Heart Valves: Before and after surgery

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Indications for intervention in Valvular disease

To prevent sudden death and preserve cardiac function

Decision is based on the risk of medical therapy weighed against the risk of operation
Indications for valve surgery - all valves lesions

- Symptoms (in the presence of definite severe valve disease)
- Having cardiac operation for other reasons with incidental moderate / more valve lesion
Mitral Regurgitation

• Onset of atrial fibrillation

• Repairable valve with severe MR

• ECHO parameters:
  – LV volume loading (ESD > 4-4.5cm)
  – LV dysfunction (EF <60%)
  – Pulmonary hypertension
Mitral Stenosis

• Onset of atrial fibrillation

• ECHO parameters
  – Focused on right heart
    • pulmonary hypertension
    • RV dysfunction
    • Worsening tricuspid regurgitation
Aortic Stenosis

• ECHO parameters:
  – Declining LV systolic function
  – Ascending aortic enlargement (bicuspid valve)
Aortic Regurgitation

• ECHO parameters
  – LV volume load (ESD >5-5.5cm / EDD 7.5)
  – LV systolic dysfunction (EF < 55%)
  – Aortic dilatation
Pre-op assessment

• Cardiac
  – Angiogram: CT vs Invasive
  – ECHO: Transthoracic vs transtoesophageal
  – MRI

• Non cardiac
  – Vascular ultrasound
  – Lung function
  – CT
Pre-op review

• Explain indications for surgery
  – Introduce concept of valve types

• Expected outcome
  – What to expect post op

• Potential complications

• Acknowledge emotional issues

• Planning
  – Family
  – Work
Mitral Valve Repair

• Preserves native valve issue
• Still have prosthetic material (valve ring)
• Durable

• Valve dysfunction
  – Recurrent MR
  – Valvular stenosis
When it comes to valve replacement the big question is: Tissue vs Mechanical.
Tissue Valve Replacements

I’ll be back
Tissue Valves

Pros

- Low profile – “more physiological”
- No need for anticoagulation
- Silent

Cons

- Limited shelf life
Valve Type - tissue

• Homograft
  – Ross procedure

• Stented valves
  – Mosaic – porcine
  – Bovine

• Stentless
  – Porcine
What Can Go Wrong With a Tissue Valve?

- Valve not sized correctly for patient
- Stenosis
- Regurgitation
  - Early
    - Valve not aligned correctly
    - Leak around the valve
  - Late
    - Degeneration of valve: Acute vs chronic
Clinical features

• Symptoms
• Signs – should not hear regurgitant murmurs
• Investigations – Haemolysis – Climbing BNP – ECHO
Valve Type Mechanical

• Ball and Cage
  – Starr-Edwards valve

• Single Leaflet Tilting Disc
  – Medtronic-Hall

• Bileaflet Tilting Disc
  – St Jude
  – ATS
  – Carbomedics
  – On-X
Mechanical Valves

Pros

- √ Durable

Cons

- X Intrinsically obstructive
- X Need for anticoagulation
- X Valve sounds
- X Risk of thromboembolism
What Can Go Wrong With a Mechanical Valve?

• Valve not sized correctly for patient

• Regurgitation
  – Paravalvular

• Mechanical failure
  – Fracture of supporting apparatus

• Thrombotic complications
  – In situ: valve obstruction – pannus
  – Valve dysfunction – leaflet dysfunction
  – Embolic event

• Bleeding complications
What to Expect from the Hospital

• Medication plan
  – Temporary medications
  – Anti-coagulation: range and duration

• Cardiac rehab

• Follow up
  – Clinical review
  – Bloods, ECG / CXR and ECHO
Early post op review

- Symptoms
- Pain control
- Psychosocial
- Medications review:
  - What is new and what is missing
- Signs
- Routine bloods:
  - Blood count, Renal function, Albumen, INR
Post Operative Complications

- Early
  - Arrhythmia, especially atrial fibrillation / flutter
  - Renal failure / ischaemic injury
  - Pre-existent LV dysfunction exacerbated / uncovered by surgery

- Pericardial irritation
  - Pericarditis
  - Pericardial effusion
  - Dressler / Post pericardotomy syndrome

- Cerebral
  - Stroke
  - Cognitive dysfunction

- Inflammatory
  - Endocarditis
  - Pulmonary embolism
  - Urinary / chest

- Nutritional
  - Renal failure / ischaemic injury
  - Malnutrition
  - Anaemia

- Pulmonary
  - Pleural effusion
  - Pulmonary embolism
Post Operative Complications (Late)

– Arrhythmia, especially atrial fibrillation / flutter

– Infection
  • Endocarditis: unexplained fever consider infective endocarditis and culture blood prior to empirical antibiotic Rx

– Heart Failure
  • Ventricular dysfunction – valvular cardiomyopathy
  • Prosthetic valve dysfunction

– Embolic risk
  • Atrial arrhythmias
  • Mechanical valve
  • Infection
<table>
<thead>
<tr>
<th></th>
<th>Annual event rates with warfarin[^{a,b}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major thromboembolism</td>
<td>1.2% - 1.9%</td>
</tr>
<tr>
<td>Major bleeding (chronic treatment)</td>
<td>1.6% - 2.5%</td>
</tr>
<tr>
<td>Major bleeding + CRNMB</td>
<td>6%</td>
</tr>
<tr>
<td>Valve thrombosis</td>
<td>0.1% - 0.3%</td>
</tr>
</tbody>
</table>

### Event Rates in Developed and Developing Countries

<table>
<thead>
<tr>
<th>Event</th>
<th>Developed countries (44,918 patient-years follow-up)</th>
<th>Developing countries (12,642 patient-years follow-up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thromboembolism</td>
<td>1.8% per patient-year</td>
<td>2.6% per patient-year</td>
</tr>
<tr>
<td>Prosthetic valve thrombosis</td>
<td>0.1% per patient-year</td>
<td>1.3% per patient-year</td>
</tr>
<tr>
<td>Bleeding</td>
<td>1.0% per patient-year</td>
<td>1.9% per patient-year</td>
</tr>
</tbody>
</table>

Higher event rates in developing countries than developed countries

<table>
<thead>
<tr>
<th>Valve Type</th>
<th>Mitral</th>
<th>Aortic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starr-Edwards</td>
<td>2.5 - 3.5</td>
<td>2.5 – 3.5</td>
</tr>
<tr>
<td>Single / bileaflet</td>
<td>2.5 - 3.5</td>
<td>2.0 - 3.0</td>
</tr>
</tbody>
</table>

Increase the range by 0.5 if

a) patient has embolic event when in target range
b) Other risk factors for embolic event: severe LA enlargement, LV dysfunction (EF <40%), AF
Mechanical Valves and Aspirin

- LV impairment
- 2 mechanical valves
- Atrial fibrillation
- Embolic event when INR therapeutic
- Acute vascular syndrome when on warfarin
Mechanical Valves and Stents

• Try and avoid Drug eluting stents

• Minimise length of “triple therapy”
  – Warfarin – try and avoid the highs
  – Aspirin
    • BMS at least 6 months
    • DES indefinite
  – Clopidogrel
    • BMS ideally at least 3 months
    • DES at least 6 months
Valve clinic

- Referral criteria:
  - **INCLUSION CRITERIA:**
    - After mechanical valve replacement
    - Some people with stable tissue valves
    - Warfarin/INR support
  - **EXCLUSION CRITERIA:**
    - Patients with unstable tissue valves
    - Multiple co-morbidities
    - Uncontrolled heart failure

- Getting to know each other
- Assessment and review for symptoms of valve dysfunction
- CVD Risk assessment and management (PREDICT)
- Warfarin knowledge and empowerment
- Endocarditis awareness
- Management including referral/Follow up or cardiologist review

- 30 minute slots
- 7 patients per clinic
- Waiting room assessments used
- Clinic nurses do ECG/BP/BMI
- NP prescribes
- Echocardiogram and follow up as per local guidelines
<table>
<thead>
<tr>
<th>Demographics and valve</th>
<th>RHD (n=90)</th>
<th>Non RHD (n=127)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>38%</td>
<td>72%</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Non European</td>
<td>82%</td>
<td>37%</td>
<td>&lt;.0001</td>
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<tr>
<td>Age (Mean ± SD)</td>
<td>46.4 ± 16.0</td>
<td>65.0 ± 13.1</td>
<td>&lt;.0001</td>
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<tr>
<td><strong>Aortic valve</strong> (n=148)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical</td>
<td>44%</td>
<td>32%</td>
<td>0.0002</td>
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<tr>
<td>Tissue/repair</td>
<td>16%</td>
<td>43%</td>
<td></td>
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<tr>
<td><strong>Mitral valve</strong> (n=104)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical</td>
<td>66%</td>
<td>15%</td>
<td>&lt;.0001</td>
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<tr>
<td>Tissue/repair</td>
<td>8%</td>
<td>15%</td>
<td></td>
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<tr>
<td><strong>Tricuspid valve</strong> (n=31)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical</td>
<td>1%</td>
<td>0</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Tissue/repair</td>
<td>13%</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>Redo surgery</td>
<td>37%</td>
<td>9%</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Risk factors</td>
<td>RHD (n=90)</td>
<td>Non RHD (n=127)</td>
<td>P value</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------</td>
<td>-----------------</td>
<td>---------</td>
</tr>
<tr>
<td>AF</td>
<td>39 (43.3)</td>
<td>26 (20.5)</td>
<td>0.0003</td>
</tr>
<tr>
<td>Type 2 DM</td>
<td>11 (12.2)</td>
<td>33 (26.0)</td>
<td>0.01</td>
</tr>
<tr>
<td>Current smoker</td>
<td>20 (22.2)</td>
<td>12 (9.4)</td>
<td>0.009</td>
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<tr>
<td>SBP (Mean ± SD)</td>
<td>126.9 ± 16.1</td>
<td>134.4 ± 18.7</td>
<td>0.004</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>2.67 ± 0.91</td>
<td>2.48 ± 1.01</td>
<td>0.09</td>
</tr>
<tr>
<td>Weight gain</td>
<td>n=58 (65%)</td>
<td>n=70 (55%)</td>
<td>0.0033</td>
</tr>
<tr>
<td>n=58 (65%)</td>
<td>10.88 ± 10.50</td>
<td>6.42 ± 6.73</td>
<td></td>
</tr>
<tr>
<td>BMI (Mean ± SD)</td>
<td>32.0 ± 7.7</td>
<td>29.6 ± 6.2</td>
<td>0.02</td>
</tr>
</tbody>
</table>
Exercise and Prosthetic Valves

- Good LV function
- No prosthetic valve obstruction
- No significant pulmonary hypertension
- No issues with Viagra
Pregnancy and Prosthetic Valves

- Try and avoid mechanical valves in women of child bearing age
- Warfarin teratogenicity (+ other agents)
- Transition to low molecular weight heparin
  - Increased thrombotic risk
  - Early identification of pregnancy
- Deliver in centre with cardiac experience
Driving and Valve Surgery

Medical standards for individuals applying for or renewing a class 2, 3, 4 or 5 licence and/or a P, V, I or O endorsement

When driving may resume or may occur

An individual may be fit to drive if there is only mild valvular disease of no haemodynamic significance, and there are no conditions that would otherwise render the individual unfit to drive.

An individual may be fit to drive three months after successful valve surgery, if there is no evidence of valvular dysfunction and there are no electrocardiographic changes, symptoms, arrhythmias, cardiac failure, poorly controlled anticoagulant therapy (see section 3.6), severe hypertension or other conditions that would render the individual unfit to drive. Specialist assessment should be undertaken before driving can resume. The Agency may impose licence conditions for regular medical assessment, eg annual cardiologist review.

- other conditions that would render the individual unfit to drive
- there is no sternotomy or other pain that would interfere with driving.
Endocarditis Prevention

- Good dental care
Endocarditis Risk

• Early
  – Generally a complication of surgery

• Late
  – Follow typical bacteriological pattern
  – Tissue valves – leaflet infection
  – Mechanical valves – valve support structures
Endocarditis Diagnosis

• High index of suspicion
  – Persistent febrile illness, malaise, lethargy
  – New regurgitant murmur
  – Embolic event

• Blood cultures (at least 2 sets, ideally 3 over 1 hour) pre any empirical antibiotic therapy
Rheumatic Fever Prevention

- Penicillin Prophylaxis
  - At least until 10 years after the last episode of rheumatic fever / until the age of 30 – or until the youngest child is past early school age
  - Ideally indefinitely
  - Prompt assessment of sore throat: swab and Rx
Is There an Alternative to a Surgically Placed Valve

• Mitral valve:
  – Balloon mitral valvuloplasty
  – Mitral valve clip

• Aortic valve:
  – Balloon aortic valvuloplasty
  – Transcatheter Aortic Valve Implantation (TAVI)
TAVI

- Non surgical candidate
- High risk (>10% risk)
  - Increased
    - Risk stroke
    - Vascular complications
PHV delivery within the native calcific valve