

# Infective Endocarditis Surgery?

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*No conflicts of interest*



# How can IE surgery benefit patient outcomes ?

Survival: through correction/avoidance of

- Pump failure
- Progressive multi organ impairment
- Cerebral and systemic embolic events
- Major cardiac and systemic complications in active IE

Quality of Life:

- Minimisation of embolic events causing cerebral and systemic injury
- restoring cardio-vascular integrity and competent heart valves

Both influence the timing of surgery

# Teamwork in IE management

- ▶ Cardiologists: ECHO/Angio/Interventional
- ▶ Cardiac Surgeons: Experienced, Reflective, Assertive (ERA current)
- ▶ Infectious Disease specialists
- ▶ Intensivists
- ▶ Imaging specialists
- ▶ Neurologists/ Neurosurgeons
- ▶ Haematologists
- ▶ Allied Health personnel

# What do Cardiologists/Surgeons/Patients need for best outcomes?

- ▶ Prompt notification on admission of potential IE patient at treating hospital to apply 24hr diagnostic, investigational and treatment facilities for this condition.
- ▶ Is IE Diagnosis confirmed or in doubt?
- ▶ What clinical and investigative data is available at notification?
- ▶ Opportunity to view patient and related data
- ▶ Capacity to engage and contribute to IE team management plan

# Important Host factors in IE

- ▶ Heart failure:
  - Valve regurgitation/stenosis
  - Muscle injury (emboli, CAD)
  - Elevated diastolic pressures impacting on lungs/liver/kidneys
  - Conduction/rhythm disturbances related to IE
- ▶ Infective emboli
  - Cerebral
  - Systemic
- ▶ Presence of cardio-vascular devices (ppm/AICD/ASD,VSD devices) + shunts

# Contributions to Pump failure

- ▶ Valve regurgitation/stenosis
  - Has greatest effect on Left heart; related to valve destruction.
- ▶ Is there associated Coronary artery disease?
- ▶ Is heart muscle damage present? (Acute/chronic)
- ▶ Has lung function been affected by IE (Emboli? Abscess? Oedema? Haemorrhage?)
- ▶ What are current liver and renal functional parameters/trends?

# Infective Vegetations and Emboli

## ► Vegetations:

- ? Organism(s) producing vegetations: Staph>Strep>fungal>HACEK
- Vegetation embolic potential:
  - ? Size:(>10mm important + mobility)
  - ? Location: AMVleaflet > aortic + host/antibiotic effects over time?

# Potential cerebral embolic complications

- ▶ Infarction
- ▶ Haemorrhagic conversion of infarct with I-C Haemorrhage (1-3 weeks)
- ▶ Infective Intracranial Aneurysm (IIA) (“mycotic” = fungal)
- ▶ Abscess formation (oedema, swelling ++, haemorrhage risk)
- ▶ Subarachnoid haemorrhage
- ▶ Meningo-encephalopathy

# Cerebral Emboli impacts

- ▶ Emboli with micro haemorrhage Number, size, location (<10mm + no stroke = IE surgery)
- ▶ Larger cerebral infarct, ? stroke degree, (haemorrhagic conversion time 1-3W) ? Op >3W
- ▶ Infected Intracranial Aneurysm (IIA) (Cerebral angio/CT angio ? bleed/If no bleed = surgery)
- ▶ Cerebral abscess: need to define size + effects (<10mm no impact on IE surgery timing)
- ▶ Meningoencephalitis: rare, no data as yet to inform IE surgery timing and risk

# Imaging in Vegetative IE

- i). Cardiac: 3D TTE + TOE
- ii). Cranial: Diffusion weighted MRI: (detects ischaemia > abscess > haemorrhage)
- iii) ? Cerebral Angiography, CT angio: (? IIA +/- haemorrhage specific)
- iv) Systemic arterial emboli/abscess: FDG PET/CT or MRI

# Imaging for Cardiac complications of IE

- ▶ MSCT: best for abscess, false aneurysm, ?annular PVE
- ▶ Coronary angiogram / CTCA ? CADisease
- ▶ <sup>18</sup>F-FDG PET-CT: active infective foci identification

# When to operate in confirmed IE

## 1. Cardiogenic shock

a) Related to acute left sided valve regurgitation/stenosis

(Aortic > Mitral): in the absence of stroke and <10mm cerebral emboli shown by MRI = surgery

b) If stroke present, need to confirm duration of stroke, no intracerebral haemorrhage or ruptured IIA present.

c) Depending on age/risks for CAD, may need Coronary angiogram(?Aortic vegetations present = CT angiogram)

? Renal/liver/lung function)

Timing - emergency (< 24hrs)

## 2. Uncontrolled IE

- ▶ Virulent/resistant organisms: Staph aureus, Staph lugdunensis, VRE, pseudomonas, fungal
- ▶ Anatomical extension of infection: aneurysm, fistula, A-V block development
- ▶ Cardiac abscess formation (Peri-aortic or mitral eg: Staph aureus)
- ▶ New or increasing valve regurgitation on treatment (TOE)
- ▶ Persisting positive Blood Cultures despite treatment

Timing

Urgent (within 48hrs)

# 3. a) Vegetation management

## ▶ No clinical stroke:

- No cerebral emboli on MRI
- Surgery indicated if:
  - i) Vegetations >10mm, mobile, involving AMVL > Ao Valve (TOE)
  - ii) Organism Staph aureus, Staph lugdenensis > Strep bovis > fungal
  - iii) No size reduction in first week of treatment
  - iv) Native Valve retention rate high

## ▶ Clinical Stroke:

- No cerebral haemorrhage
- Surgery indicated if:
  - i) < 10mm single or multiple cerebral emboli on MRI
  - ii) < 3 days since stroke
  - iii) As for i-iv above

Timing urgent (within 48 hrs)

### 3. b) Vegetation management

► Clinical stroke with cerebral haemorrhage

If haemorrhage < 10mm, single or multiple

- valve function stable; mild-moderate stenosis/regurgitation
- vegetations > 15mm, mobile, Staph aureus IE, on treatment 1 Week
- haemorrhage size stable (serial MRI)
- Patient cognition intact to understand risks/benefits of surgery

Advise surgery with risk of death < 10%, stroke increase <10%

Timing    urgent (< 48 hrs)

if ICH large, impaired conscious state, defer surgery 3-4 weeks

# 4. Surgery for Cardiac complications of IE (Uncontrolled, poorly controlled IE)

- Contributing factors: Calcification (leaflets, annulus), prosthetic valves  
Organisms: Staph aureus, MRSA, VRE, Gm -ve's, fungal  
Host status
- Imaging to identify the following: utilise TOE, MSCT, PET/CT
  - a) False aneurysm:- Aortic root (MAIVF, IVS, IASeptum)  
- Posterior mitral annulus
  - b) Annular abscess (MSCT, PET/CT)
  - c) Fistulae (TOE best)
  - d) Emerging heart block (ECG daily)
  - e) Prosthetic Valve Endocarditis. (PET/CT)
- In the absence of major ICH these complications require urgent surgery.  
Mortality risk < 10%

Timing **urgent** (< 48hrs)

# Important Surgical considerations

- ▶ Which valves are regurgitant and why? (Destruction/perforation/chordal rupture/ leaflet aneurysm, calcification - BAV/senile)
- ▶ What is the potential for valve repair? (Mitral > tricuspid > aortic)
- ▶ Where are vegetations located? (Size / mobility)
- ▶ Are there embolic complications? (Cerebral / Systemic)
- ▶ Is the patient able to understand management options / provide valid consent

# Operative Goals.

- ▶ Aim for CPB time < 3hrs, x clamp time < 2hrs (not always achievable)
- ▶ Confirm muscle, valve, vegetation, complication status with TOE specialist prior to CPB
- ▶ Excise all visible vegetative material; exclude aneurysms/abscess /fistulae from circulation; restore cardiac anatomy/repair valves/ if valve replacement required utilise biological valves if ICH (allograft > commercial, no anticoagulants post surgery)
- ▶ Use continuous monofilament suture material for repair/replacement

# Allograft tissue use in IE

- ▶ Provides tissue incubated with antibiotics for >12hrs during processing
- ▶ AVR: Supple and conforms to Aortic root at arterial perfusion pressures  
Has > 10 year functional durability (Fukushima S. et al: July 2014. JCTVS)
- ▶ TV repair: allograft leaflet durability sound at 10 years (Bishwo M S Shrestha et al: Annals Thoracic Surgery, April 2010; 89,(4),1187-1194)

# Valve replacement options in IE

- ▶ **No cerebral haemorrhage:**

Choice of mechanical / xenograft/ Allograft valves

- ▶ **Cerebral haemorrhage present: Xenograft or allograft only.**

To avoid use of anticoagulants post operatively, thus minimizing the risk of extension of intracranial haemorrhage post operatively.

# Post operative ICU management in IE

- ▶ Haemodynamic stabilization, respiratory support, renal support if required
- ▶ Nutrition @ 24hrs post op
- ▶ TOE day 1 to evaluate cardiac valves and muscle function
- ▶ 2<sup>nd</sup> daily inflammatory markers for baseline and trends. ? B-cultures
- ▶ Check histology and culture results of tissue excised during surgery.
- ▶ Daily review by relevant team members

# Conclusions

- ▶ NVE and PVE when confirmed on blood culture, requires urgent comprehensive imaging to identify valve function, presence of vegetations, cerebral embolus presence or not, and intracardiac pathology.
- ▶ **Emergency surgery:** is required in the presence of cardiogenic shock after confirmation of the absence of significant intracerebral haemorrhage.
- ▶ Intra-cardiac identification of mobile vegetations >10mm, aneurysm formation, fistula, developing abscess and emerging or established heart block; each require  
**Urgent surgery:** after ICH presence <10mm has been confirmed by MRI.
- ▶ Use of allograft or xenograft tissue for valve replacement and intra-cardiac repair using monofilament suture material constitutes best IE surgical practice.
- ▶ Mortality risk for surgery in the above setting is < 15-20%, with expected 1 and 5 year survival of > 80% and 75% respectively.
- ▶ Quality of life during that time is expected to parallel 80-90% of an age matched population.
- ▶ **Major stroke and ICH >10mm prohibits emergency or urgent surgery** for IE due to risks of stroke extension.