GUIDELINES

The epidemiology of infective endocarditis (IE) has changed. There has been a shift to the elderly population, associated with non-rheumatic valves, and nosocomial IE is increasingly seen as a result of interventional procedures and devices [1,2].

The changing risk factor profile has lead to a change in relative frequency of causative pathogens. Staphylococcal endocarditis has increased dramatically and is now the second most common cause of IE[6]. In nosocomial endocarditis staphylococcal aureus is the commonest causative pathogen [1]

Critical care patients are at particular risk of IE. Specific risk factors include central venous lines, temporary pacing wires, immunosuppresion and prolonged intensive care stay. This risk is increased in the presence of a pre-existing cardiac lesion.

Diagnosis of IE in the critical care patient can be particularly challenging. Patients have often received antibiotics prior to admission and this reduces the sensitivity of blood cultures. Haemofiltration, the elderly and immunosuppressed may not mount or permit the same rise in temperature which will prompt cultures and so delay the isolation of the microorgansim. Trans-thoracic echocardiographic views are often suboptimal in immobile or ventilated patients; heightening the difficulty in this diagnosis.

The clinical presentation of IE is highly variable and dependent on the underlying micro-organism and any patient predisposing factors. The European Society of Cardiology 2009 guidelines have identified various clinical scenarios where IE should be considered with the intention to promptly identify and treat this elusive condition [3].

1.1 Recommendation: IE must be suspected in the following circumstances

- New regurgitant murmur
- Embolic events of unknown origin
- Sepsis of unknown origin (especially if associated with IE causative organism)
- Fever: the most frequent sign of IE
  IE should be considered if fever is associated with:
  - Intracardiac prosthetic material:
  - Previous history of IE
  - Previous valvular or congenital heart disease
  - Other predisposition for IE: immunocompromised state, IVDU
  - Predisposition and recent intervention associated with bacteraemia
  - Evidence of congestive cardiac failure
  - New conduction disturbance
  - Positive blood cultures with typical IE causative organism or positive serology for Q fever
  - Vascular or immunological phenomena: embolic event, Roth spots, splinter haemorrhages, Janeway lesions, Osler's nodes
  - Focal or non-specific neurological symptoms or signs
  - Evidence of PE/infiltration (right sided IE)
  - Peripheral abscesses (renal, splenic, cerebral, vertebral) of unknown cause

There is no serological test to identify IE and the diagnosis relies on clinical, serological and radiological features that hope to increase the likelihood of its diagnosis. The accepted criteria for the diagnosis of IE are the modified Duke criteria, which stratifies patients into definitive, possible and rejected IE. The modified Duke criteria are shown below.

Modified Duke Criteria

Pathological criteria
-Positive Histology or culture from a pathological material obtained at autopsy or cardiac surgery

Major Criteria
-Two positive blood cultures with a typical organism
-Persistent bacteriaemia
-Positive serology for coxiella
-Positive echocardiogram
1. Vegetation or
2. Abscess or
3. New regurgitation
4. Dehiscence of prosthetic valves

Minor Criteria
-Predisposing heart disease
-Fever>38
-Immunological phenomena
-Vascular phenomena

Definite IE
-Pathological criteria satisfied, or
-Two major criteria, or
-One major and two minor criteria or
-Five minor criteria

Possible IE
-One major and one minor criteria, or
-Three minor criteria

Rejected IE
-Firm alternate diagnosis
-Resolution with four days or led antibiotics
-No pathological evidence of IE at autopsy/surgery
-Does not meet definite or possible criteria

The cornerstones of the diagnosis of IE are positive blood cultures and evidence of vegetations, usually by echocardiography.

1.2 Recommendation: Initial investigation for patients who fulfil the above criteria (1.1):

- A minimum of 3 separate sets of peripheral blood cultures containing 10mls of blood, at least 1 hour apart, taken using a sterile technique according to trust guidelines (see guideline on BC technique)

NB: virtually all intensive care patients with a fever fulfil the clinical criteria as they are likely to have a risk factor for IE such a central venous line or recent procedure predisposing to bacteraemia.

BLOOD CULTURES

The level of bacteraemia in IE is relatively constant. This makes blood cultures a sensitive test in IE and also means that their sensitivity is independent of the time course of fever. Some pathogens however are slow growing or do not grow on culture media, therefore when there is a high degree of suspicion repeat cultures and close liaison with a microbiologist is essential.

1.3 Recommendation: Negative blood cultures

- In patients in whom there is POSSIBLE IE and negative blood cultures (initial 3 sets) there is little benefit of repeat blood cultures
- In patients in whom there is POSSIBLE IE on antibiotics and negative blood cultures, if safe to do so an antibiotic holiday should be initiated and repeat blood cultures should be sent
- In patients in whom there is POSSIBLE IE and negative blood cultures early liaison with microbiology and Infectious disease (ID) team is recommended for possibly serology, cell culture and gene amplification

1.4 Recommendation: Positive blood cultures

- All patients with positive blood cultures growing an organism compatible with IE and a clinical suspicion of IE should have a TTE and should be discussed with microbiology, ID and cardiology teams

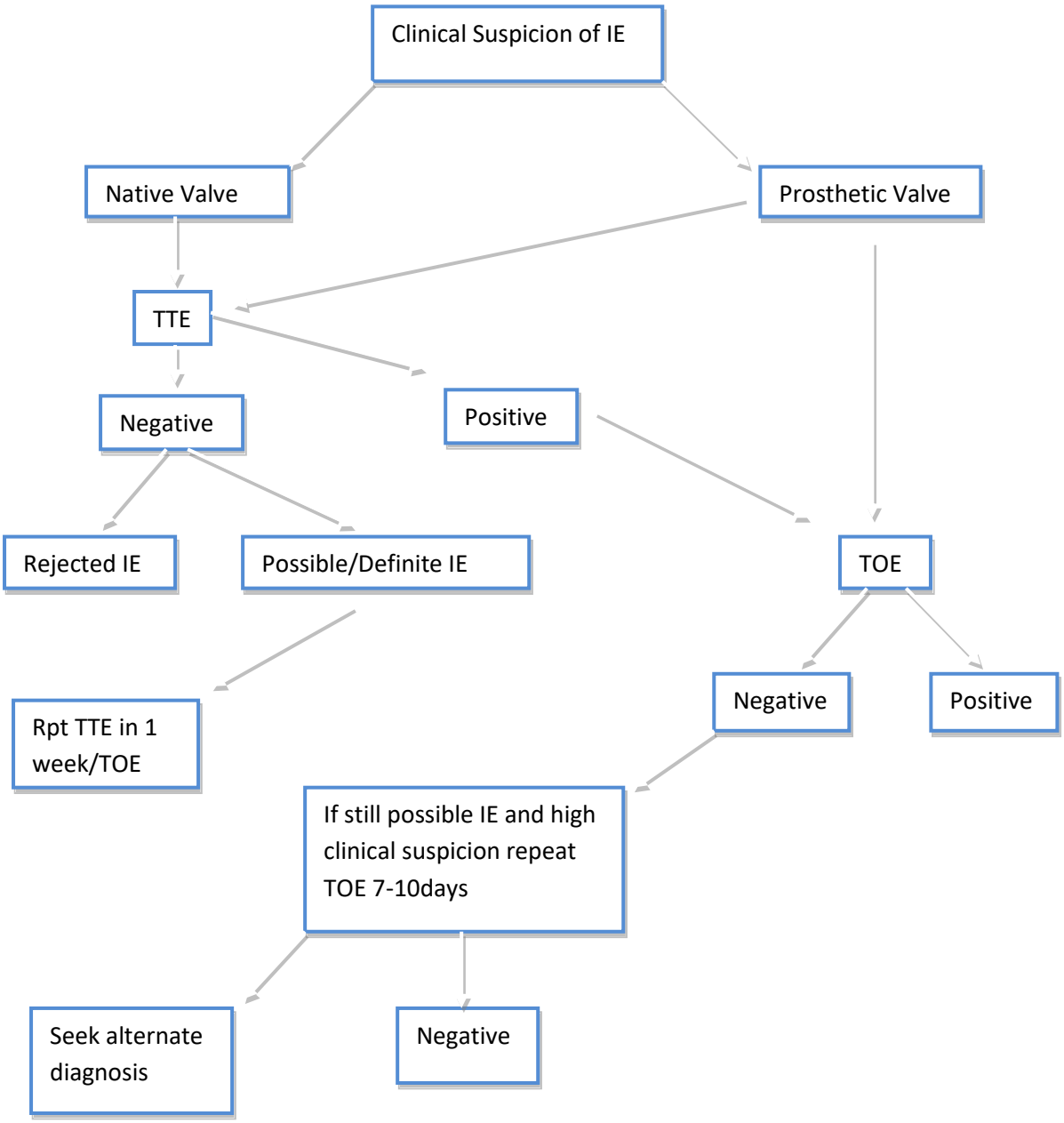
ECHOCARDIOGRAPHY

Trans-thoracic echocardiography (TTE) and trans-oesophageal echocardiography (TOE) are essential tools in the diagnosis of IE. The major echocardiographic findings in IE are: vegetation, valve destruction with severe regurgitation, abscess and new dehiscence of prosthetic valve. There are other suggestive features seen on echocardiography not described in the Duke's system. These are pseudoaneurysm, perforation and fistula formation.

The sensitivity of TTE in the diagnosis of IE ranges from 40-63% and that of TOE from 90-100%[4]. In patients whom there is a high clinical suspicion of IE repeat TTE/TOE 7-10days following the initial study has been strongly advised by the ESC guidelines on endocarditis[3]. Figure 1.1 shows the indications for TTE/TOE in suspected IE.

1.5 Recommendation: Echocardiography

- In all patients in whom there is a clinical suspicion of IE the flow diagram in below should be followed



Flow diagram denoting the role of echocardiography in the diagnosis of IE in critical care: adapted from the ESC and ACC guidelines[3,5].

1.6 Recommendation: Prosthetic valves

- All patients with a prosthetic valve and clinical suspicion of

1.7 Recommendation: Staphylococcal *aureus* Bacteraemia

- All patients with staphylococcal *aureus* sepsis as a primary presentation should have a TOE
- If staphylococcal *aureus* bacteraemia is secondary to infected vascular access device (VAD) echocardiography should be considered in the following circumstances:
  - Failure of the temperature to resolve after prompt removal of VAD and 72 hours of

Author: R. Hindocha; April 2022;
Adapted from guidelines 2010; Lumley/Hindocha

To be reviewed April 2024.

References

1. Hoen B, Alla F, Selton-Suty C, Beguinot I, Bouvet A, Briancon S, Casalta JP, Danchin N, Delahaye F, Etienne J, Le Moing V, Leport C, Mainardi JL, Ruimy R, Vandenesch F. Changing profile of infective endocarditis: results of a 1-year survey in France. JAMA 2002;288:75–81.

2. Hill EE, Herijgers P, Claus P, Vanderschueren S, Herregods MC, Peetermans WE. Infective endocarditis: changing epidemiology and predictors of 6-month mortality: a prospective cohort study. Eur Heart J 2007;28:196–203

3. Guidelines on prevention, diagnosis and treatment of infective endocarditis European Heart Journal (2009) 30, 2369–2413

4. Tleyjeh IM, Steckelberg JM, Murad HS, Anavekar NS, Ghomrawi HM, Mirzoyev Z, Moustafa SE, Hoskin TL, Mandrekar JN, Wilson WR,
5. ACC/AHA guidelines on the management of patients with valvular heart disease: A report of the American college of cardiology/American heart association task force on practice guidelines. Circulation, August 2006; 114:450-527