

# CHALLENGES IN INFECTIVE ENDOCARDITIS

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# INTRODUCTION

- IE IS DEFINED AS FOCUS OF INFECTION WITHIN HEART .
- IE IS FREQUENTLY ACQUIRED IN HEALTH CARE SETTINGS .
- MORTALITY RATE IS HIGH.
- IE IS HETROGENOUS IN ETIOLOGY,CLINICAL MANIFESTATIONS AND COURSE .

# INTRODUCTION

- STAPHYLOCOCCUS AUREUS HAS BECOME THE PREDOMINANT CAUSATIVE ORGANISM.
- AGGRESSIVE FORM OF DISEASE SEEN IN VULNERABLE OR ELDERLY PATIENTS .
- LONGSTANDING CONTROVERSY SUCH AS TIMING OF SURGERY OR ROLE OF ANTIBIOTIC PROPHYLAXIS HAVE NOT BEEN RESOLVED .

# INTRODUCTION

- LACK OF RESEARCH FUNDING AND INFRASTRUCTURE WITH FEW RC TRIALS TO GUIDE THE PRACTISE .
- PRESENT ARTICLE REVIEW THE CHALLENGES POSED BY INFECTIVE ENDOCARDITIS AND OUTLINES CURRENT AND FUTURE STRATEGIES TO LIMIT ITS IMPACT .

# INCIDENCE OF IE

IT AFFECTS 3 TO 10% OF THE POPULATION .

- EARLIER DAYS IT WAS SEEN IN RHD OR CHD .
- NOW RISK FACTORS FOR IE ARE PVR,DVC,IV DRUG USERS AND IMMUNOSUPPRESSION.

# INCIDENCE OF IE

- 25% OF IE INCIDENCE IS DUE TO HEALTHCARE ACQUIRED.
- IMPLANTABLE CARDIAC DEVICES, TAVR AND SURGICALLY IMPLANTED PROSTHETIC VALVE ARE COMMON RISK FACTORS FOR HEALTHCARE ACQUIRED IE.

# PREVENTION OF IE

POPULATION AT RISK.

PREVENTIVE STRATEGIES.

PREVENTIVE INTERVENTIONS.

# MECHANISM OF IE

- IE DEVELOPS IN THREE STAGES ;
- BACTEREMIA .
- ADHESION.
- COLONISATION.
  
- BIOFILM FORMATION.



# MICROORGANISMS IN IE

- STAPHYLOCOCCI ,
- STREPTOCOCCI,
- ENTEROCOCCI ,
- CANDIDA ,
- PSEUDOMONAS AERUGINOSA ,
- HACEK GROUP OF ORGANISMS.

# ANTIBIOTIC PROPHYLAXIS

- NO RCT FOR ANTIBIOTIC PROPHYLAXIS IN DENTAL PROCEDURES.
- EFFICACY OF ANTIBIOTIC PROPHYLAXIS.
- EMERGING RESISTANCE DUE TO OVER USAGE OF ANTIBIOTICS

# GUIDELINES FOR ANTIBIOTIC IN IE

**TABLE 2** ACC/AHA and ESC Guidelines on Use of Antibiotic Prophylaxis for the Prevention of IE

	ACC/AHA	Class, Level of Evidence	ESC	Class, Level of Evidence
Dental procedures that involve manipulation of gingival tissue, manipulation of the periapical region of teeth, or perforation of the oral mucosa*	<ol style="list-style-type: none"> <li>1. Patients with prosthetic cardiac valves</li> <li>2. Patients with previous IE</li> <li>3. Cardiac transplant recipients with valve regurgitation due to a structurally abnormal valve</li> <li>4. Patients with CHD, including               <ol style="list-style-type: none"> <li>a. Unrepaired cyanotic CHD, including palliative shunts and conduits;</li> <li>b. Completely repaired CHD repaired with prosthetic material or device, whether placed by surgery or catheter intervention, during the first 6 months after the procedure; or</li> <li>c. Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device</li> </ol> </li> </ol>	Ia, B	<ol style="list-style-type: none"> <li>1. Patients with any prosthetic valve, including a transcatheter valve, or those in whom any prosthetic material was used for cardiac valve repair</li> <li>2. Patients with previous IE</li> <li>3. Patients with CHD, including               <ol style="list-style-type: none"> <li>a. Any type of cyanotic CHD</li> <li>b. Any type of CHD repaired with a prosthetic material, whether placed surgically or by using percutaneous techniques, up to 6 months after the procedure, or lifelong if residual shunt or valvular regurgitation remains</li> </ol> </li> </ol>	Ia, C
Vaginal delivery†	<ol style="list-style-type: none"> <li>1. Patients with prosthetic cardiac valve or prosthetic material used for cardiac valve repair‡</li> <li>2. Patients with unrepaired and palliated cyanotic CHD, including surgically constructed palliative shunts and conduits‡</li> </ol>	Ia, C	Not recommended. "During delivery the indication for prophylaxis has been controversial and, given the lack of convincing evidence that infective endocarditis is related to either vaginal or caesarean delivery, antibiotic prophylaxis is not recommended" (145).	III, C

# EFFECTS OF CHANGING GUIDELINES ON IE.

- IN 2002, THREE FRANCE SURVEYS SHOWED NO INCREASE IN INCIDENCE OF IE WITHOUT ANTIBIOTIC PROPHYLAXIS.
- IN 2007 , ACC/AHA GUIDELINES SHOWED NO INCREASE IN INCIDENCE IN IE IN PATIENTS WITH PROSTHETIC VALVE , CHD, PREVIOUS IE PATIENTS AND CARDIAC TRANSPLANTS PATIENTS .
- CURRENT ACC/AHA/ESC GUIDELINES IS TO LIMIT PROPHYLAXIS TO INDIVIDUALS WITH IE .

# PREVENTION OF HEALTHCARE ASSOCIATED IE

- SPECIFIC STRATEGIES FOR PREVENTION.
- OLDER PATIENTS.
- PATIENTS WITH DEGENERATIVE VALVE DISEASES.
- MOST FREQUENT RISK FACTORS ARE HAEMODIALYSIS, CANCER, DM AND CARDIAC DEVICES.
- STAPHYLOCOCCUS AUREUS IS CAUSATIVE ORGANISM IN ONE THIRD OF THE CASES.

# PREVENTION OF HEALTHCARE ASSOCIATED IE

- IN HOSPITAL MORTALITY OF HEALTHCARE ASSOCIATED IE IS HIGHER THAN COMMUNITY ACQUIRED IE.
- HAND HYGEINE, BARRIER PRECAUTIONS AND ANTISEPSIS.
- VACCINES.
- LONG LASTING BACTERICIDAL COATING.

# DIAGNOSIS

- RAPID AND ACCURATE DIAGNOSIS IS REQUIRED .
- DELAYED DIAGNOSIS AND INITIATION OF THERAPY LEADS TO COMPLICATIONS AND WORSE CLINICAL OUTCOMES .
- CLINICAL PRESENTATION INCLUDES RANGES FROM LOW GRADE FEBRILE ILLNESS ,HF SYNDROME OR STROKE.
- MODIFIED DUKES CRITERIA.

# DIAGNOSIS

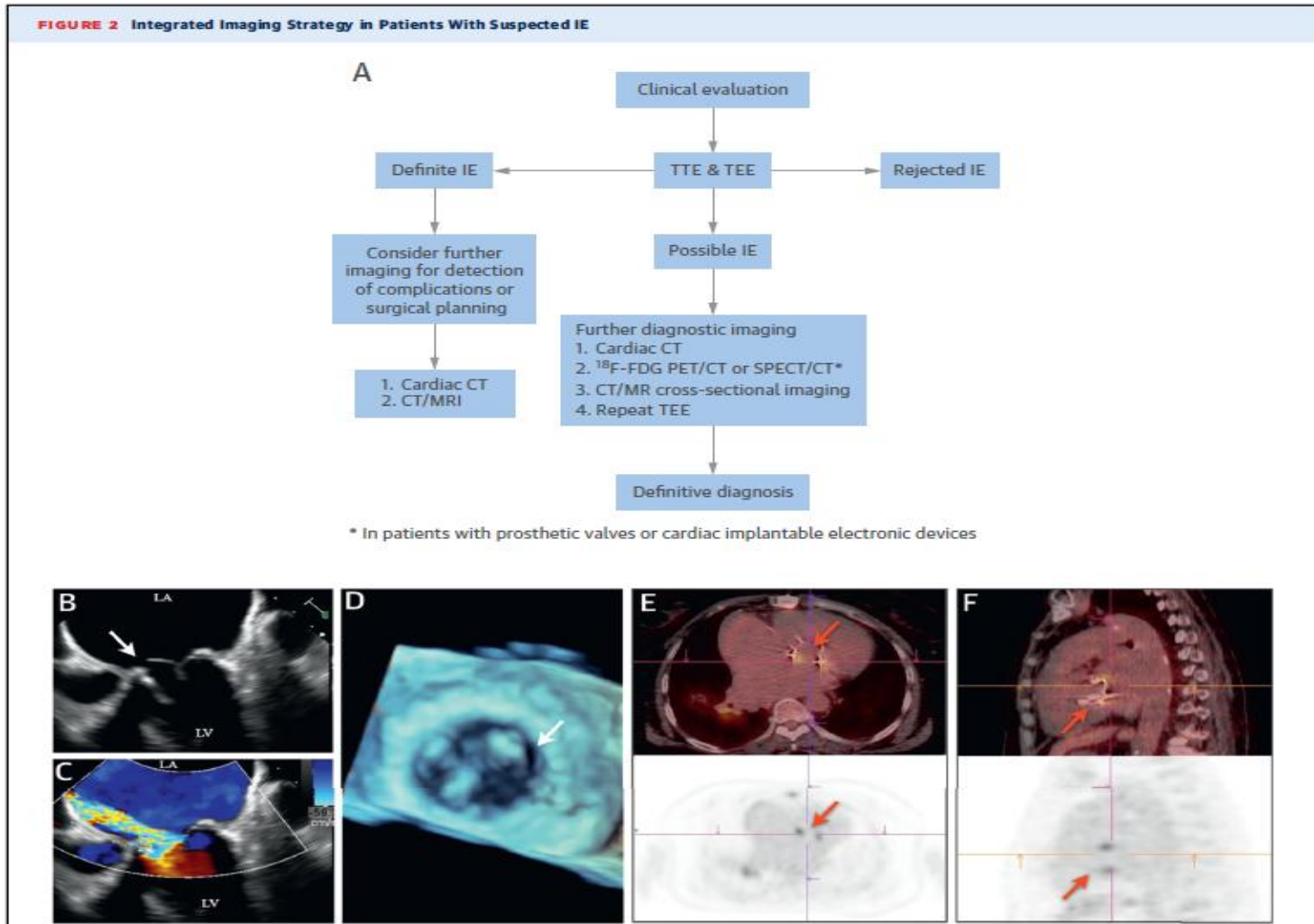
- UP TO 30% OF PATIENTS ARE LABELLED AS POSSIBLE DUE TO NEGATIVE FINDINGS IN BLOOD CULTURE AND ECHO.
- DEFINITIVE CARDIAC IMAGING AND MICROBIOLOGY ARE OF INTEGRAL IMPORTANCE IN MAKING DIAGNOSIS OF IE .



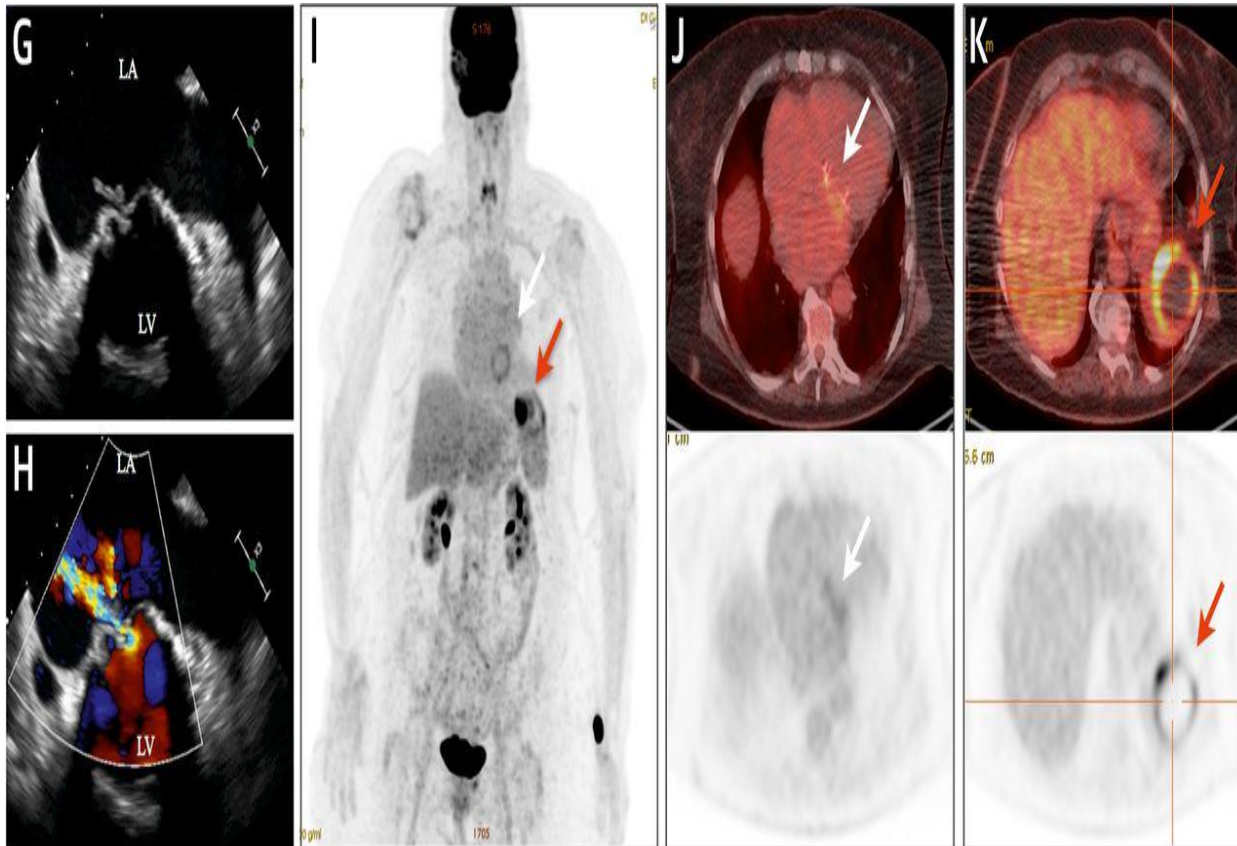
# IMAGING

- TTE IS INITIAL IMAGING OF CHOICE IN NVE AND PVE.
- TEE IS MORE SPECIFIC AND SENSITIVITY IN MAKING DIAGNOSIS OF IE THAN TTE.
- TTE IS USEFUL IN ASSESSEMENT OF VENTRICULAR SIZE, FUNCTION, VALVULAR ABCESS.
- TEE IS USEFUL FOR DETECTION OF COMPLICATIONS SUCH AS PERFORATION, FISTULA AND ABSCESS .

# IMAGING STRATEGY IN IE



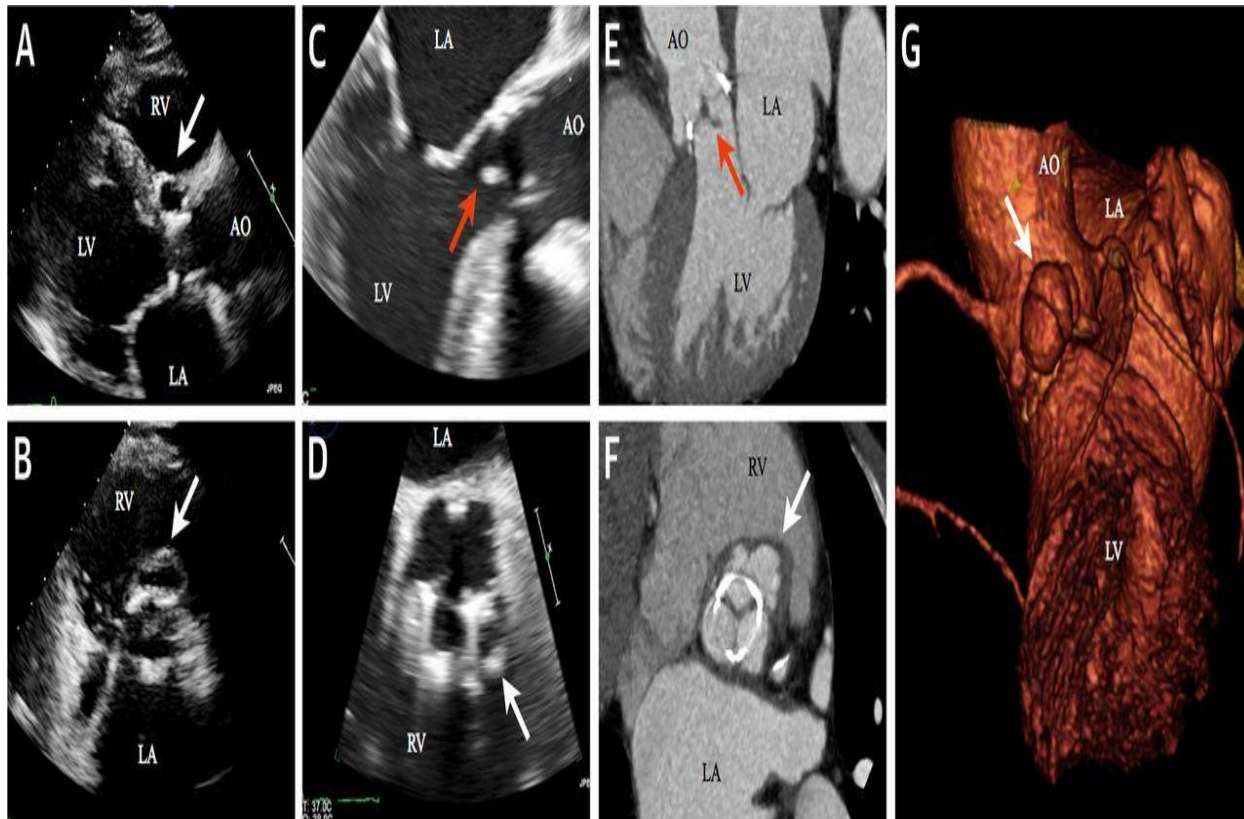
# IMAGING IN IE



# CARDIAC CT SCAN

- CARDIAC CT IS EQUIVALENT TO TEE FOR DEMONSTRATING PARAVALVULAR ANATOMY AND COMPLICATIONS.
- CT IS HELPFUL IN PLANNING SURGICAL STRATEGY .
- CT IMAGING WITH METABOLIC IMAGING IS USEFUL IN POSSIBLE IE .
- PET/SPECT CT IMAGING HELPS IN INCREASING SENSITIVITY AND SPECIFICITY IN POSSIBLE IE PATIENTS .

# CARDIAC CT IMAGES



# MRI

- SUBCLINICAL COMPLICATIONS LIKE EMBOLISM, HAEMORRHAGE OR ABSCESS.
- MRI OF BRAIN, SPLEEN, LIVER AND KIDNEY .
- CEREBERAL ANGIOGRAPHY IDENTIFIES INTRACRANIAL MYCOTIC ANEURYSMS.

# MICROBIOLOGY

- STAPH. AUREUS IS MOST COMMON WITH >30% OF CASES.
- IN PVE , S.AUREUS IS MOST COMMON.
- CONS IS APPROX 10% OF CASES.
- STREPTOCOCCUS IS 20%.
- ENTEROCOCCUS IS 10%.
- HACEK IS 5%.

# MANAGEMENT

- IE TEAMS INCLUDING  
CARDIOLOGIST, SURGEON,  
INFECTIOUS DISEASE PHYSICIANS,  
MICROBIOLOGIST, NEPHROLOGIST,  
NEUROLOGIST AND RADIOLOGIST.

CENTRALIZED CARE WITH ADVANCE  
DIAGNOSTIC IMAGING, SURGICAL  
EXPERTISE .



# ANTIBIOTIC THERAPY

- UNCOMPLICATED IE CAUSED BY STREPTOCOCCI WITH NORMAL RENAL FUNCTION – PENICILLIN OR CEFTRIAZONE WITH AMINOGLYCOSIDE .
- UNCOMPLICATED METHICILLIN SENSITIVE STAPHYLOCOCCI – PENICILLIN WITH AMINOGLYCOSIDE .

# ANTIBIOTIC THERAPY

- MAJOR CHALLENGES ARE BACTERIAL TOLERANCE AND ANTIBIOTIC RESISTANCE .
- TOLERANCE OCCURS WHEN VARIANTS OF BACTERIA PERSISTS INSPITE OF ANTIBIOTIC THERAPY.
- TOLERANCE AND SLOW BACTERICIDAL GROWTH REQUIRES 4 TO 6 WKS OF PARENTERAL ANTIBIOTIC THERAPY.

# SURGERY

- PROGRESSIVE VALVE DAMAGE.
- TISSUE DAMAGE.
- UNCONTROLLED INFECTION.
- HIGH RISK OF EMBOLISM.
- PARAVALVULAR EXTENSION.
- LARGE VEGETATION.
- HEART FAILURE.

# INDICATIONS OF SURGERY IN IE

**TABLE 3** Indications for Surgery in AHA and ESC Guidelines

	AHA Guidelines 2015 (89)	Class, Level of Evidence	ESC Guidelines 2015 (68)	Class, Level of Evidence	Timing†
Heart failure	Early surgery* is indicated in patients with IE who present with valve dysfunction resulting in symptoms or signs of HF	I, B	Aortic or mitral NVE, or PVE with severe acute regurgitation, obstruction, or fistula causing refractory pulmonary edema or cardiogenic shock	I, B	Emergency
	Early surgery* is indicated in patients with PVE with symptoms or signs of HF resulting from valve dehiscence, intracardiac fistula, or severe prosthetic valve dysfunction	I, B	Aortic or mitral NVE, or PVE with severe regurgitation or obstruction causing symptoms of HF, or echocardiographic signs of poor hemodynamic tolerance	I, B	Urgent
Uncontrolled infection	Early surgery* is indicated in patients when IE is complicated by heart block, annular or aortic abscess, or destructive penetrating lesions	I, B	Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation)	I, B	Urgent
	Early surgery* is reasonable for patients with relapsing PVE	IIa, C			
	Early surgery* should be considered, particularly in patients with IE caused by fungi or highly resistant organisms (e.g., VRE, multidrug-resistant gram-negative bacilli)	I, B	Infection caused by fungi or multiresistant organisms	I, C	Urgent/elective
	Early surgery* is indicated for evidence of persistent infection (manifested by persistent bacteremia or fever lasting >5-7 d, and provided that other sites of infection and fever have been excluded) after the start of appropriate antimicrobial therapy	I, B	Persisting positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci PVE caused by staphylococci or non-HACEK gram-negative bacteria	IIa, B IIa, C	Urgent Urgent/elective
Prevention of embolism	Early surgery* is reasonable in patients who present with recurrent emboli and persistent or enlarging vegetations despite appropriate antibiotic therapy	IIa, B	Aortic or mitral NVE, or PVE with persistent vegetations >10 mm after ≥1 embolic episode despite appropriate antibiotic therapy	I, B	Urgent
	Early surgery* is reasonable in patients with severe valve regurgitation and mobile vegetations >10 mm	IIa, B	Aortic or mitral NVE with vegetations >10 mm, associated with severe valve stenosis or regurgitation, and low operative risk	IIa, B	Urgent
	Early surgery* may be considered in patients with mobile vegetations >10 mm, particularly when involving the anterior leaflet of the mitral valve and associated with other relative indications for surgery	IIb, C	Aortic or mitral NVE, or PVE with isolated very large vegetations (>30 mm) Aortic or mitral NVE, or PVE with isolated large vegetations (>15 mm) and no other indication for surgery	IIa, B IIb, C	Urgent Urgent

# POOR PROGNOSIS IN SURGERY

- STROKE.
- SEPSIS.
- HAEMODYNAMICALLY UNSTABLE.
- LIVER DISEASE.
- S.AUREUS INFECTION.
- ACTIVE IE.
- RENAL DISEASE.

# EARLY SURGERY

- LARGE VEGETATION.
- SEVERE REGURGITATION.
- MORTALITY BENEFITS.
- EMERGENCY (WITHIN 24HRS)
- URGENT (WITHIN FEW DAYS)
- ELECTIVE(WITHIN FEW WKS)

# IE AFTER TAVR

- TAVR PATIENTS ARE MORE PRONE FOR IE.
- BIG CHALLENGE .
- ELDERLY,FRAIL,MULTIPLE HEALTHCARE INTERVENTIONS.
- HIGH RISK FOR BACTEREMIA.
- POOR OUTCOME IF MANAGED MEDICALLY.

# IE AFTER TAVR

- >70% PATIENTS PRESENT WITH FEVER.
- STAPHYLOCOCCI IS COMMONEST ORGANISM.
- COREVALVE SYSTEM WAS AN INDEPENDENT RISK FOR IE.
- HIGH RISK FOR SURGERY /TRANSCATHETER VALVE IN VALVE.



# STROKE IN IE

- 20-40% OF PATIENTS.
- ADVERSE PROGNOSTIC FACTOR FOR SURVIVAL .
- RISK OF STROKE IS HIGHEST AT DIAGNOSIS .
- RISK REDUCES WITH ANTIBIOTIC THERAPY.

# RISK FACTORS FOR STROKE IN IE

- VEGETATION SIZE(>10 TO 15MM).
- MITRAL VALVE INVOLVEMENT.
- VEGETATION MOBILITY.
- S.AUREUS INFETION.

# STROKE

- UNRESOLVED CHALLENGE IS ROLE OF SURGERY IN THE PREVENTION OF STROKE/EMBOLISM AND SELECTION OF PATIENT.
- OPTIMAL TIMING OF SURGERY.
- RISK OF HEMORRAGIC TRANSFORMATION.
- EARLY VS DELAYED SURGERY.
















# CARDIAC DEVICE INFECTION

- PPI, ICD AND CRT DEVICES .
- CDI MAY INVOLVE GENERATOR POCKET, DEVICE LEADS OR ENDOCARDIAL SURFACES .
- RISK FACTORS ARE POST OP HAEMATOMA, REINTERVENTION OF LEAD, LONG PROCEDURE TIME , IMPLANTATION OF >2 LEADS, DM, ESRD, COPD, MALIGNANCY AND HF.

# CARDIAC DEVICE INFECTION

- DIAGNOSIS ECHO, TEE, BLOOD CULTURE, PET/CT SCAN.
- TREATMENT – COMPLETE REMOVAL OF INFECTED SYSTEM .
- PROLONGED ANTIBIOTIC THERAPY.

## CENTRAL ILLUSTRATION: Infective Endocarditis: Preventive Strategies, Diagnosis, and Management

Preventive strategies	Improving diagnosis	Optimal management
 Reduce hospital acquired bacteremia	 High index of clinical suspicion in at-risk groups	 Evaluation by an endocarditis team
 Good oral hygiene for at-risk groups	 Patient education	 Early risk stratification
 Antibiotic prophylaxis for high risk groups	 Early echocardiography	 Early transfer to center of expertise
 In future, antibacterial coatings/materials	 Adjunctive imaging if echocardiography non-diagnostic	 Tailored antibiotic therapy
	 Rapid microbiology results with antibacterial sensitivity	 Early surgery for selected patients
		 Monitoring for complications

Cahill, T.J. et al. J Am Coll Cardiol. 2017;69(3):325-44.

# CONCLUSION

- CHALLENGES OF IE ARE DIVERSE .
- PROSTHETIC DEVICES WITH REDUCED SUSCEPTIBILITY TO BACTERIAL ADHESION .
- DENTAL PROCEDURES PERFORMED WITH ANTIBIOTIC PROPHYLAXIS OR NOT.
- ANTIBIOTIC GUIDELINES.
- SURGICAL INDICATIONS AND OPTIMAL TIMINGS PLAYS A CRUCIAL ROLE.
- MORE RCT ARE REQUIRED .

**THANK YOU**