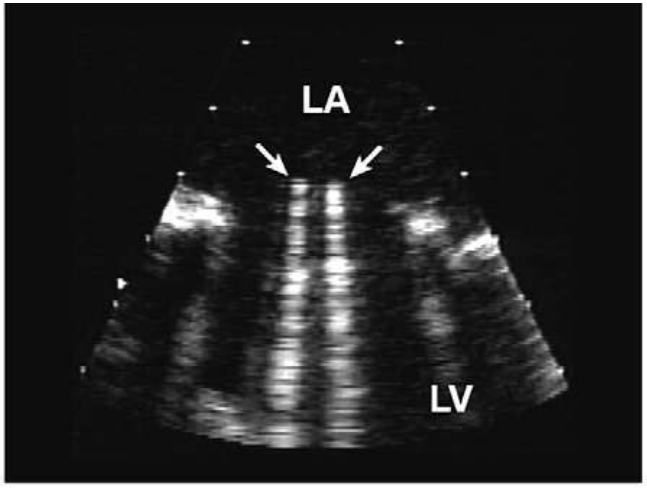
PROSTHETIC.V

PROSTHETIC.V

VALVE TYPE

The valve types now implanted include:

- 1-bileaflet and tilting disc mechanical valves,
- 2-stented porcine and pericardial xenografts,
- 3-stentless porcine xenografts,
- 4-cadaveric homografts,
- 5-autografts (Ross procedure).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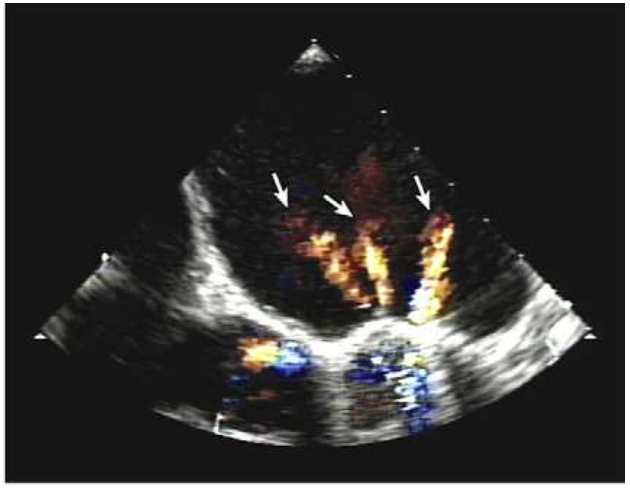

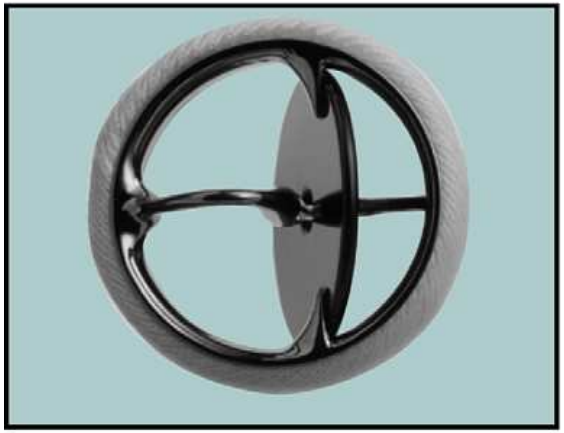

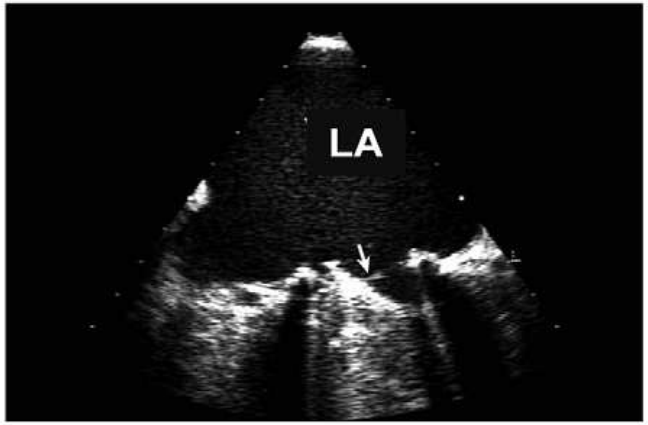
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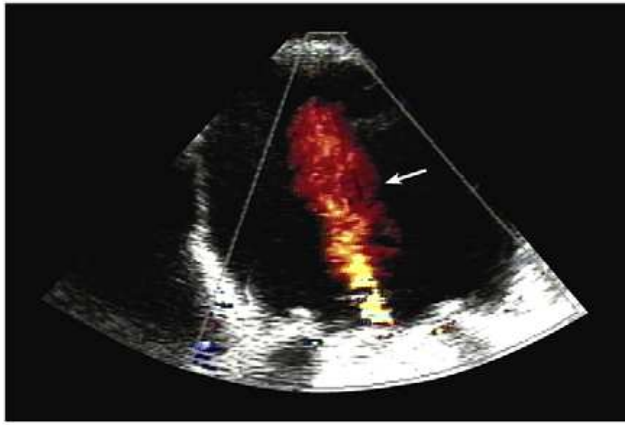

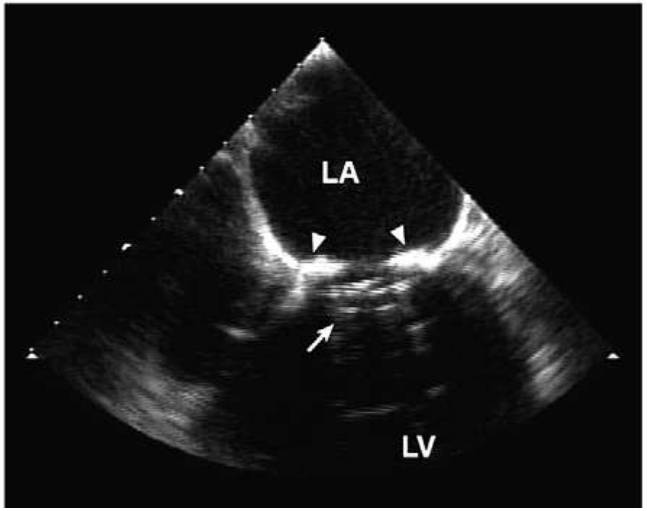
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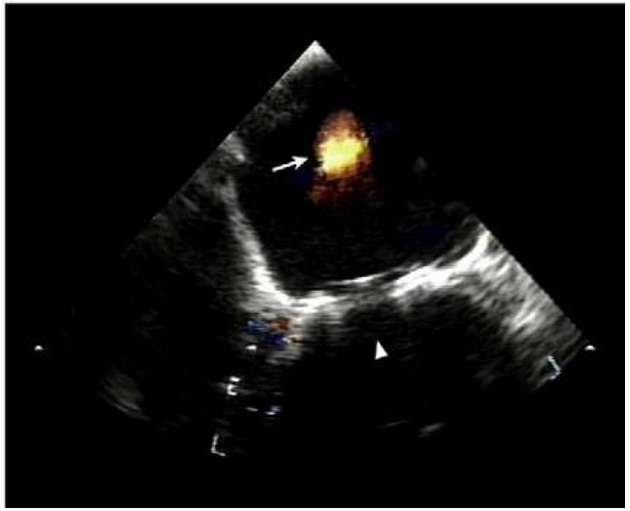
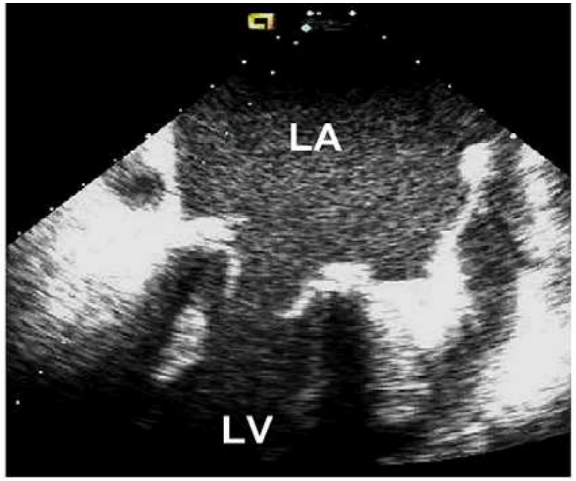


TYPES

- Examples of bileaflet, single-leaflet, and caged-ball mechanical valves and their transesophageal echocardiographic characteristics taken in the mitral position in diastole (middle) and in systole (right).
- The arrows in diastole point to the occluder mechanism of the valve and in systole to the characteristic physiologic regurgitation observed with each valve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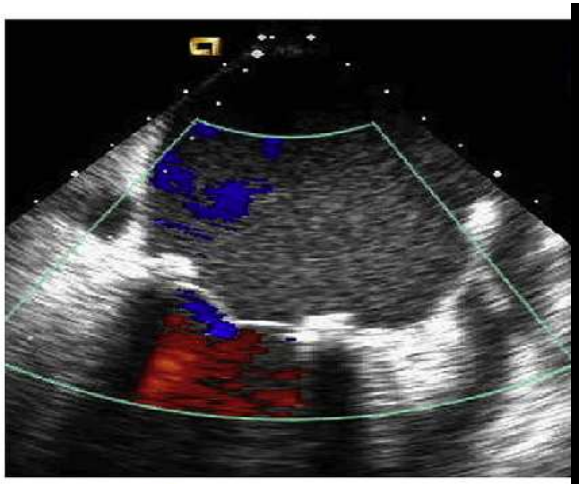

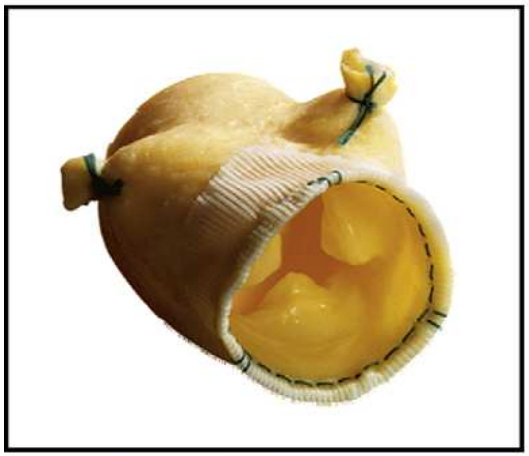

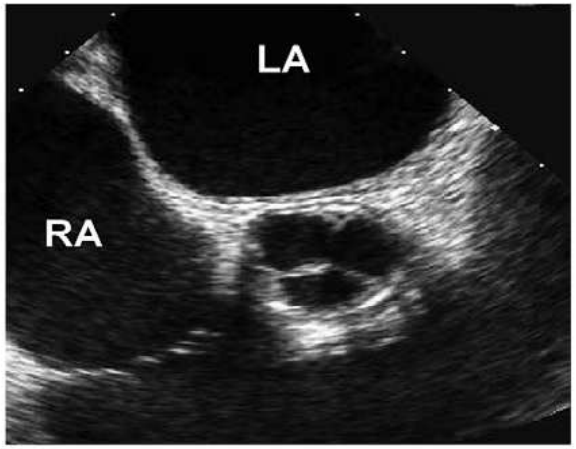
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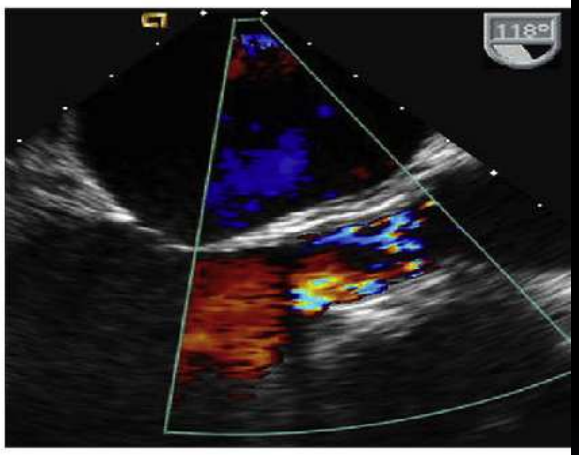
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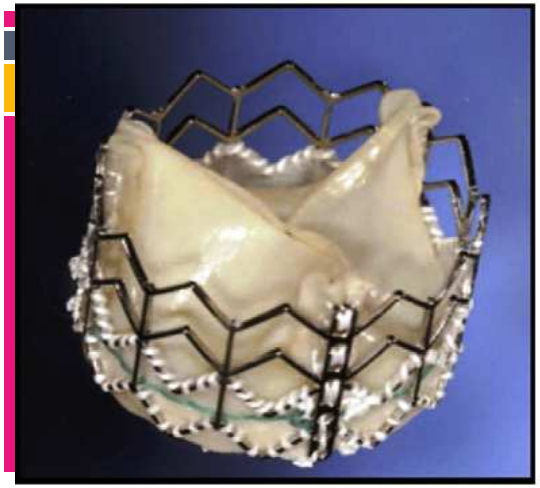

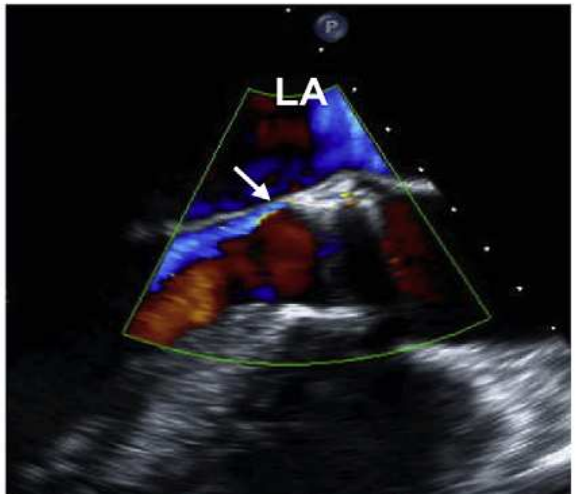
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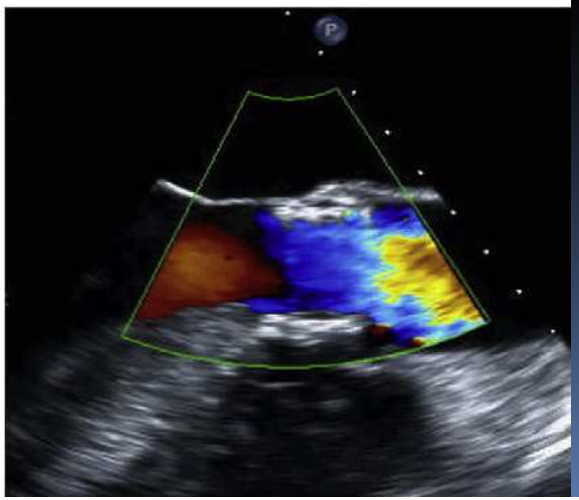


TYPES

- Examples of stented, stentless, and percutaneous biologic valves and their echocardiographic features in diastole (middle) and in systole (right) as seen by TEE. The stentless valve is inserted by the root inclusion technique. Mild perivalvular AR in the percutaneous valve is shown by arrow. The percutaneous biologic valve is currently for investigational use only.

NATURE OF TYPES

- By their design, almost all replacement valves are obstructive compared with normal native valves
- The degree of obstruction varies with the type and size of the valve.
- Thus, it may be difficult to differentiate obstructive hemodynamics due to valve design from those of mild obstruction observed with pathologic changes and from prosthesis-patient mismatch (PPM)

physiologic’’ regurgitation

- Most mechanical.V and many biologic.V are associated with trivial or mild transprosthetic regurgitation.
- The pattern of this“physiologic” regurgitation varies with the design of the replacement valve

TYPES

- There is no ideal valve, and all prosthetic valves are prone to dysfunction

Biologic . v

- -stented porcine and pericardial xenografts,
- -stentless porcine xenografts,
- -cadaveric homografts,
- -autografts (Ross procedure).

Biologic . v

- The most frequently implanted biologic valve is a stented xenograft.
- The valve may be an entire porcine valve or a composite from 2 or 3 individual pigs
- The cusps of stented pericardial xenografts are made from pericardium
- Usually, pericardium is bovine,but pericardium of other species has also been used

Biologic . v

- Stentless xenograft graft valves usually consist of a preparation of porcine aorta
- Homograft valves consist of cryopreserved human aortic or, less commonly, pulmonary valves.
- Stentless valves were introduced to increase the effective orifice area (EOA). It was also hoped that less stresses on the cusps & better durability and less thrombosis

SIZE

- Usually, the reported size of a prosthesis refers to the outer diameter of the valve ring, in millimeters .
- In a study comparing valve size as stated by the manufacturer against a modeled patient tissue annulus provided by machined polypropylene blocks, the patient "tissue annulus" diameter ranged from 3.5 mm smaller to 3.0 mm larger than the labeled size.

POSITION

- The various valve types can differ also by their implantation position relative to the valve annulus.
- This is mainly in the aortic site.
- Valve implantation can be intra-annular, partially supra-annular, or wholly supra-annular.
- The supra-annular position is designed to lift as much of the replacement valve above the annulus to maximize the orifice area available for flow.
- The maximum label size implantable may then be limited by the diameter of the aortic root or the position of the coronary ostia

Percutaneous valves

- Percutaneous valves have been implanted in the pulmonary and aortic positions

apicoaortic conduit

- This operation interposes a fabric conduit containing a bioprosthetic or mechanical valve between the LV apex and descending aorta. Postoperative evaluation focuses on evaluation of the apical cannula for absence of thrombus and adequate flow

2D

- Rocking motion of a replacement valve is almost invariably a sign of a large dehiscence in the aortic position.

For valves in the mitral position, however, retention of the posterior or both the anterior and posterior native leaflets can allow increased mobility of a normal prosthesis

pressure recovery

can occur in two regions:

- (1) downstream of a valve
- (2) within some prosthetic valves, typically bileaflet or caged-ball valves
- In the first scenario , as flow expands into the wider lumen beyond a valve, velocity and kinetic energy will decrease and pressure will be recovered

pressure recovery

- The pressure gradient measured directly by catheter therefore decreases as the catheter port is moved downstream from the prosthetic orifice and will generally be smaller than the gradient estimated from maximal CW Doppler velocity at the vena contracta the smallest area occupied by flow.
- The magnitude of this phenomenon is generally small, except in which the aorta is <30 mm in diameter, an infrequent finding in adults.

pressure recovery

- In the case of mechanical bileaflet prostheses the particular design of the valve may cause a separate phenomenon of pressure recovery at the level of the valve. This is may else be observed in caged-ball prostheses.

pressure recovery

- The smaller central orifice in bileaflet valves may give rise to a high-velocity jet that corresponds to a localized pressure drop that is largely recovered once the central flow reunites with flows originating from the two lateral orifices

pressure recovery

- CW Doppler recording often includes this high-velocity jet, which leads to overestimation of gradients and thus underestimation of EOA compared with the invasive hemodynamic standard, particularly in smallprostheses and in high flow states

PPM

- PPM occurs when the EOA of the prosthesis is too small in relation to the patient's body size, resulting in abnormally high postoperative.
- Gradients increase exponentially when the indexed EOA is < 0.8 to 0.9 cm2/m2
- PPM is considered to be hemodynamically : insignificant if the indexed EOA is > 0.85 cm2/m2, moderate if between 0.65 and 0.85 cm2/m2, severe if <0.65 cm2/m2

PPM

- The reported prevalence of moderate PPM varies between 20% and 70%,
- whereas that of severe PPM is between 2% and 11%.
- The main adverse clinical outcome ascribed to PPM is reduced short-term and long-term survival, particularly if associated with LV dysfunction

PPM

- There are some reports of lesser regression of LVH, increased incidence of late cardiac events, and less improvement in functional class, although other studies have found little effect .
- If PPMis anticipated, choosing an alternative prosthesis or considering aortic root enlargement surgery is advised

PPM

- PPM has also been described in the mitral position.
- It has been suggested that the indexed EOA of mitral prostheses should ideally be no less than 1.2 to 1.3 cm2/m2 to avoid abnormally high postoperative gradients

PPM

- Depending on the study, the reported prevalence for mitral PPM varies between 39% and 71% and was shown to be associated with persisting pulmonary hypertension and decreased long-term survival.

PPM

- Recent data suggest that PPM may not have similar detrimental effects in obese patients (body mass index > 30 kg/m2) compared with nonobese patients
- For similar body surface areas, obese
- patients tend to have lower cardiac output requirements.

DOPPLER

- It is not appropriate to use the PHT formula (220/PHT) to estimate orifice area in prosthetic valves .
- This is valid only for moderate or severe stenoses

  with orifice areas < 1.5 cm2. For larger valve areas, the pressure half-time reflects atrial and LV compliance characteristics and loading conditions and has no relation to valve area

DOPPLER

- Doppler recordings should be performed at a sweep speed of 100 mm/s.
- Measurements should be taken over 1 to 3 cycles in sinus rhythm.
- In atrial fibrillation, Doppler measurements should be performed when possible during periods of physiologic heart rate (65-85 beats/min).

DOPPLER

- Averaging from 5 to 15 beats in atrial fibrillation has been suggested but is cumbersome and may still give an unrepresentative result, because cycle lengths may vary substantially

REGURGITATION

- Two types of "physiologic" regurgitation may be seen: a closing volume (a displacement of blood caused by the motion of the occluder) and true trivial or mild regurgitation at the hinges of the occluder

REGURGITATION

- The bileaflet valves typically have multiple jets located just inside the sewing ring, where the closed leaflets meet the housing, and centrally, where the closed bileaflets meet each other.

- Regurgitation is increasingly reported in normal biologic valves, mainly because of increased sensitivity of current ultrasound machines. Stentless valves, including homografts and autografts, are more likely than stented valves to have minor regurgitant jets.

- Percutaneous aortic valves may have small central and/or paravalvular regurgitation

Pathologic regurgitation

Central or paravalvular

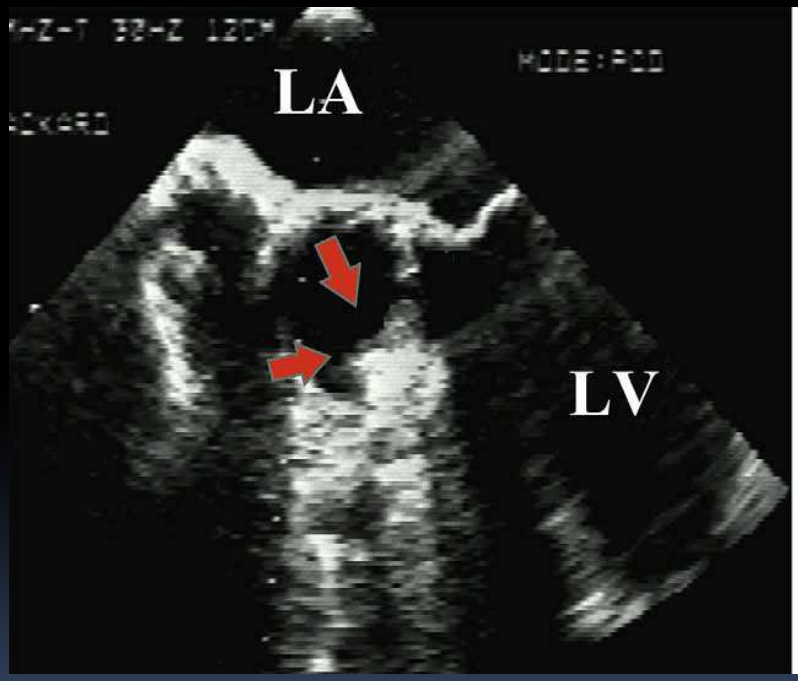
Most pathologic central valvular regurgitation is seen with biologic valves,

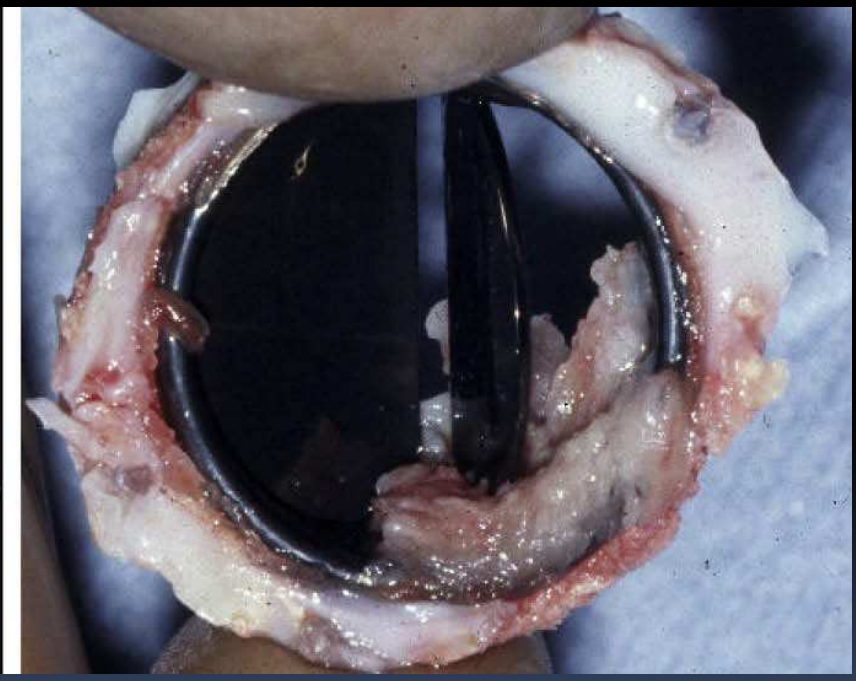
whereas paravalvular regurgitation is seen with either valve type and is frequently the site of regurgitation in mechanical valves

SMALL PARA.V.LEAK

- There is no evidence that they increase the risk for endocarditis, but on occasion, they may cause hemolytic anemia due to red cell destruction

PANNUS





AV

- High gradients may be seen with normally functioning valves with a small size, increased stroke volume, PPM, or valve obstruction.
- Conversely, a mildly elevated gradient in the setting of severe LV dysfunction may indicate significant stenosis

AV

- Recent data have shown that a cutoff of AT of 100 ms differentiates well between normal and stenotic prosthetic valves.

AV.DVI

- DVI is a dimensionless ratio of the proximal velocity in the LVOT to that of flow velocity through the prosthesis:
- DVI = V.LVOT / V.AV (VTI)
- DVI can therefore be helpful to screen for valve dysfunction, particularly when the cross-sectional area of the LVO tract cannot be obtained or valve size is not known.
- A DVI < 0.25 is highly suggestive of significant valve obstruction

DVI

- One must bear in mind that high velocity alone is not proof of intrinsic prosthetic obstruction and may be secondary to high flow or PPM .
-
- If the DVI is >0.25 and the jet shows early peaking of the velocity (AT < 100 ms),most likely, the valve is normal, particularly if the other quantitative parameters fall in the normal or intermediate Range .
- In this case, the high velocity is most likely because of high flow, PPM, or pressure recovery from a bileaflet or cagedball valve

AV

- Obstruction of the valve starts to be suspected when the DVI is <0.30 and is highly suggested if the DVI is <0.25 and the jet has a rounded contour, with late peaking of the velocity (AT > 100 ms) .
- In a normal DVI of >0.30 but a rounded contour and an AT > 100 ms, prosthetic stenosis should be considered, the reason for the elevated LVO velocity being either improper position of PW Doppler sample volume (too close to the valve, causing high velocity recording in the LVO) or subvalvular narrowing.

AV

- In the converse situation of a low DVI (<0.25) and a NI contour of the jet & an AT < 100 ms, an improper LVO velocity recording is most likely the situation (sample volume position too far apical from the prosthesis).

AV

- Starr Edwards *Caged ball*

BILEAFLET

- Carbomedics *Bileaflet*
- *ATS*
- Edwards Duromedics *Bileaflet*
- Edwards Mira *Bileaflet*
- St Jude Medical Regent *Bileaflet*

TILTING

- Bjork-Shiley (*Single tilting disc)*
- Monostrut Bjork-Shiley *Single tilting disc*
- Omniscience *Single tilting disc*

AV

BIOLOGIC :

- Baxter Perimount (*Stented bovine)*
- Biocor (*Stented porcine)*
- Extended Biocor (*Stentless)*
- Bioflo (*Stented bovine pericardial)*
- Carpentier Edwards Pericardial *Stented bovine pericardial*
- Carpentier Edwards Standard *Stented porcine*
- Cryolife (*Stentless)*
- Hancock (*Stented porcine)*
- Ionescu-Shiley *Stented bovine pericardial*
- Medtronic Mosaic *Stented porcine*
- Prima *Stentless*

MV

- As a general rule, however, a peak E velocity < 1.9 m/s is likely to be normal in most patients with mechanical valves unless there is markedly depressed LV function .
- If the peak velocity is >1.9 m/s in a mechanical valve, one should consider a normally functioning valve with a high velocity versus prosthetic valve dysfunction (stenosis or regurgitation) .
- This cutoff may be slightly higher in some bioprosthetic valves .

MV

- Because MR also increases transmitral flow velocity, patients with elevated peak E velocity may require TEE to exclude significant MR.

MV.MG

- Mean gradient is also useful in assessing prosthetic mitral valve function and is normally < 5 to 6 mm Hg .
- However, values up to 10 and 12 mm Hg have been reported in normally functioning Starr-Edwards and St Jude bileaflet prostheses, respectively, highlighting the need to compare serial values in the same patient over time

MV.MG

- High mean gradients may be due to hyperdynamic states, tachycardia or PPM, regurgitation, or stenosis.
- The mean gradient is significantly affected by heart rate, so the HR at which the MG is measured should always be reported

MV.PHT

- A large rise in PHT on serial studies or a markedly prolonged single measurement (>200 ms) may be a clue to the presence of prosthetic valve obstruction, because the pressure half-time seldom exceeds 130 ms across a normally functioning mitral valve prosthesis

DVI

- The VTI.MV/VTI.LVOT ratio would be elevated either in stenosis (increased velocity across the valve) or regurgitation (increased velocity across the valve and decreased velocity in the LVOT).
- In mechanical valves, a VTI.MV/VTILVOT < 2.2 is most often normal

MV

BILEAFLETS

- Carbomedics *Bileaflet*
- St Jude Medical *Bileaflet*
- On-X *Bileaflet*
- Duromedics *Bileaflet*

MV

TILTING

- Bjork-Shiley *Tilting disc*
- Bjork-Shiley monostrut *Tilting disc*
- Medtronic- Hall *Tilting disc*
- Omnicarbon *Tilting disc*

MV

BIO

- Biocor *Stentless bioprosthesis*
- Bioflo pericardial *Stented bioprosthesis*
- Carpentier- Edwards *Stented bioprosthesis*
- Hancock I & 2 *Stented bioprosthesis*
- Ionescu-Shiley *Stented bioprosthesis*
- Mitroflow *Stented bioprosthesis*

Findings suspicious for prosthetic pulmonary valve stenosis

- Cusp or leaflet thickening or immobility
- Narrowing of forward color map
- Peak velocity through the prosthesis > 3 m/s or >2 m/s through a homograft*
- Increase in peak velocity on serial studies†
- Impaired RV function or elevated RV systolic pressure

PV

- normal homografts have a peak velocity < 2.5 m/s (mean gradient < 15 mm Hg),
- and normal xenografts have a peak velocity < 3.2 m/s (mean gradient < 20 mm)

TV

- Obstruction is also suggested on CW Doppler by an E velocity > 1.7 m/s, mean gradient > 6 mm Hg, or pressure half-time > 230 ms

PROSTHETIC.VHD

CLASS I

A bioprosthesis is recommended in patients of **any age** for whom

1- anticoagulant therapy is contraindicated

2-cannot be managed appropriately

3-is not desired

PROSTHETIC.VHD

- Class IIa
- 1. A mechanical prosthesis is reasonable for AVR or MVR in patients less than 60 years of age who
- do not have a contraindication to anticoagulation
- 2. A BIOprosthesis is reasonable in patients more than 70 years of age
- 3. Either a bioprosthetic or mechanical valve is reasonable in patients between 60 - 70 years of age

PROSTHETIC.VHD

Class IIb

1. **AVR by a pulmonary autograft (the Ross procedure), when performed by an experienced surgeon, may be considered in young patients when VKA anticoagulation is contraindicated or undesirable**

MECHANICAL PROSTHETIC.VHD

WARFARIN + ASA(LIFE LONG)>>INR=2.5

INR = 3 IN:

1-MVR

2-AVR + AF/LOW LVEF/Hx OF TE

3- OLD VALVE,,CAGE BALL

BIO.PROSTHESIS

CLASS IIa

BIO.PROSTHESIS OR REPAIR

ASA LIFE LONG

WRAFARIN IN BIO.MVR or REPAIR FOR 3MO//INR=2.5

CLASS IIb

WARFARIN FOR BIO.AVR

ADITION OF PLAVIX TO ASA FOR 6 mo IN TAVI

Bridging Therapy for Prosthetic Valves

CLASS I

1-MINOR procedures (such as dental extractions or cataract removal) with LOW bleeding risk: Continuation of WARFARIN.

2-major surgery without bridging Tx in :

AVR WITH NO RF & BILEAFLET.V

3-bridging Tx IN MVR/AVR+RF/OLDER VALVE

Bridging Therapy for Prosthetic Valves

- **CLASS IIa**

1-FFP or PCC is reasonable with mechanical valves receiving WARFARIN IN emergency noncardiac invasive surgery

2-FFP or PCC in patients with mechanical valves and uncontrollable bleeding who require reversal of anticoagulation

Prosthetic Valve Thrombosis

TTE & TEE CLASS I

FLOUROSCOPY CLASS IIa

Class IIa

1.Fibrinolytic Tx for thrombosed L-sided prosthetic .V IF:

- recent onset (<14 days)
- FC I to II symptoms
- small thrombus (<0.8 cm2) otherwise SURGERY

2. Fibrinolytic therapy is reasonable for thrombosed right-sided prosthetic heart valves (FIRST OR AFTER HEPARIN Tx)

Prosthetic Valve Stenosis

- 1. Repeat valve replacement is indicated for severe & symptomatic prosthetic valve stenosis.

Prosthetic Valve Regurgitation

Class I

severe(trans or para) valvular regurgitation with intractable hemolysis or HF :Surgery

ClassIIa

Percutaneous repair of paravalvular regurgitation is reasonable in patients with prosthetic heart valves and intractable hemolysis or NYHA class III/IV HF who are at high risk for surgery and have anatomic features suitable for catheter-based therapy when performed in centers with expertise in the procedure

Prosthetic Valve Regurgitation

- **Class IIa**
- **1. Surgery for operable patients with severe sym or asymptomatic bioprosthetic regurgitation**

IE

A-2 TIMES B/C IN AT RISK PATIENTS WITH
unexplained fever for more than 48 hours or

newly diagnosed left-sided valve regurgitation

B-TEE is recommended in all patients with known or suspected IE when TTE is nondiagnostic,

when complications have developed or are clinically suspected, or when intracardiac device leads

are present

IE.Tx

Class IIa

1. It is reasonable to temporarily discontinue anticoagulation in patients with IE who develop CNS symptoms compatible with embolism or stroke regardless of the other indications for anticoagulation (AT THE TIME OF DIAGNOSIS OF IE IS CLASS IIb)

SURGERY FOR IE

- CLASS I

Early in patients with IE who present with:

- 1-valve dysfunction resulting in HF
- **2-left-sided IE caused by *Staph aureus*, *fungal* , *or* other highly resistant organisms**
- **3-IE complicated by heart block, annular or aortic abscess, or destructive penetrating lesions**
- **4-persistent bacteremia or fevers more than 5 to 7 days after onset of appropriate Tx**
- **6-Complete removal of PPM/ICD(leads and the generator) as part of the early management plan in documented DEVICE IE (WITHOUT DEVICE .INV/under V. surgery) IS CLASS IIa**

RECURENT IE

- prosthetic V.IE >>>Tx>>>Relapsing without other identifiable source for portal of infection>>>EARLY SURGERY is class I
- Early surgery in patients with IE with recurrent emboli and persistent vegetations despite appropriate antibiotic herapy>>>class IIa

IE

- Class IIb

1. Early surgery in patients with native V.IE WITH mobile vegetations greater than 10 mm in length (with or without clinical evidence of embolic phenomenon)

PREGNANCY

- II a

1-SEVERE MS+SYMPTOMATIC FC 3-4>>>PTMC

& FC 4 NOT SUITABLE FOR PTMC>>SURGERY

2-AVR IN SYMPTOMATIC FC 3-4&SEVERE AS

Prosthetic Valves in Pregnancy

1-WARFARIN in 1st trimester(DOSE<5mg) >>>IIa

2-Dose-adjusted continuous intravenous UFH & ENOXA in replace of W (if dose>5mg) in 1st trimester >>>IIa otherwise:

If W dose<5mg >>>>IIb

3-LMWH to pregnant patients with mechanical prostheses WITHOUT anti- Xa levels monitoring 4 to 6 hours after administration>>>III