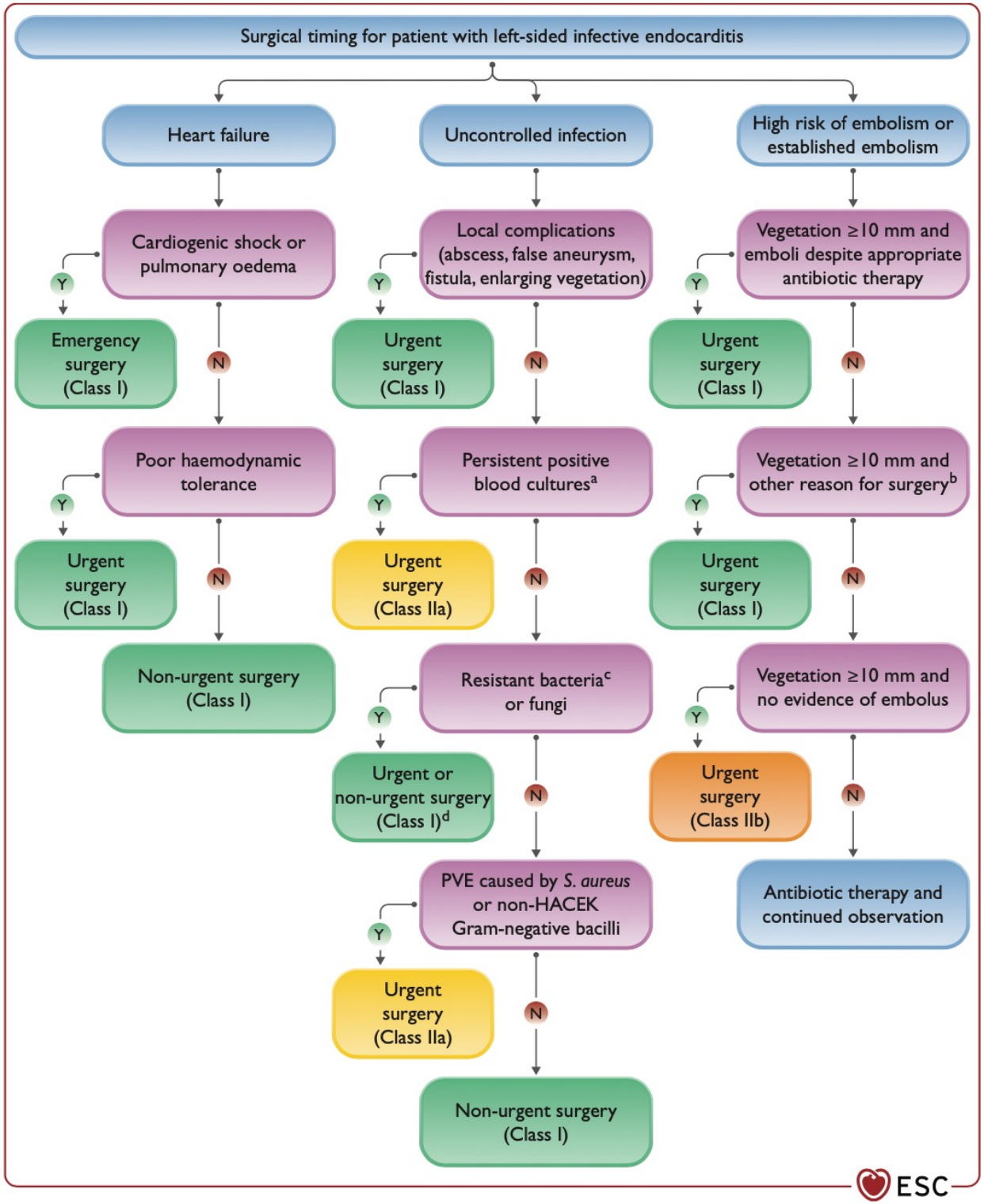


Figure 8 Phases of antibiotic treatment for infective endocarditis in relation to outpatient parenteral antibiotic therapy and partial oral endocarditis treatment. i.v., intravenous: OPAT, outpatient parenteral antibiotic treatment; TOE, transoesophageal echocardiography. [a]Criteria for switching to OPAT or partial oral treatment of endocarditis are given in the Supplementary data online, Table S8.

Guidelines ESC 2023

Endocardite: Traitement chirurgical

- **Indications**
  - Complications hémodynamiques
  - Sepsis non contrôlé
  - Embol gauche
  - Végétation > 10mm
  - Abcès
- **Types de chirurgie**
  - Eviter prothèse mécanique
  - Plastie, Ross, homogreffe



Guidelines ESC 2023

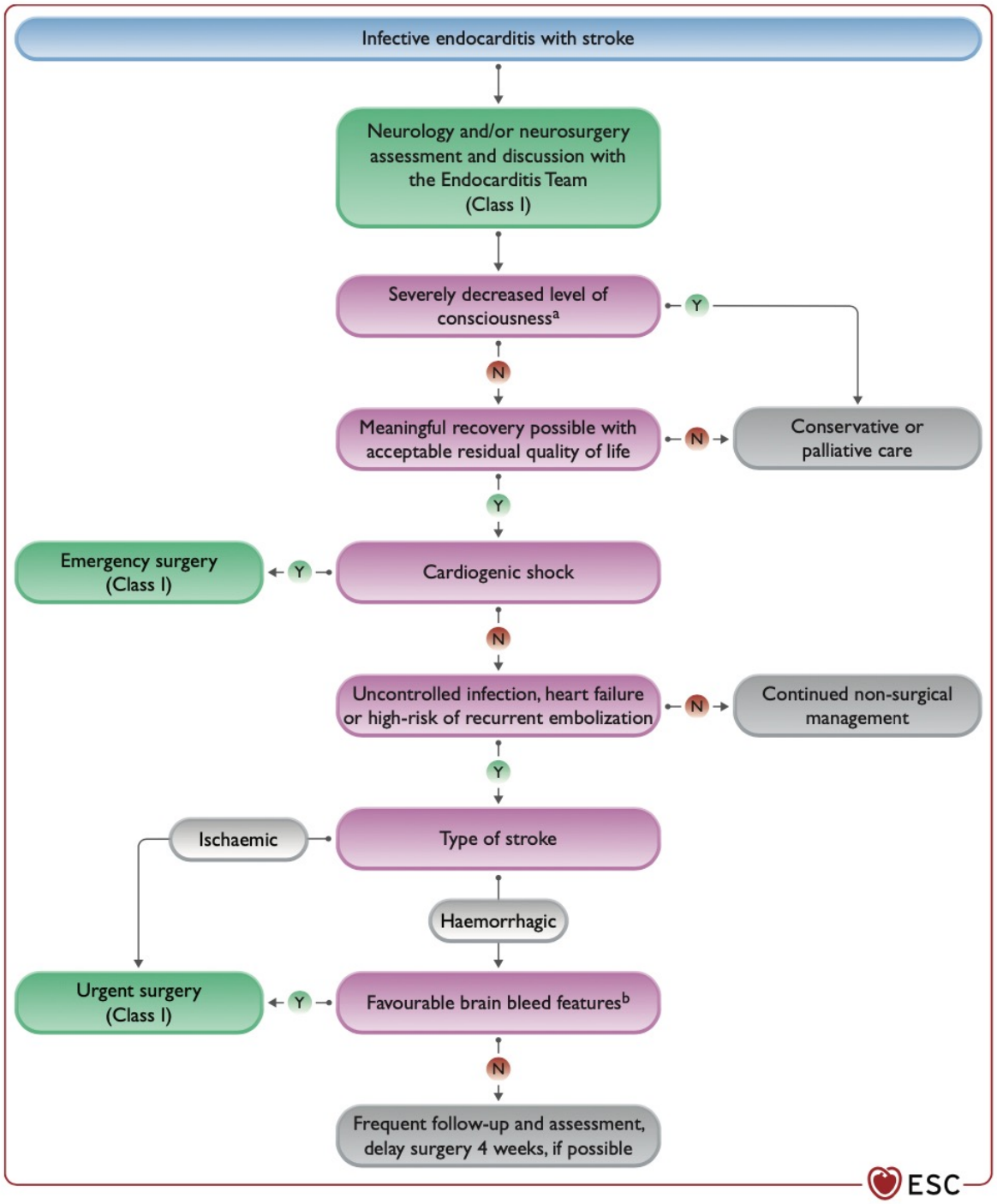


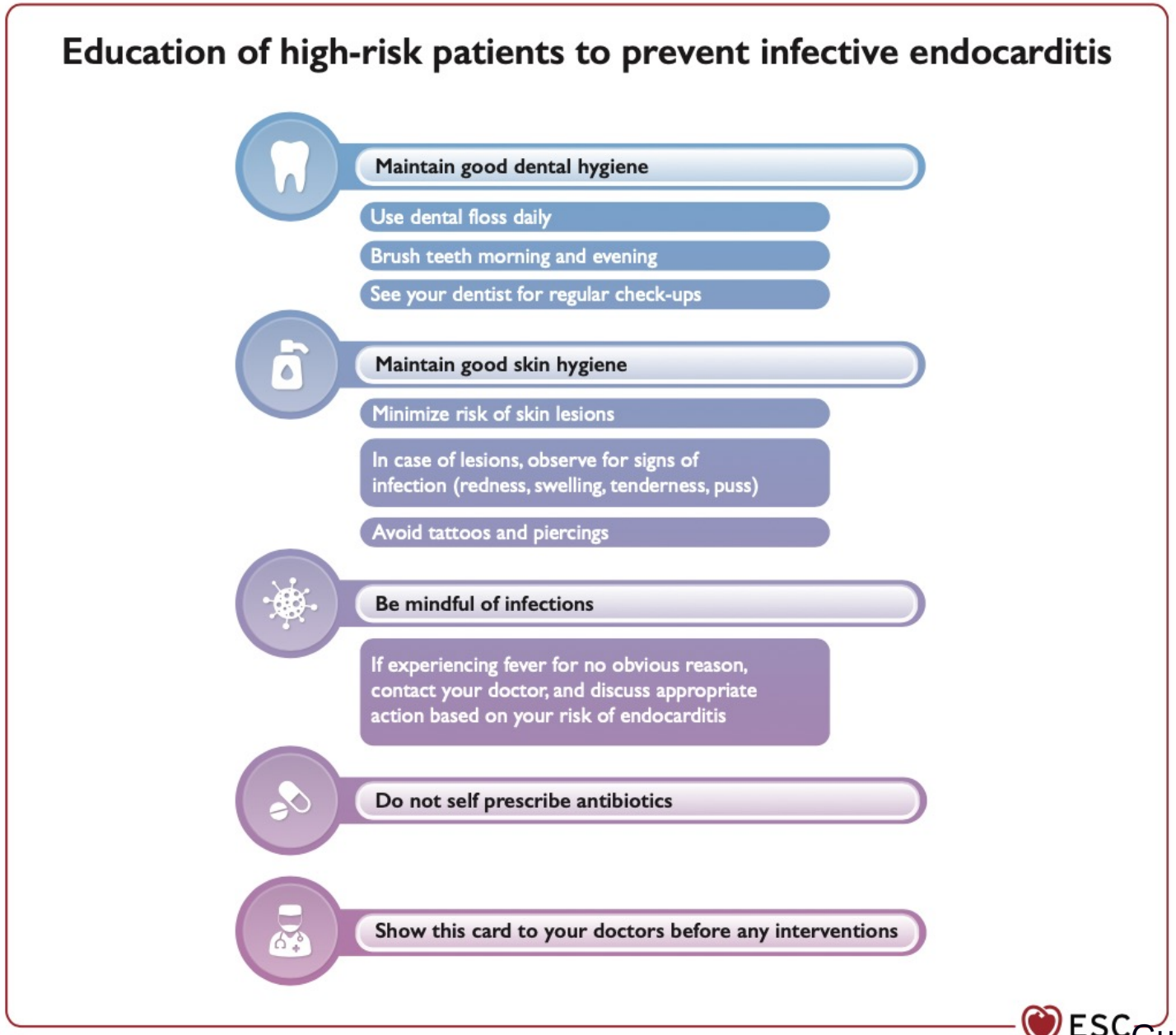
Figure 11 Surgery for infective endocarditis following stroke. NIHSS, National Institutes of Health Stroke Scale Score. Surgery timing: emergency, within 24 h. Urgent, within 48–72 h. Non-urgent, within same hospital admission. [a]Glasgow Coma Scale ≤4 or NIHSS >18. [b]Intracranial haemorrhage volume <30 mL or NIHSS <12.

Endocardite: prévention

Recommendations	Class[a]	Level[b]
Recommendations for antibiotic prophylaxis in patients with cardiovascular diseases undergoing oro-dental procedures at increased risk of infective endocarditis		
Antibiotic prophylaxis is recommended in patients with previous IE.	I	B
General prevention measures are recommended in individuals at high and intermediate risk of IE.	I	C
Antibiotic prophylaxis is recommended in patients with surgically implanted prosthetic valves and with any material used for surgical cardiac valve repair.	I	C
Antibiotic prophylaxis is recommended in patients with transcatheter implanted aortic and pulmonary valvular prostheses.	I	C
Antibiotic prophylaxis is recommended in patients with untreated cyanotic CHD, and patients treated with surgery or transcatheter procedures with post-operative palliative shunts, conduits, or other prostheses. After surgical repair, in the absence of residual defects or valve prostheses, antibiotic prophylaxis is recommended only for the first 6 months after the procedure.	I	C
Antibiotic prophylaxis is recommended in patients with ventricular assist devices.	I	C
Antibiotic prophylaxis is not recommended in other patients at low risk of IE.	III	C

Guidelines ESC 2023

Endocardite: prévention



ESC Guidelines ESC 2023

‘What to do’ and ‘What not to do’ messages from the Guidelines

Recommendations for infective endocarditis prevention in high-risk patients		
Antibiotic prophylaxis is recommended in dental extractions, oral surgery procedures, and procedures requiring manipulation of the gingival or periapical region of the teeth.	I	B
Recommendations for infective endocarditis prevention in cardiac procedures		
Pre-operative screening for nasal carriage of *S. aureus* is recommended before elective cardiac surgery or transcatheter valve implantation to treat carriers.	I	A
Peri-operative antibiotic prophylaxis is recommended before placement of a CIED.	I	A
Optimal pre-procedural aseptic measures of the site of implantation are recommended to prevent CIED infections.	I	B
Periprocedural antibiotic prophylaxis is recommended in patients undergoing surgical or transcatheter implantation of a prosthetic valve, intravascular prosthetic, or other foreign material.	I	B

Table 6 Prophylactic antibiotic regime for high-risk dental procedures

Situation	Antibiotic	Single-dose 30–60 min before procedure	
		Adults	Children
No allergy to penicillin or ampicillin	Amoxicillin	2 g orally	50 mg/kg orally
	Ampicillin	2 g i.m. or i.v.	50 mg/kg i.v. or i.m.
	Cefazolin or ceftriaxone	1 g i.m. or i.v.	50 mg/kg i.v. or i.m.
Allergy to penicillin or ampicillin	Cephalexin[a,b]	2 g orally	50 mg/kg orally
	Azithromycin or clarithromycin	500 mg orally	15 mg/kg orally
	Doxycycline	100 mg orally	<45 kg, 2.2 mg/kg orally >45 kg, 100 mg orally
	Cefazolin or ceftriaxone[b]	1 g i.m. or i.v.	50 mg/kg i.v. or i.m.

POPULATION CONGENITALE - ENFANTS

Infective Endocarditis in Children With Congenital Heart Disease

Cumulative Incidence and Predictors

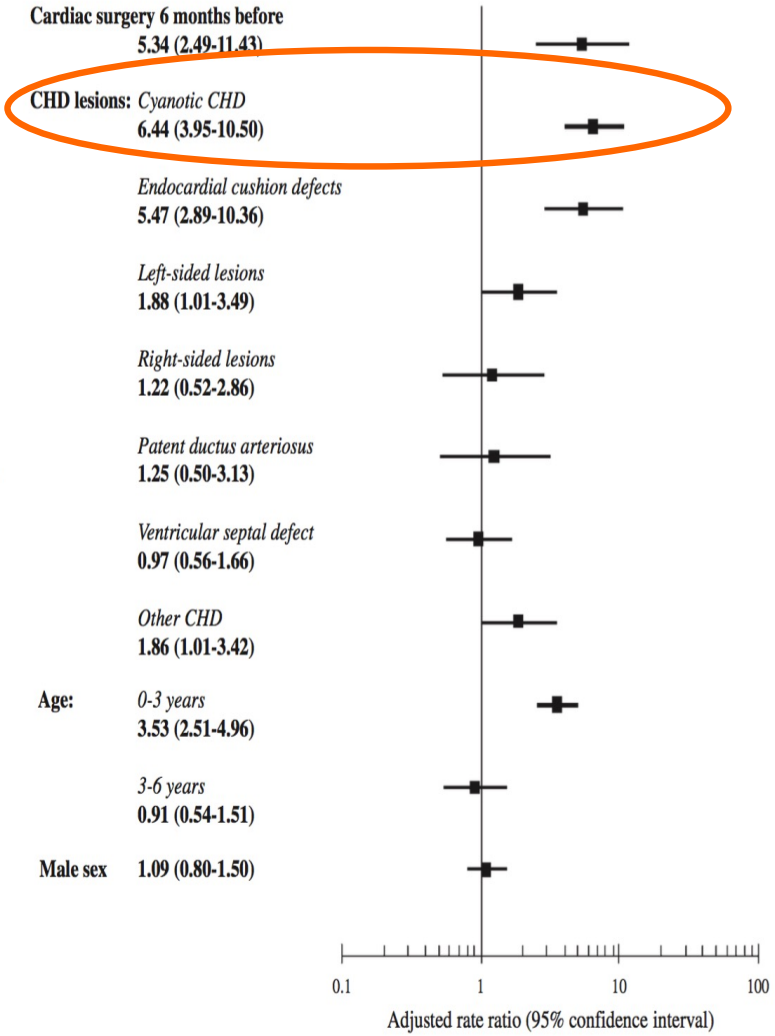
34 279 enfants avec CC suivis de 0 à 18 ans

Incidence annualisée = 4.1 / 10 000 pt-année

Table 2. Lesion Group–Specific Cumulative Incidence and Incidence Rate of IE in Children With CHD

CHD Lesions	Cumulative Incidence (95% CI) per 1000 Children			Incidence Rate (95% CI) per 10 000 Person-Years
	0–6 y	0–12 y	0–18 y	
Cyanotic CHD	16.8 (11.9–23.8)	23.3 (17.0–31.8)	31.0 (22.5–42.7)	20.7 (15.4–27.7)
Endocardial cushion defects	5.5 (2.3–13.1)	8.7 (4.1–18.6)	11.1 (5.4–22.9)	7.7 (3.9–15.4)
Left-sided lesions	2.7 (1.3–5.7)	4.8 (2.6–8.7)	7.9 (4.4–14.0)	4.4 (2.6–7.4)
Right-sided lesions	2.3 (1.0–5.5)	2.3 (1.0–5.5)	4.2 (1.5–11.5)	2.9 (1.3–6.5)
Patent ductus arteriosus	3.2 (1.4–7.1)	3.2 (1.4–7.1)	3.2 (1.4–7.1)	3.5 (1.6–7.7)
Ventricular septal defect	2.0 (1.2–3.2)	2.4 (1.5–3.8)	3.2 (1.9–5.3)	2.4 (1.5–3.7)
Atrial septal defect	1.9 (1.3–2.9)	2.2 (1.5–3.4)	3.0 (1.9–4.8)	2.3 (1.6–3.4)
Other CHD	2.9 (1.4–5.8)	3.7 (1.8–7.3)	5.5 (2.9–10.6)	3.7 (2.0–6.7)
Overall	3.2 (2.6–3.9)	4.2 (3.5–5.1)	6.1 (5.0–7.5)	4.1 (3.5–4.9)

CHD indicates congenital heart disease; CI, confidence interval; and IE, infective endocarditis.



POPULATION CONGENITALE - ADULTES

Table 4 Prediction model for developing IE, and score chart for the risk of developing IE up to 5 and 10 years

Predictor	HR(95% CI)	Points
Baseline valve-containing prosthetics	3.57(2.38–5.36)	3
Main defect[a]		
Pulmonary atresia with ventricular septal defect	4.05(1.85–8.86)	3
Double-outlet right ventricle	3.01(0.91–9.94)	2
Tetralogy of Fallot	1.81(0.99–3.33)	1
Univentricular heart	1.69(0.51–5.54)	1
Left-sided lesions	1.55(0.99–2.44)	1
Other	1	0
Multiple defects	1.68(1.15–2.46)	1
History of IE	2.21(1.22–4.01)	2
Male	1.89(1.28–2.81)	1

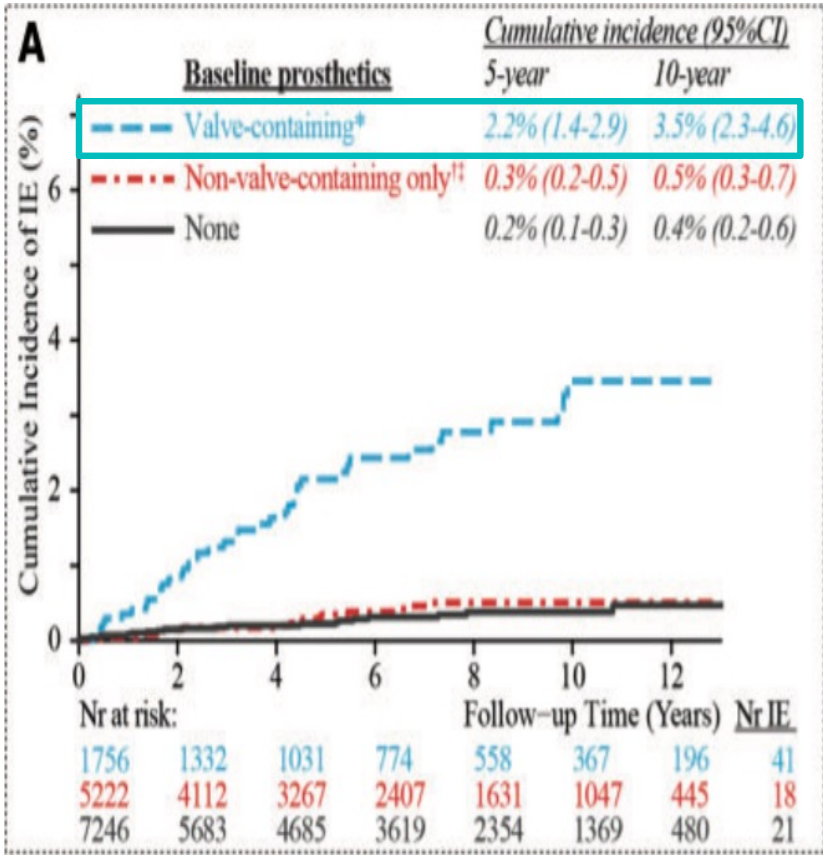
Score (sum points)

	Score									
	0	1	2	3	4	5	6	7	8	>8
Predicted 5 year risk (%)	<1	<1	1	1	1	2	3	4	7	9
Predicted 10 year risk (%)	<1	1	1	1	3	3	5	7	12	15

Registre CONCOR (14 224 patients>18 ans)

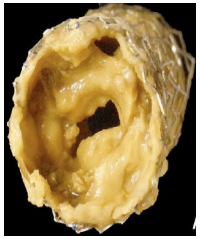
Incidence EI : **1.33/1000 pt-years**

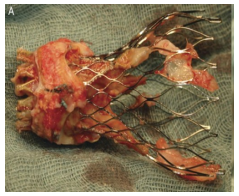
Prothèse valvulaire: **HR=3.57(2.58–5.36)**

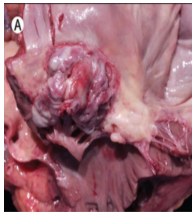


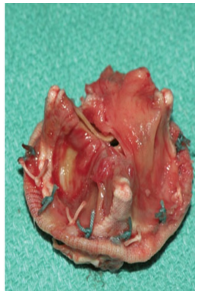
Kuijpers et al. Eur Heart Jour 2017

INCIDENCES COMPARATIVES









Valve Melody : **0.8 – 3% pt-année**

Valves/conduits pulmonaire chir : **0.5 - 3% pt-année**

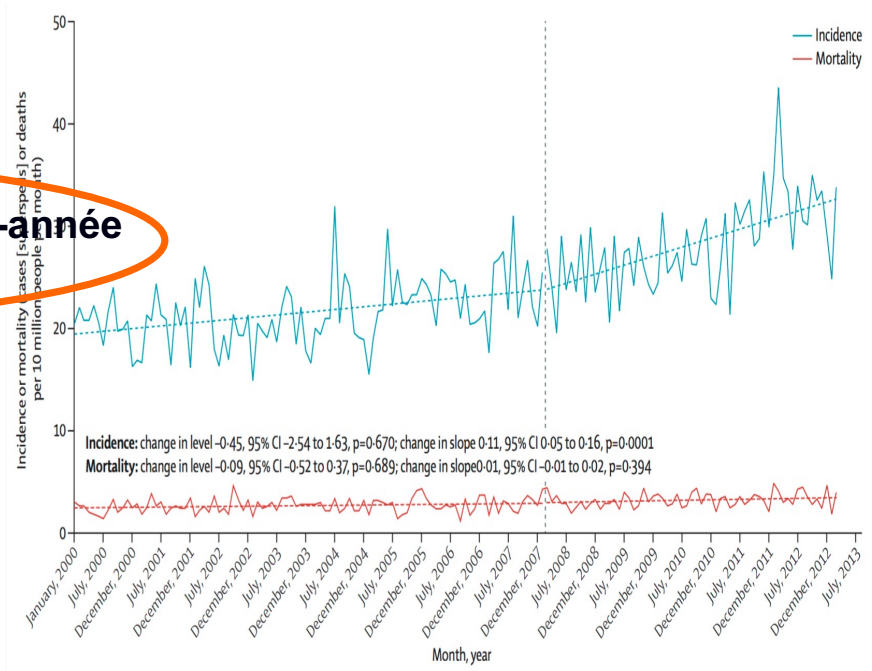
TAVI: **0.67 – 2.1% pt-année**

Valves Ao/mitrale chir : **0.3 – 1.2% pt-année**

Dispositifs electroniques implantables : **1.9/1000 device-année**

Patients avec CC: **0.4 – 1.33 / 1000 pt-année**

Population générale : **30 -100/ million pt-année**



Miranda et al. Eur Heart Jour 2016
Wang et al. JAMA 2007
Rushani et al. Circulation 2013
Habib et al. Eur Heart Jour 2015
Dayer et al. Lancet 2015

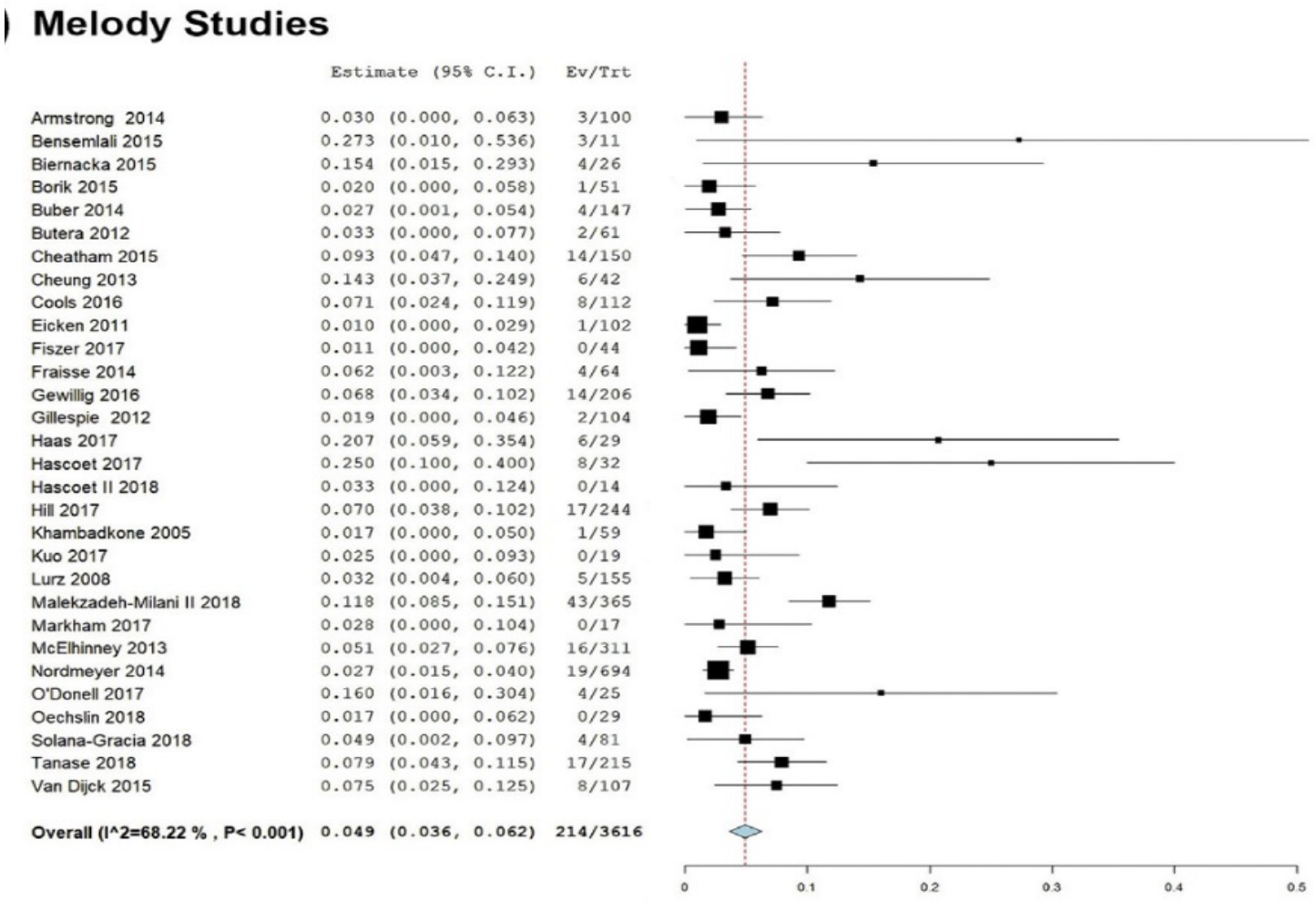
VALVES PERCUTANÉES

Melody Valve

Sapien Valve | Sapien XT Valve | Sapien X3 Valve

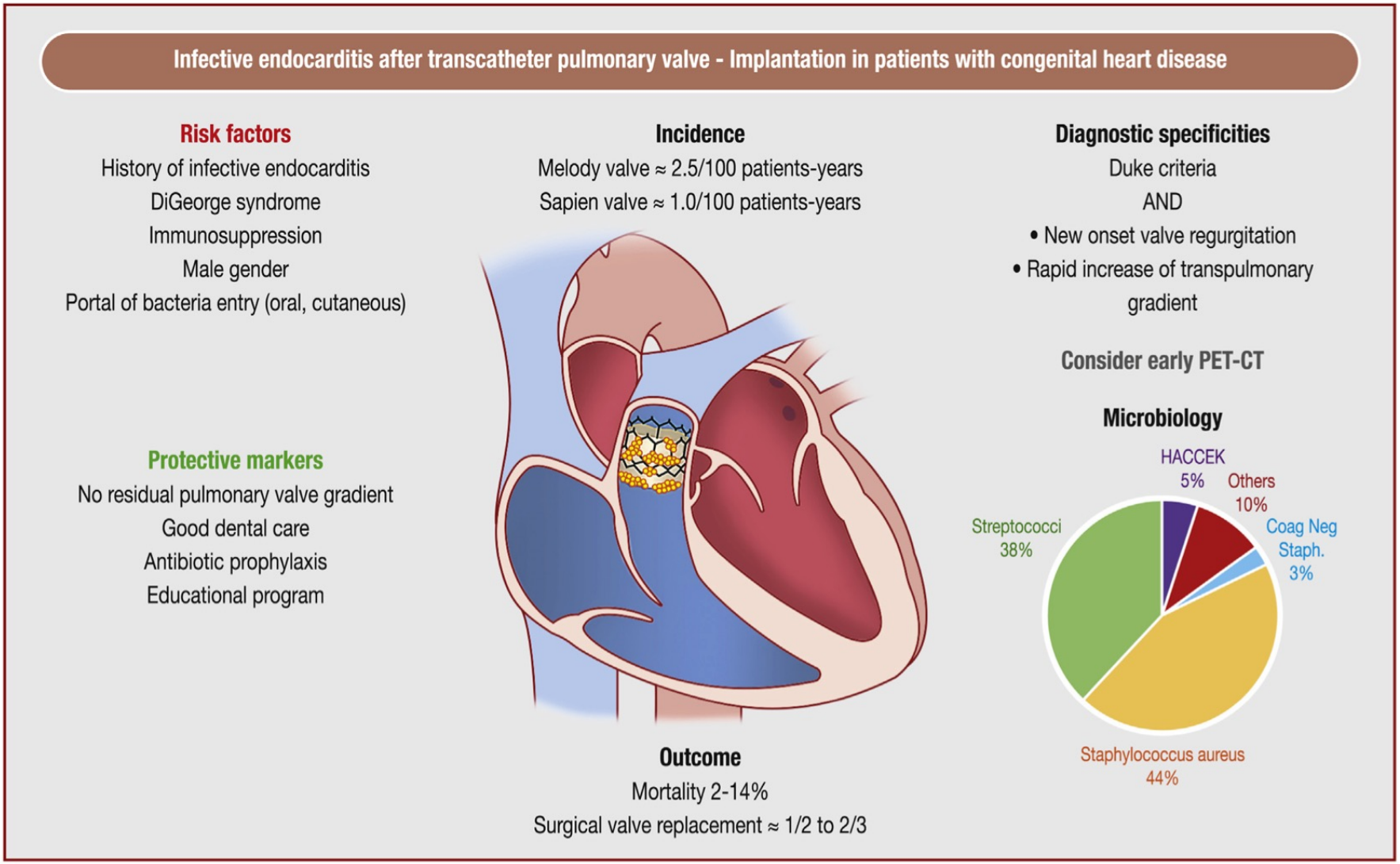
Lehnert J Card 2019

The risk of infective endocarditis following interventional pulmonary valve implantation: A meta-analysis



In total, 3616 patients were treated with Melody® valves and 501 with Sapien™ valves (Fig. 3). While patients with Melody® valves reported 214 IE cases, those with Sapien™ valves had only 5 cases. The pooled incidence of Melody®-PPVI was 4.9% (95% CI: 3.6–6.2) and 1.3% for Sapien™ valves (95% CI: 0.3–2.3) (Fig. 3).

Lehner J Card 2019



Central Illustration. Infective endocarditis after transcatheter pulmonary valve implantation in patients with congenital heart disease: Incidence, risk factors, protective markers, diagnostic characteristics, microbiology and clinical outcomes. HACCEK, *Haemophilus*, *Actinobacillus*, *Cardiobacterium*, *Capnocytophaga*, *Eikenella*, *Kingella*.

Lourtet-Hascoet 2023 ACVD

Myocardites aiguës

Généralités

- Série autopsique: identification d'une myocardite dans 8,6% à 12% en cas de mort subite
- Evolution vers la CMD possible et non exceptionnelle

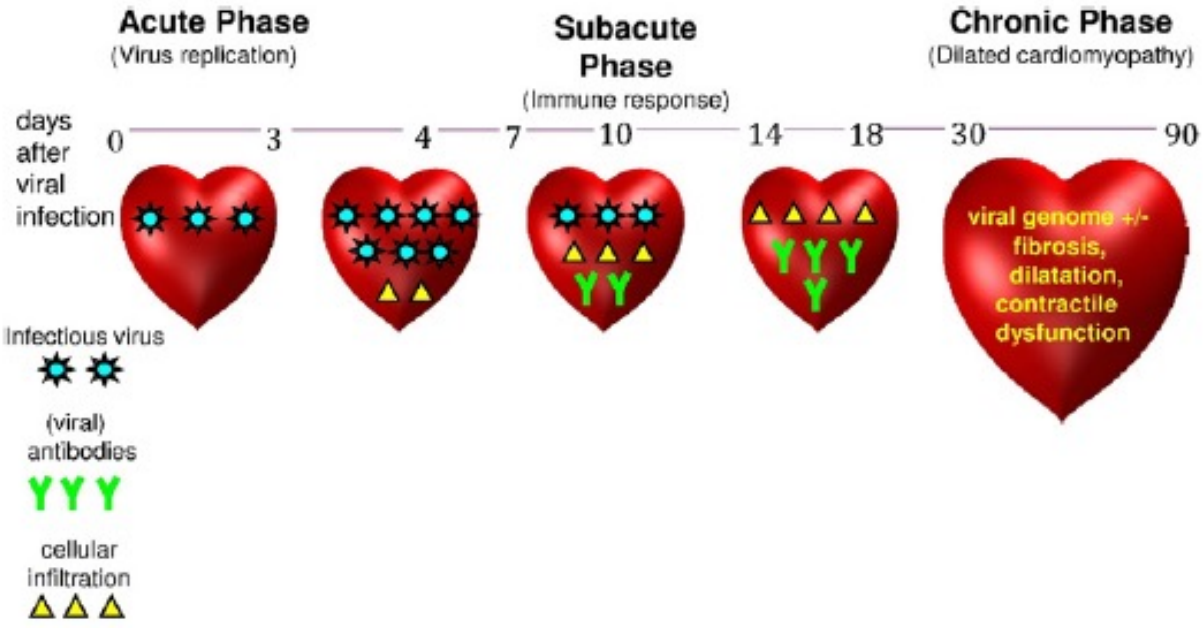
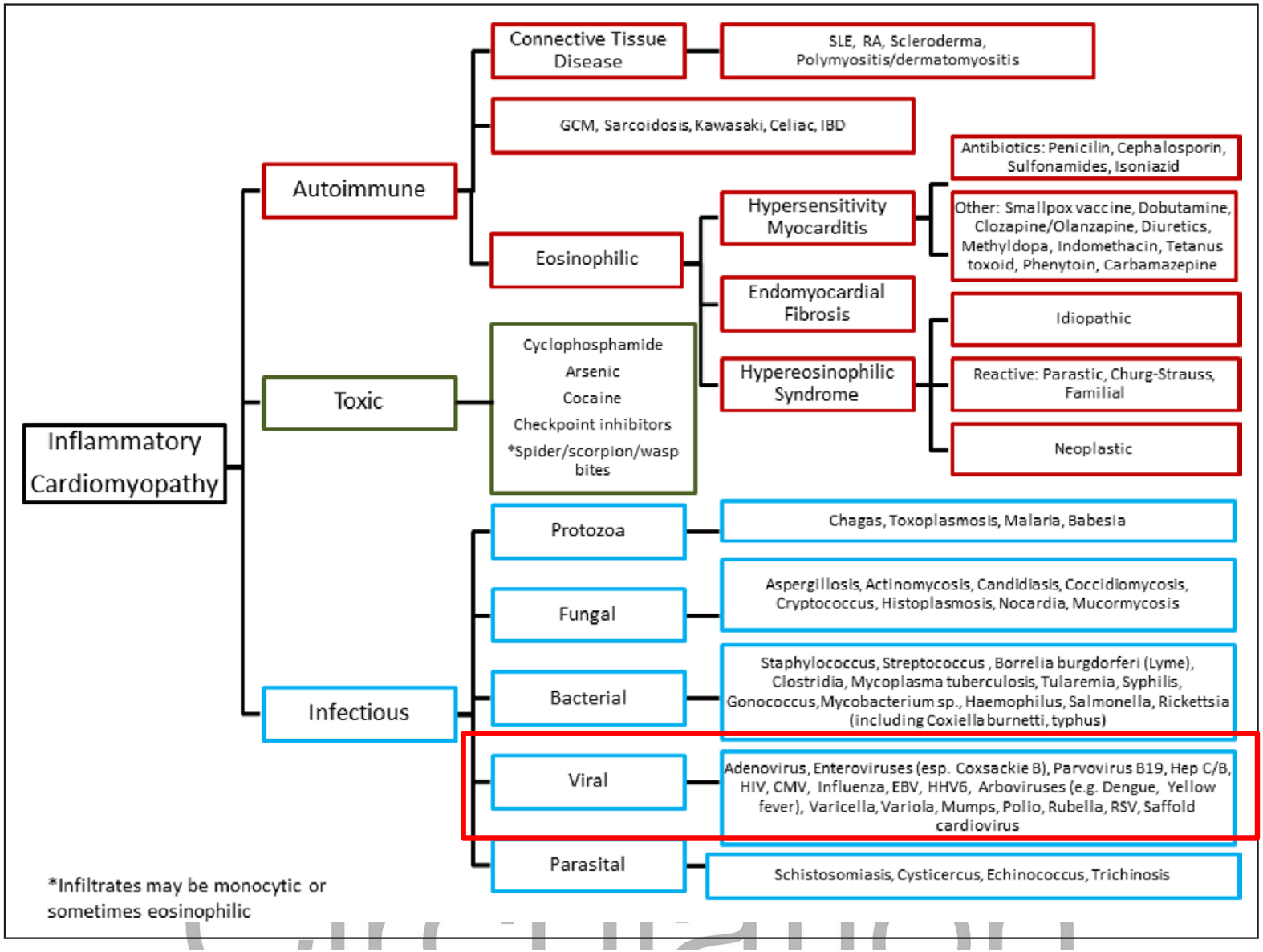


Figure 1 **Time Course of Viral Myocarditis**

Time course of viral myocarditis in 3 phases (derived from murine models). The acute phase of myocarditis takes only a few days, whereas the subacute and chronic phase covers a few weeks to several months. Modified from Kawai (22).

Kindermann, JACC 2012

Etiologies des myocardites



Kociol et al

Recognition and Management of Fulminant Myocarditis

Diagnostic positif de la myocardite

- **Clinique évocatrice:**
  - douleur thoracique, fièvre (30%), tachycardie (58%), dyspnée (68%)
  - Choc cardiogénique (forme fulminante, 5-10/1 mill d'habitants/an)
  - Mort subite (TDR ou TDC)
- **Biologie:** Troponine, BNP ou N-proBNP
- **ECG:** infarctus du myocarde
- **Echocardiographie:** dysfonction modérée à sévère
- **IRM** et/ou **biopsie endomyocardique** (BEM)
- **Sérologies virales** peu utiles en pratique clinique

Diagnosis and Management of Myocarditis in Children

A Scientific Statement From the American Heart Association

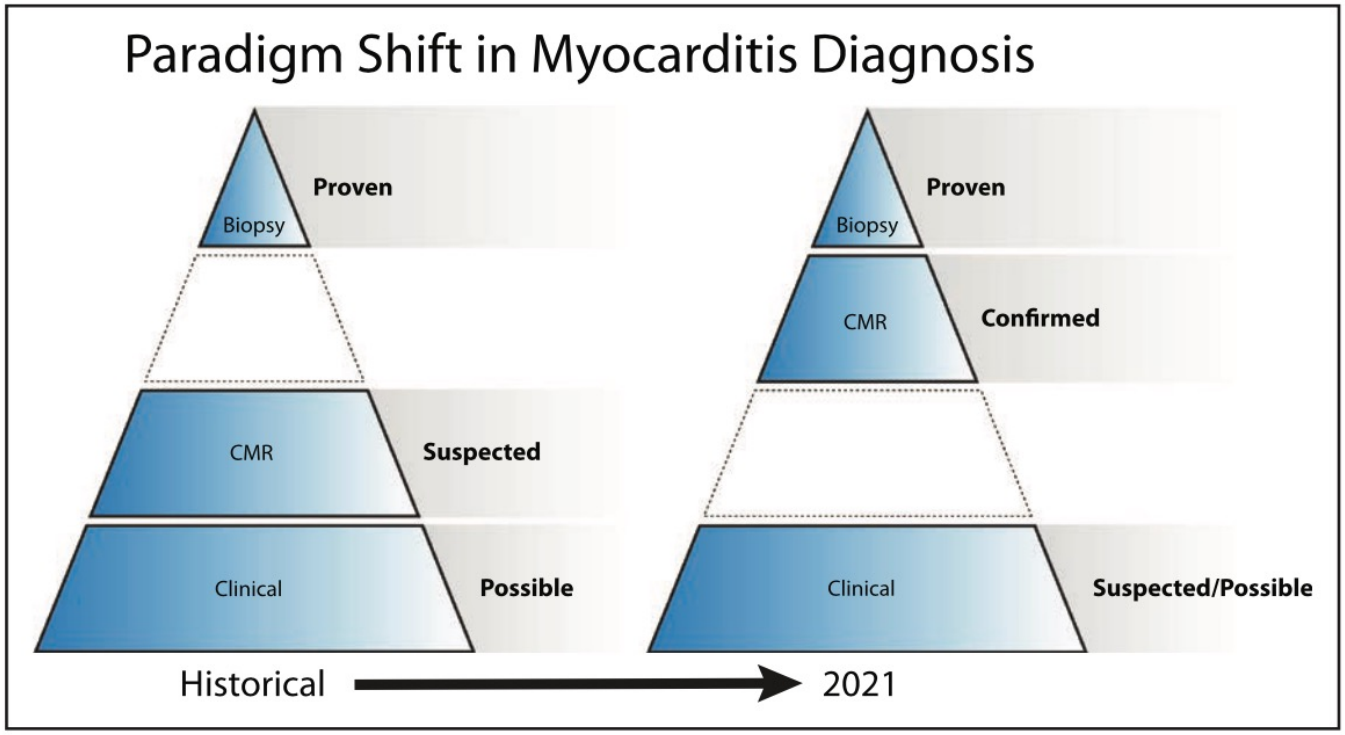
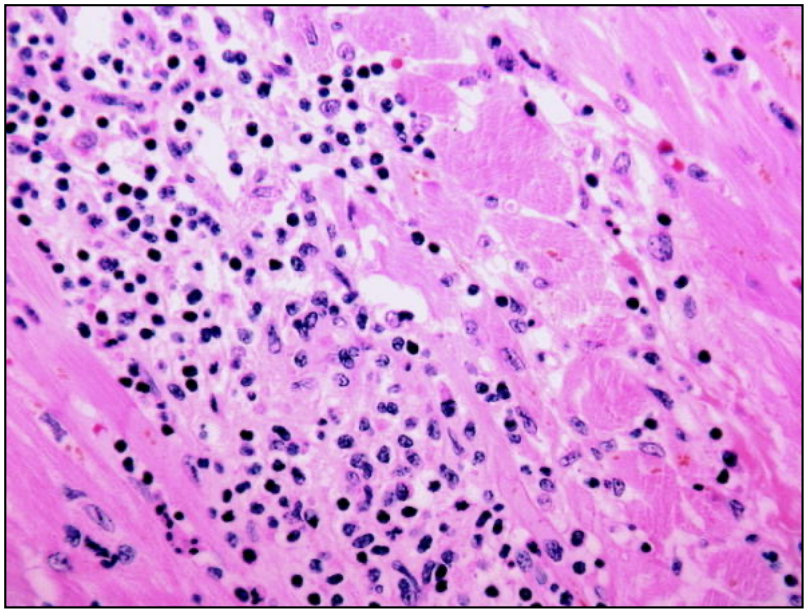


Figure 1. Four strata of certainty in the diagnosis of myocarditis include biopsy proven, clinically suspected confirmed by cardiac magnetic resonance (CMR), clinically suspected, and possible myocarditis. The shift in diagnosis acknowledges advancements in CMR and improvement in identifying a constellation of clinical findings supportive of myocarditis. Dotted empty boxes illustrate gaps in the tiers of diagnostic certainty and opportunities for further advancement.

Law et al. Circ 2021

Critères de Dallas historiques (1986)



Infiltration lymphocytaire
Signe de nécrose non ischémique

Diagnostic	Image histologique
Myocardite aiguë	Infiltrat inflammatoire (lymphocytaire) Nécrose et/ou dégénérescence des myocytes en l'absence de maladie coronarienne
Myocardite subaiguë	Infiltrat inflammatoire sans nécrose apparente
Absence de myocardite	Image histologique normale

Tableau 2. Critères de Dallas.

Magnani JW et al. Circulation 2006 Cooper LT et al. Circulation 2007

Problèmes des critères de Dallas

- Myocardite avec atteinte hétérogène du myocarde -> Biopsies multiples > 5
- **Geste invasif:** mortalité 0,5%, complications 5%: perforation cardiaque, hémopéricarde, tamponnade
- Geste plus risqué chez le nourrisson
- Variabilité d'interprétation même entre experts
- « Goldstandard » mais discutée ++

Table 1. Risks Associated With Endomyocardial Biopsy in 546 Procedures

Overall 33 complications (6%)
Sheath insertion 15 (2.7%)
12 (2.0%) arterial puncture during local anesthesia
2 (0.4%) vasovagal reaction
1 (0.2%) prolonged venous oozing after sheath removal
Biopsy procedure 18 (3.3%)
6 (1.1%) arrhythmia
5 (1.0%) conduction abnormalities
4 (0.7%) possible perforation (pain)
3 (0.5%) definite perforation (pericardial fluid)
2 of 3 patients with definite perforation died

Data derived from Deckers et al (20).

Indication d'une BEM

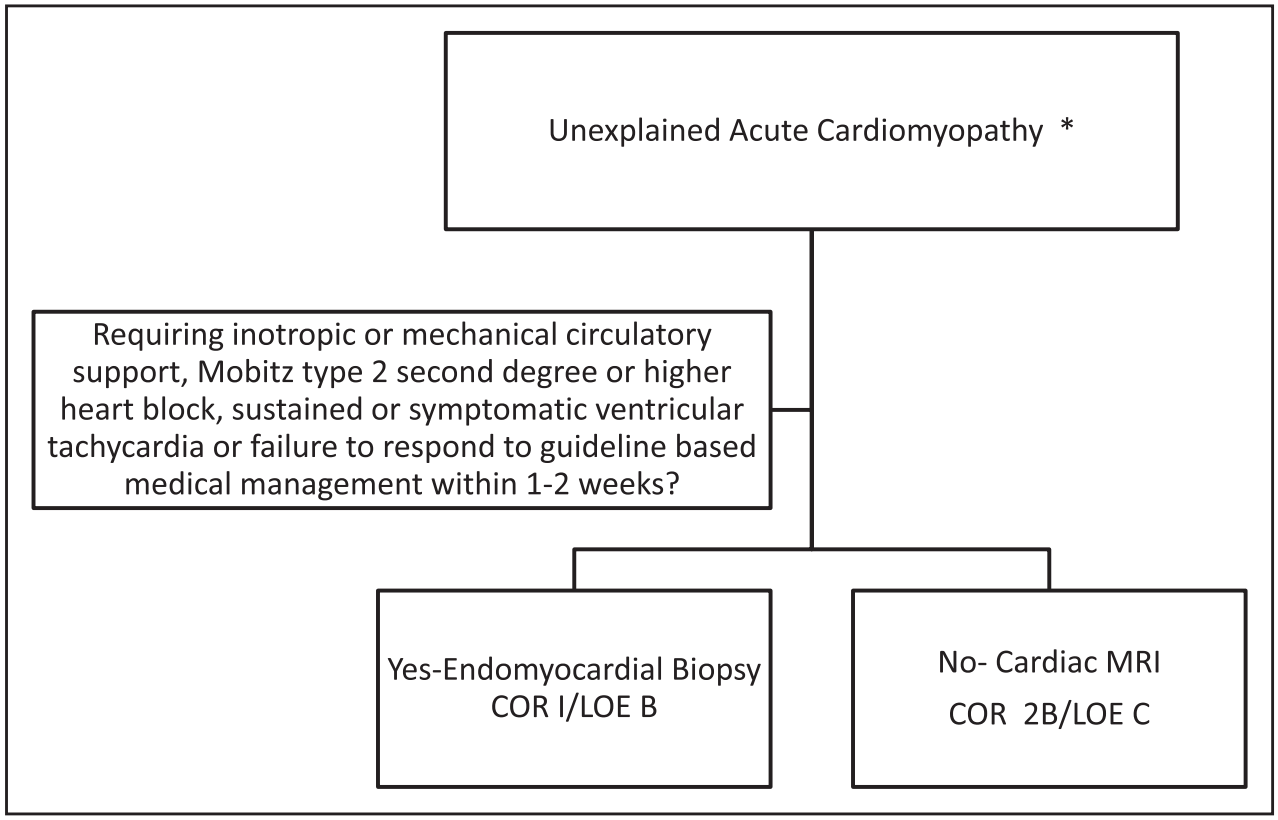


Figure 3. Indications for endomyocardial biopsy (EMB).
Guideline-based algorithm for whether EMB is indicated. COR indicates Class of Recommendation; LOE, Level of Evidence; and MRI, magnetic resonance imaging. *Usually a dilated cardiomyopathy. Fulminant myocarditis may have normal end-diastolic diameter with mildly thickened walls. Exclude ischemic, hemodynamic (valvular, hypertensive), metabolic, and toxic causes of cardiomyopathy as indicated clinically. Reprinted from Bozkurt et al.[3] Copyright © 2016, American Heart Association, Inc.

Lake Louise Criteria: IRM

Trois séquences IRM contributives:

- 1. Œdème en T2
- 2. rehaussement précoce du myocarde
- 3. rehaussement tardif du myocarde

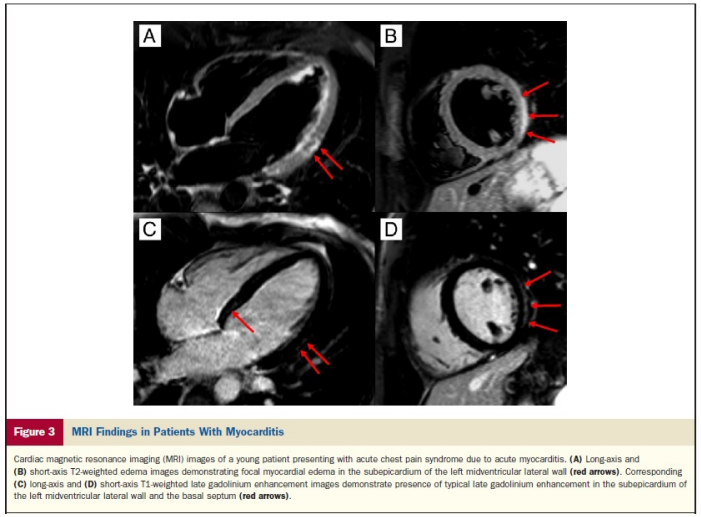


Figure 3 MRI Findings in Patients With Myocarditis

Cardiac magnetic resonance imaging (MRI) images of a young patient presenting with acute chest pain syndrome due to acute myocarditis. **(A)** Long-axis and **(B)** short-axis T2-weighted edema images demonstrating focal myocardial edema in the subepicardium of the left midventricular lateral wall **(red arrows)**. Corresponding **(C)** long-axis and **(D)** short-axis T1-weighted late gadolinium enhancement images demonstrate presence of typical late gadolinium enhancement in the subepicardium of the left midventricular lateral wall and the basal septum **(red arrows)**.

- Diagnostic positif si > 2 critères :
  - Hypersignal T2
  - Ratio Signal myocarde / muscle périph augmenté après injection de Gadolinium
  - Hypersignal en rehaussement tardif

- Refaire IRM à 1-2 semaines si:
  - 0 critère mais symptômes trop récents, forte suspicion clinique
  - 1 seul critère présent

Friedrich MG et al. JACC 2009; Update Ferrera JACC 2018

Diagnosis and Management of Myocarditis in Children

A Scientific Statement From the American Heart Association

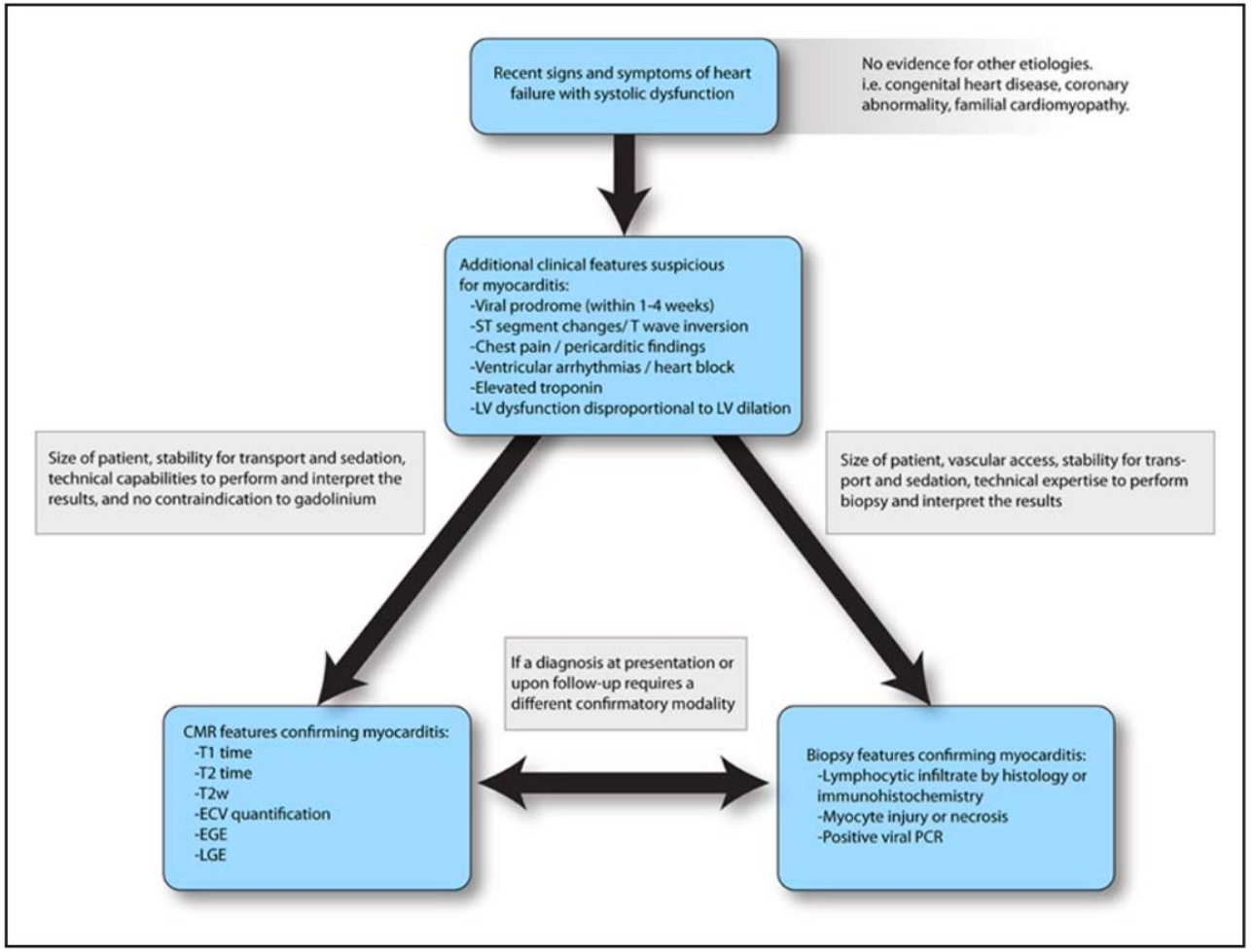


Figure 3. A simplified framework to confirm the suspicion of myocarditis. This diagnostic approach leverages various modalities, starting with clinical features followed by the application of cardiac magnetic resonance (CMR) or endomyocardial biopsy to confirm clinically suspected myocarditis. ECV indicates extracellular volume; EGE, early gadolinium enhancement; LGE, late gadolinium enhancement; LV, left ventricular; PCR, polymerase chain reaction; and T2w, T2-weighted imaging.

Law et al. Circ 2021

Traitement en fonction de la forme clinique

- **Myocardite segmentaire focale:** Repos, arrêt de sport 6 mois, bétabloquant 6 mois
- **Myocardite aiguë diffuse chez l'enfant**
  - PEC en réa +/- assistance circulatoire (HNF)
  - Traitement d'attaque:
    - Immunomodulateurs, immunosuppresseurs, Anti-inflammatoire, immunoadsorption
- **Myocardite fulminante**
  - PEC du choc cardiogénique
- **Myocardite chronique active**
  - Discuter immunosupresseurs

Traitement
ce qui est admis …

Traitement de l'insuffisance cardiaque

- **Selon les guidelines**
- **Selon la classe fonctionnelle NYHA**
  - IEC
  - Diurétiques
  - B-bloquant
  - ARA II
- **Formes sévères: Prise en charge en réanimation**
  - **Traitement « agressif »**
  - **Assistance circulatoire** (> 60 à 80 % survivants et récupération ad integrum possible)
  - **Drogues inotropes positives et héparine!**

Kindermann, et al., *JACC* 2012
Amabile et al. Heart 2006

Traitement de la myocardite par assistance

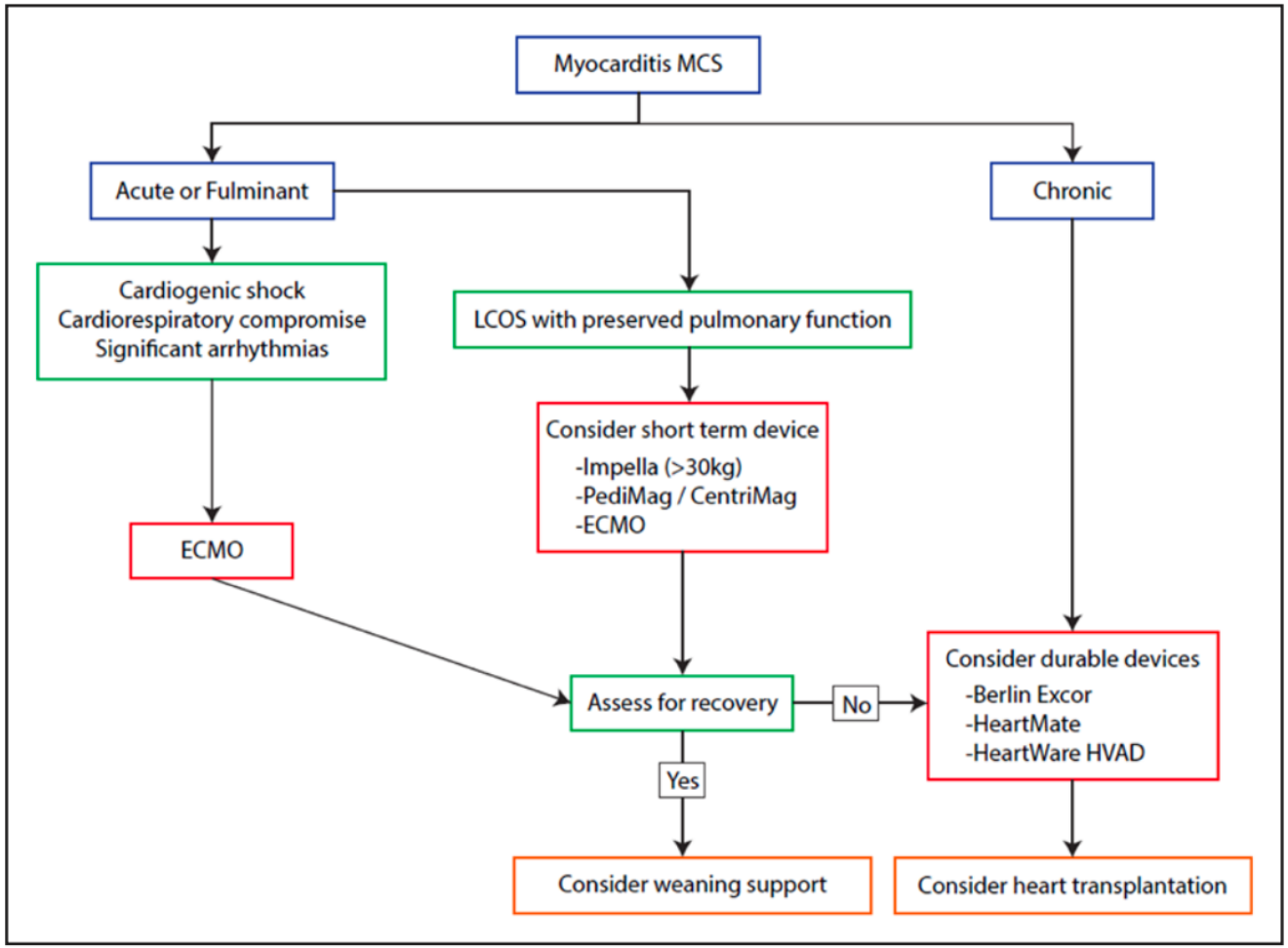


Figure 5. Potential strategy for mechanical circulatory support (MCS) in acute myocarditis.
Device names are examples of devices within the categories only and are not the only options. ECMO indicates extracorporeal membrane oxygenation; and LCOS, low cardiac output syndrome.

Circ 2021

Traitement
ce qui est discuté …

Immunoglobulines
Anti-inflammatoires
Antiviraux
Immunosuppresseurs

Immunosuppressive Treatment for Myocarditis in the Pediatric Population: A Meta-Analysis

Study	N	Age	Study methodology	IMSA	IMSA dosage, time of IMSA start	Follow-up	Observed variables	Inclusion criteria
Camargo et al. (9)	50	5 months–15 years	PNCT	P, CyA	P & A: 2.5 mg/kg/d, 1 week; 2.0 mg/kg/d, 3 weeks; 1.5 mg/kg/d, 4 weeks Cy: 1.5 mg/kg/d, 1 week; 1.0 mg/kg/d, 7 weeks; 0.5 mg/kg/d, 1 week	8.4±1.2 months	LVEDD, LVEF, PWP, CI, HR	Active myocarditis based on EMB findings
Aziz et al. (6)	68	3.7 ± 2.9 years	RCT	P	2 mg/kg/d, 1 month	15.1±9.2 months	LVEDD, LVESD, LVEF	Duration of symptoms for<3 months and continued LV failure and reduced EF
Drucker et al. (7)	46	–	CCT	IVIG	2,000 mg/kg 24 h; 1,000 mg/kg/d, 1 weeks	10.5±2.1 months	LVFS, LVEDD, death	Acute (<3 months) onset of congestive heart failure and echocardiographic documentation of diminished LV function and EMB
Bhatt et al. (8)	83	4.4 ± 3.2 years	PNCT	IVIG	400 mg/kg/d, 5 days	-	LVEF, death	Had viral infection with fever of < 2 weeks' duration; developed acute and severe heart failure after this illness; evidence of LV dysfunction on echocardiography EF< 40%; no previous or family history of cardiomyopathy
Gagliardi et al. (10)	114	36.6 ± 42.8 months	CCT	P, Cy	P: 2 mg/kg/d, 1 month; 0.5 mg/kg/d, 6 months; Cy: 6–8 mg/kg/d until blood concentration reached 170–210 ng/cm^3	13 years	LVEF, LVEDV, death	Congestive heart failure patients received right cardiac characterization and EMB
Camargo et al. (11)	10	42.1 ± 18.9 months	CCT	P, A	2.5 mg/kg, 4 weeks; 1.5 mg/kg, 4 weeks (both drugs)	9 months	LVEF, CI, death	Patients presenting with dilated cardiomyopathy who were clinically stable, under ambulatory care, with LVEF between 15 and 30%

PNCT, prospective non-controlled trial; RCT, randomized controlled trial; CCT, case–control study (including historical controls); IMSA, immunosuppressive agent; P, prednisolone; CyA, cyclosporine; A, azathioprine; IVIG, intravenous immunoglobulin G; LVEF, left ventricular ejection fraction; LVEDD, left ventricular diastolic dimension diameter; LVESD, left ventricular systolic dimension diameter; PWP, pulmonary wedge pressure; HR, heart rate; LVFS, left ventricular fractional shortening; CI, cardiac index, EMB, endomyocardial biopsy.

Immunosuppressive Treatment for Myocarditis in the Pediatric Population: A Meta-Analysis

- Groupe d'enfants avec immunosuppresseurs amélioration significative:
  - Fraction d'éjection VG
  - Diamètre télédiastolique VG
  - Diminution décès et transplantation

- **MAIS:** 1 seule étude RCT, effectifs faibles, follow-up court

Conclusions: There may be a possible benefit, in the short term, to the addition of immunosuppressive therapy in the management of myocarditis in the pediatric population. However, further prospective investigation is warranted to validate this finding.

Bing He, Xiaoou Li and Dan Li*

November 2019 | Volume 7 | Article 430

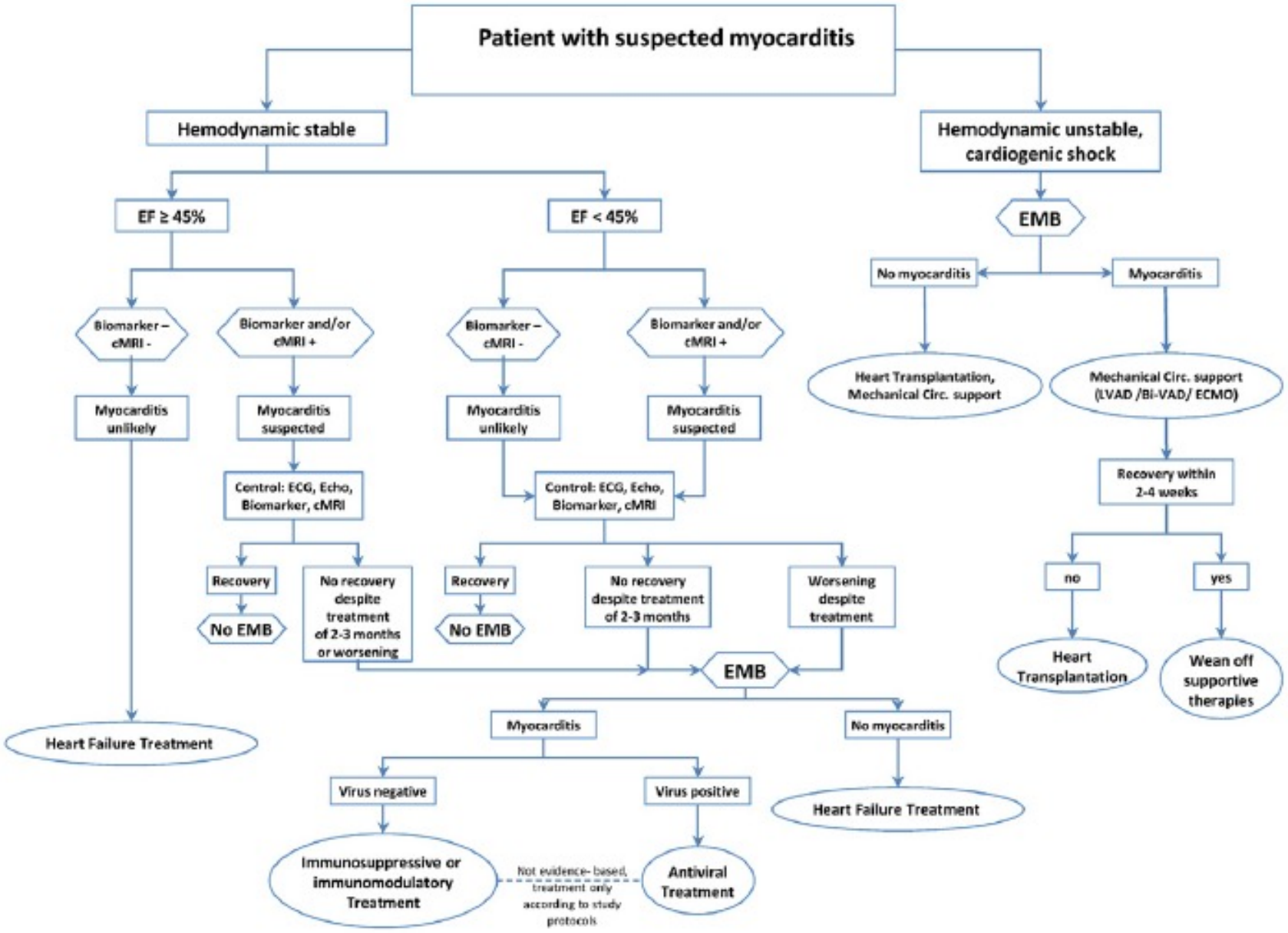


Figure 5 **Proposed Diagnostic and Therapeutic Algorithm for Suspected Myocarditis**

Proposed diagnostic and therapeutic algorithm for patients with suspected acute myocarditis considering biomarkers, cardiac magnetic resonance imaging (cMRI), and endomyocardial biopsy (EMB). BI-VAD = biventricular assist device; Circ. = circulatory; ECMO = extracorporeal membrane oxygenation; LV = left ventricular; LVAD = left ventricular assist device.

Kindermann et al. JACC 2012

Pronostic

- Bon pronostic
  - Myocardite active
  - Fonction VG préservée
- Myocardite fulminante
  - Très bon pronostic à long terme si on passe la phase aigue vivante
  - Complète récupération possible
- Mauvais pronostic
  - Dysfonction VD, PAP élevée, syncope, PA basse, Fc élevée, QRS > 120 msec…