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Different surgical techniques for the management of small aortic annulus in patients with rheumatic aortic stenosis

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ABSTRACT

Background: Rheumatic Heart Disease (RHD) may cause aortic valve stenosis and with small aortic annuli, using small aortic valve prothesis can lead to Prosthesis-Patient Mismatch (PPM). Aortic root enlargement (ARE) techniques, such as Nicks, Manouguian, and Konno–Rastan, allow for using larger prosthetic valves, improving hemodynamics and patient outcomes.

Aim: To evaluate surgical techniques for managing small aortic annuli in rheumatic aortic stenosis.

Keywords: *Rheumatic Heart Disease, aortic annuli, Aortic root enlargement.*

1. INTRODUCTION

Cardiovascular diseases (CVD) remain the top cause of mortality in both industrialized and developing nations, despite advancements in healthcare (1). Heart valve damage caused by an immune system overreaction to group A streptococcal pharyngitis is known as rheumatic heart valve disease (RHVD), a major consequence of acute rheumatic fever. Rheumatic heart valve diseases (RHVDs) primarily impact women and are among the top causes of cardiovascular death in children and young adults in low- and middle-income nations. Damage to the valve's structure from chronic inflammation and fibrosis is what ultimately leads to the valve's inability to operate (2).

Rheumatic fever and congenital bicuspid aortic valve are the two most common causes of aortic stenosis (AS), a common valvular disease. About 1% to 2% of people are affected by it (3).

Dyspnea, chest pain, and heart failure develop slowly after 10–20 years in rheumatic AS. Due to poor prognosis, severe symptomatic patients require aortic valve replacement early. Prescence of small aortic annulus complicates disease (4).

When it comes to treating individuals with sever aortic valvular stenosis, surgical heart valve replacement is a safe, well-established, and successful choice. There is a lower chance of death associated with the surgery (5).

Using Nicks-Nuñez or Rittenhouse-Manouguian procedures, aortic root expansion enables bigger prosthetic valve insertion and reduces mismatch risk. Konno-Rastan procedure, is used mostly in youngsters, tackles subaortic stenosis but increases root size most. Other ways to overcome small aortic annulus are supra-annular valve implantation and developing regent valves optimize prosthesis placement (6).

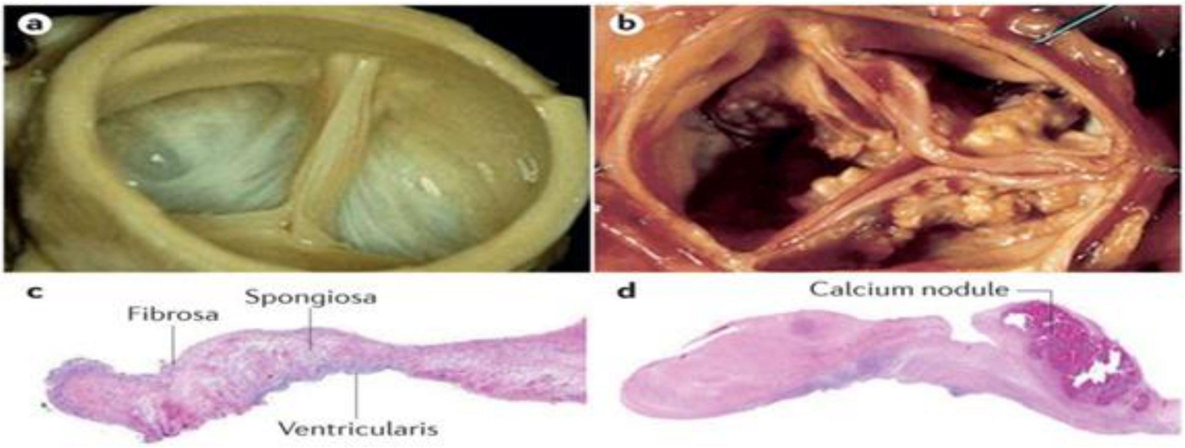

Figure 1: Macroscopic and histopathologic appearance of normal and abnormal aortic valves (7)

2. Anatomy of the Aortic Valve

The semilunar aortic valve connects the aorta to the left ventricular outflow tract by three leaflets that are attached to their respective sinuses. When the leaflets converge at fibrous zones, also known as commisures, a structure resembling a crown is produced. The sinotubular junction connects aortic sinuses to the ascending aorta. The coronary sinuses (the sinuses of Valsalva) also enable the leaflets to retract during systole and keep the coronary flow unimpeded during diastle (8).

Aortic Valve Components

Annulus

In addition to anchoring the valve leaflets, it forms the semilunar crown. The annulus and the mitral valve are joined by the left fibrous trigone (9).

Leaflets and Commissures

Each of the three cusps—the right, left, and non-coronary ones—is named for the sinuses that sit above it. There is adequate closure provided by the Arantius nodules located in the free edge centers, and there is some overlap between the lunulae at the leaflet edges. Commissures formed by radial collagen fibers, they fasten the leaflets to the aorta's interior and exterior (10).

Interleaflet Triangles

Situated between the sinuses, which separate the cardiac interior from its exterior, are three fibrous triangles. The first is a right-angled triangle produced by meeting of the right and left coronary sinuses, which is connected to the right ventricular outflow tract. The second fibrous triangle that connects the leaflets lies between the right coronary sinus and the non-coronary sinus, here the bundle of His enters the heart via the ventricular septum, its proximity to the septum and orientation toward the right atrium are notable. The third triangle lies at the intersection of the left and non-coronary sinuses. Straight ahead, it meets the mitral valve's aortic leaflet(11).

Coronary Anatomy

The left main coronary artery (LMCA) begins in the left sinus of Valsalva and branches out into the left anterior descending artery and the circumflex artery. The RCA, which supplies blood to the right side of the heart, begins in the posterior section of the right coronary sinus. The RCA gives two branches of the posrerolateral artery (PL) and the posterior descending artery (PDA).where the PDA is coming from aids in determining coronary dominance (12).

Muscles

In contrast to the mitral valve, which uses the papillary muscles to link to the heart muscle, the aortic valve uses the annulus (13).

Physiology and Pathology of the Aortic Valve

Both the systolic and diastolic blood flow from the left ventricle are controlled by the aortic valve. When the heart contracts, it pushes leaflets into the sinuses; when the pressure in the ventricles drops below the pressure in the aorta, the valve closes, letting blood flow to the coronaries during diastole. Valve dysfunctions are primarily stenosis or insufficiency. AS which results from a smaller valve opening, raises the strain on the ventricles, whereas insufficiency raises the end-diastolic volume and wall stress in the left ventricle (14).

Rheumatic Aortic Stenosis (RAS)

The chronic inflammation and damage to the leaflets caused by recurrent Streptococcus pyogenes infections lead to RAS. The leaflets of the affected valve become swollen, fibrotic, with deposits of heavy calcification and commissural fusion. Signs of severe aortic stenosis are reduced systolic and diastolic function, a smaller stroke volume, and hypertrophied left ventricles. If untreated, severe aortic stenosis can cause death (15).

3. Clinical Presentation

Symptoms of RAS, which include dyspnea, chest pain and syncope, might go undetected for 10–20 years. With disease progression diastolic dysfunction or heart failure causes sever dyspnea, and syncope. Exertion triggers angina in RAS, but rest alleviates it (16)

Diagnostic Modalities

Echocardiography

Echocardiography is considered the most reliable method for detecting cusp calcification, thickness, and restricted motion. For AS to be considered severe, the aortic valve velocity and mean gradient must both be 4 m/s or above. When the situation gets more complex, other cutting-edge imaging techniques like CT and MRI are used in addition to echocardiography (17).

Cardiac Computed Tomography (CT)

Aortic stenosis (AS) examination frequently involves cardiac CT as an adjunct to echocardiography. Valve morphology, geometric orifice area by planimetry, left ventricular (LV) volumes, and ascending aorta dimensions can all be accurately assessed with CT, even though it does not offer hemodynamic data. Also, it measures the amount of calcification, which is useful for identifying "porcelain" aortas (18).

Cardiac Magnetic Resonance (CMR)

The structural magnetic resonance imaging (SMR) can detect AS by using contrast-enhanced blood sequences that show turbulence in the ascending aorta and left ventricular outflow tract (LVOT) (19). Among CMR's many advantages is its velocity-encoded contrast imaging (VENC) capability. It makes it possible to use the Bernoulli equation ($4V^2$) to find the peak transaortic velocity and the instantaneous gradient. When it comes to comparing subvalvular and supravalvular stenosis, as well as left ventricular mass, volume, systolic and diastolic function, in-plane velocity mapping is still considered the gold standard (20).

Given that CMR scans the entire aorta, it is useful in situations where echocardiographic imaging is inadequate, such as with bicuspid aortic valves. Late gadolinium enhancement in cardiac magnetic resonance imaging (CMR) can detect cardiac fibrosis, a disease with unfavorable clinical consequences (20).

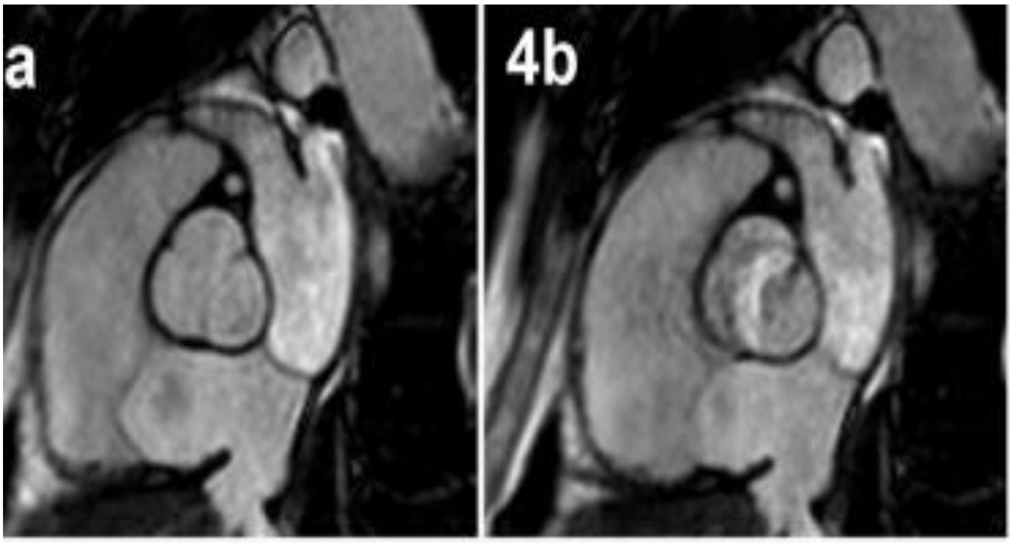

Figure 2: Cardiac magnetic resonance imaging of a bicuspid aortic valve in diastole (A) and systole (B). Turbulence through the aortic valve is seen as white (21).

Management of Aortic Stenosis

The gold standard for treating adult AS is aortic valve replacement (AVR), which can be done either surgically or percutaneously. The best choice after symptoms appear is surgical replacement. It is possible to offer short-term symptom alleviation with percutaneous aortic balloon valvuloplasty for individuals who do not meet the criteria for AVR. A balloon valvotomy or surgical procedure is available for children with bicuspid valves (22).

Medical Management of Symptomatic Severe AS

General Measures

While there is no specific medical therapy for AS, symptom management and comorbidity control are essential:

1. Limit physical activity, especially in frail patients.
2. Restrict sodium intake to 2 g/day.
3. Avoid medications causing hypotension or dehydration, as AS patients are "afterload fixed and preload dependent."
4. Prevent hyperhydration to reduce acute heart failure risk.
5. Endocarditis prophylaxis is recommended only for those with prior infectious endocarditis.
6. Screen and treat coronary artery disease appropriately (23).

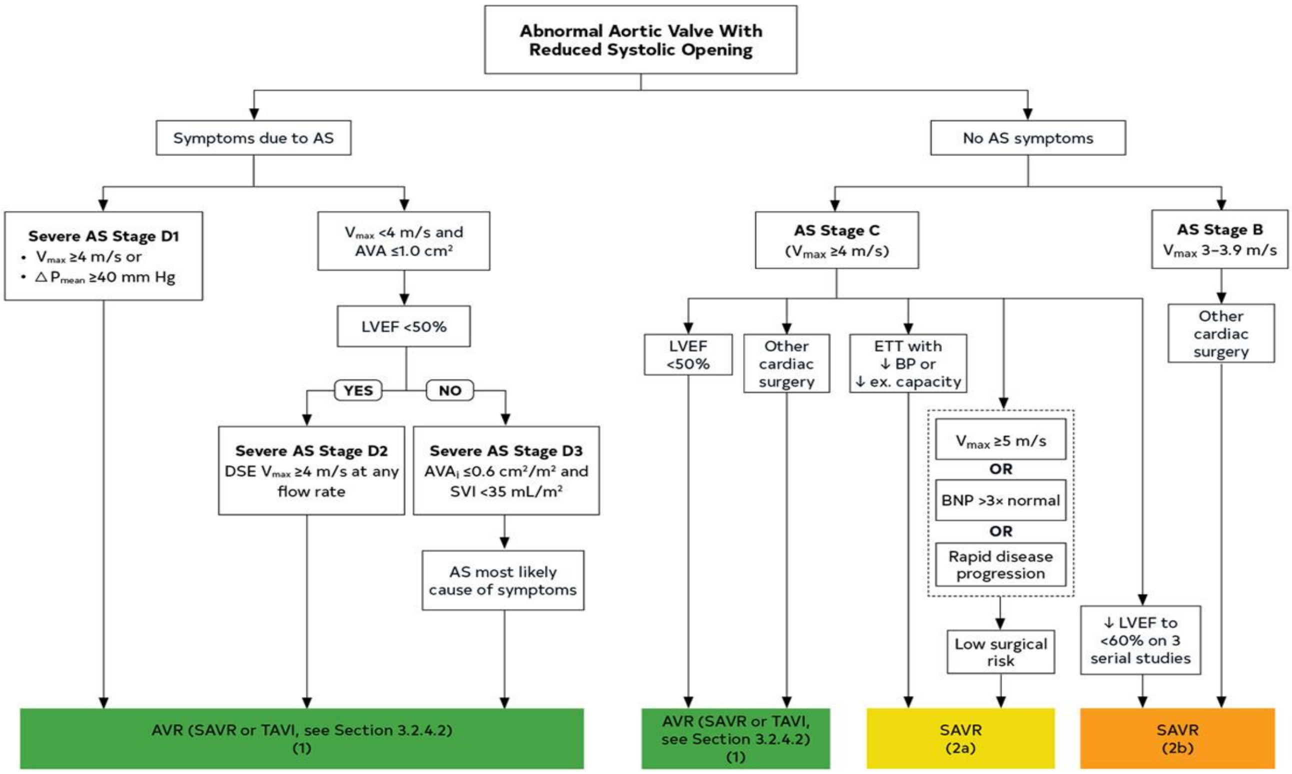

Figure 3: Timing of intervention for AS. Arrows show the decision pathways that result in a recommendation for AVR (23).

2021 American Heart Association guidelines for aortic valve stenosis. Clinical practice guidelines.

Table 1: Indication for surgery (23).

COR	LOE	Recommendations
1	A	Persons with severe high gradient AS (Stage D1) who visually or by exercise test demonstrate indications of exertional dyspnea, HF, angina, syncope, or presyncope should be administered anti-ventricular resuscitation (AVR).
1	B-NR	Patients with severe AS who do not have symptoms and have a left ventricular ejection fraction (LVEF) below 50% (Stage C2) are advised to undergo arrhythmogenesis.
1	B-NR	Individuals with severe AS (Stage C1) who are undergoing cardiac surgery for another reason and do not have any symptoms should have AVR.
1	B-NR	Stage D2 patients with symptoms of severe AS and low-flow, low-gradient cardiac failure are candidates for AVR.
1	B-NR	When LVEF is normal (Stage D3) and the patient is experiencing symptoms, AVR should be considered if the patient has severe AS with low flow and low gradient and is likely to be the cause of their symptoms.
2a	B-NR	In patients with severe AS (Stage C1) who do not exhibit any symptoms and pose little risk to surgery, AVR is recommended when an exercise test reveals a reduced exercise tolerance (adjusted for age and sex) or a fall in systolic blood pressure of at least 10 mmHg between baseline and peak exercise.
2a	B-R	Patients with very severe AS (defined as an aortic velocity of 5 m/s or above) who are asymptomatic and have a minimal surgical risk may be candidates for AVR.
2a	B-NR	If a patient's serum B-type natriuretic peptide (BNP) level is greater than three times the typical amount, they may be considered for AVR if they have severe AS (Stage C1), no symptoms, and are not a surgical risk.
2a	B-NR	It is permissible to ablate the valve (AVR) in asymptomatic persons with high-gradient severe AS (Stage C1) and low surgical risk if the aortic velocity increases by 0.3 m/s per year or more.
2b	B-NR	When left ventricular ejection fraction (LVEF) decreases to 60% or below on three separate imaging studies, asymptomatic patients with severe high gradient AS (Stage C1) may be candidates for AVR.
2b	C-EO	Individuals undergoing cardiac surgery for reasons other than stage B AS and with moderate AS may be good candidates for AVR.

2021 ESC/EACTS Guidelines for the treatment of aortic valve stenosis—the European Society for Cardio-Thoracic Surgery

Table 2: Proposed interventional indications for symptomatic (A) and asymptomatic (B) aortic stenosis, as well as the optimal interventional technique (C) (24).

Condition	Recommendation	Class	Level
A) Symptomatic aortic stenosis			
Symptomatic severe high-gradient aortic stenosis	Patients with severe, high-gradient aortic stenosis (mean gradient >40 mmHg, peak velocity >4.0 m/s, valve area <1.0 cmµ) should be treated with intervention when they undergo symptoms.	I	B
Symptomatic severe low-flow aortic stenosis	It should be considered to intervene in patients who are having symptoms and have severe low-flow aortic stenosis (SVi <35 mL/m²), low-gradient stenosis (<40 mmHg), reduced EF (<50%), and evidence of flow reserve (contractile reserve).		
Low-gradient aortic stenosis with normal EF	Individuals experiencing symptoms due to low-flow, low-gradient (<40 mmHg) aortic stenosis and normal EF should undergo thorough severity assessment prior to contemplating intervention.	IIa	C
Low-gradient AS with reduced EF without contractile reserve	Patients experiencing symptoms such as severe AS, reduced EF without flow reserve, low-flow symptoms, or low-gradient symptoms should undergo evaluation for potential management. When the severity of the AS is confirmed by CCT calcium grading, this becomes even more evident.		
Severe comorbidities	Because of the little likelihood that intervention will enhance patients' quality of life or raise their survival rate by more than a year, it is not recommended that patients with major co-morbidities undertake treatment.	III	C
B) Asymptomatic patient with severe aortic stenosis			
Severe aortic stenosis with systolic LV dysfunction	Patients without symptoms but with significant aortic stenosis and systolic left ventricular failure (LVEF <50%) should be intervened in if no other reason is found.	I	B
Severe aortic stenosis with symptoms during exercise testing	It is important to intervene when patients with severe aortic stenosis who do not exhibit symptoms do so during activity testing.	I	C
Severe aortic stenosis with LV dysfunction (LVEF <55%)	Intervention should be explored for patients without symptoms who have significant aortic stenosis and systolic left ventricular failure (LVEF <55%), unless there is another explanation.	IIa	B
Asymptomatic patients with LVEF >55% and normal exercise test	Intervention should be considered if even a little procedural risk is associated with one of these signs:		
- Very severe aortic stenosis	Mean gradient ≥60 mmHg or Vmax >5 m/s.		
- Severe valve calcification	An ideal evaluation of CCT would reveal a yearly Vmax advancement of 0.3 m/s or more		
- Markedly elevated BNP levels	(normal range adjusted for age and sex) > 3 verified by several measures and refusing to accept alternative explanations.		
Severe aortic stenosis with fall in BP during exercise	Patients with major aortic stenosis do not experience any symptoms but who experience a sustained decrease in blood pressure (>20 mmHg) when exercising warrant evaluation for potential intervention.	IIa	C
C) Mode of intervention			
Aortic valve interventions	Perform all procedures at Heart Valve Centers staffed by highly trained professionals who have access to up-to-date information on the best practices in interventional cardiology, cardiac surgery, and teamwork.	I	C
Choice between surgical and transcatheter intervention	The Heart Team must thoroughly assess the clinical, anatomical, and procedural aspects in order to make this determination. The patient should be involved in the discussion of the recommendation.		
SAVR for younger	This suggestion might be investigated for patients who have a low	I	B

patients (<75 years)	surgical risk (STS-PROM/EuroSCORE II <4%) or who are operable but do not meet the criteria for transfemoral TAVI.		
SAVR or TAVI for remaining patients	Based on specific anatomical, clinical, and procedural features of the patient, it is suggested.		
TAVI for older patients (≥75 years)	Administered to patients who do not meet the criteria for surgery or who pose a high risk of complications (STS-PROM/EuroSCORE II > 8%).	I	A
Non-transfemoral TAVI	Potential candidates include those who are unable to undergo surgery or who do not meet the criteria for transfemoral TAVI.	IIb	C
Balloon aortic valvotomy	Patients requiring a high-risk NCS immediately because hemodynamic instability or severe aortic stenosis may benefit from this procedure as a stepping stone to TAVI or SAVR.		
D) Other cardiac or ascending aorta procedures performed simultaneously with aortic valve surgery			
Severe aortic stenosis with CABG or ascending aorta surgery	Patients with significant aortic stenosis should undergo surgical surgery with aortic valve replacement before coronary artery bypass grafting (CABG) or any other valve procedure.	I	C
Moderate aortic stenosis with CABG or ascending aorta surgery	After discussing it amongst themselves, the Heart Team has decided that patients with mild aortic stenosis who are undergoing CABG or surgery on the ascending aorta or another valve should be assessed for SAVR.	IIa	C

1. If a patient has significant high gradient AS symptoms and there is little danger of the procedure causing complications, AVR can improve their symptoms, LV function, and mortality. When treated promptly, no symptoms will worsen. The surgical and TAVI outcomes for patients with severe AS and a low risk of comorbidities were excellent (25).

2. There is a risk of less than 1% of unexpected death per year for asymptomatic severe AS patients with normal LV function. The survival rate is equivalent to that of age-matched controls. Particularly for patients with low LVEF due to afterload mismatch, AVR improves survival (26).

3. Symptoms are anticipated to appear in 2-5 years for individuals with an aortic velocity of ≥4.0 m/s or a mean gradient of ≥40 mm Hg, as the disease progresses in nearly all cases with severe asymptomatic AS. There is a higher risk of reoperation within 5 years compared to the risk of AVR for other cardiac procedures (27).

4. A higher mean pressure gradient is a greater predictor of successful AVR. Despite the poor results seen in severe low gradient AS, AVR outperforms medicinal treatment, particularly in patients with low LVEF and contractile reserve (28).

5. In cases of severe AS with low flow and low gradient and normal left ventricular ejection fraction (LVEF), a complete evaluation is required because calcification is a common cause of this condition. Despite the worse survival rate with TAVI, AVR improves stroke volume and overall survival as compared to conventional treatment (29).

4. Aortic Valve Replacement Surgery
5.

(A) Conventional Aortic Valve Surgery

Surgical Approach: The patient is placed on their back while the surgeon performs a thorough median sternotomy. After making the incision, a sternal retractor is inserted to sufficiently expand the sternum (30).

Cardiopulmonary Bypass and Valve Exposure: Aortic and two stage venous cannulas are inserted into the heart to allow for bypass after the pericardium is opened. The use of an antegrade cardioplegic solution and the insertion of a left ventricular vent are standard procedures for keeping the field dry. The right coronary artery's origin lies 1.5 cm below the site of the transverse aortotomy. In order to see the valve, the aorta is cut in half, but the back part remains. The calcium from the annulus is removed and the valve leaflets are removed. The suture bundles (braided 2-0 sutures) are taken carefully through the annulus and inserted into the sewing ring. Prior to suturing the right and non-coronary cusps, the left coronary cusp is bound. Before closing the aortotomy with two layers of polypropylene sutures, the valve's leaflet motion is examined and the opening of coronary ostia are examined carefully (31).

(B) New Minimally Invasive Techniques

A minimal access technique that involves a right parasternal incision was first introduced by Cosgrove and Sabik in 1996. Different methods exist, with limited upper sternotomy (LUS) emerging as the most effective, alongside transverse sternotomy and minimal right thoracotomy (32).

Intra-operative TOE: Even for minimally invasive aortic valve surgeries, transesophageal echocardiography (TOE) is an absolute must:

- Correct placement of the double-stage femoral venous cannula for optimal venous drainage.
- Monitoring left ventricular distension during antegrade cardioplegia delivery.
- Air removal following aortic cross-clamp release.
- Assisting the weaning process from cardiopulmonary bypass (32).

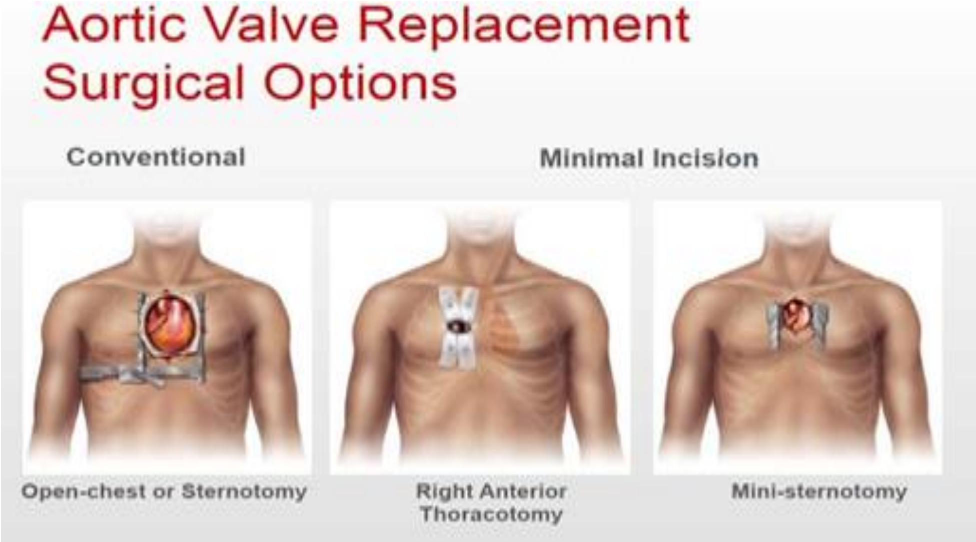

Figure 4: Skin incision in traditional sternotomy, limited upper sternotomy and right mini-thoracotomy (33)

Limited Upper Sternotomy (LUS)

The inverted 'J' technique is the frequently used limited access for aortic valve surgery since it's equally safe and effective as the traditional sternotomy approach.The ability to keep the internal mammary arteries intact and, if necessary, proceed to a complete sternotomy are two advantages (32).

Right Mini-Thoracotomy

In this procedure, an incision measuring 5 to 6 centimeters is created starting from the right side of the sternum and continuing all the way through the second or third intercostal region. Quicker healing and return to normal activities are possible outcomes due to less discomfort and fewer problems compared to conventional AV surgery. Quicker patient discharge is achieved easily (34).

6. Aortic Root Enlargement Techniques

The Nicks Procedure

The earliest recorded cases of aortotomy extension into a non-coronary sinus and annulus widening via patch repair date go back to 1970. An autologous or bovine pericardium teardrop-shaped portion is sutured into place using a 4-0 polypropylene suture . After positioning the valve prosthesis supra-annularly, 2-0 pledgeted mattress sutures are used for suturing. Particularly with bileaflet mechanical prostheses, leaflet motion must be closely inspected (35).

The Manouguian Technique

This technique, which has been around since 1979, involves potentially accessing the anterior mitral leaflet through the commissure between the left- and non-coronary sinuses by extending the aortotomy. One risk of the surgery is mitral regurgitation, which can happen because the anterior mitral leaflet patching (36).

The Konno-Rastan Procedure

In 1975, physicians reported a difficult procedure that involves expanding the right ventricular outflow system and making a longitudinal incision across the aorta and interventricular septum. Right coronary artery and cardiac conduction system injury are among the risks that can arise from a procedure that is both complex and requires a double-patch repair. However, the Konno-Rastan technique allows for three or four sizes of further augmentation, whereas the Nicks and Manouguian procedures only allow for one size. Still, the Nicks technique's widespread use and relative ease of learning make it the clear favorite (37).

7. Freestyle Stentless Bioprosthetic Aortic Valve Replacement

Freestyle stentless bioprosthetic valves are ideal for small aortic annuli and have great hemodynamic performance overall, making them suitable for a range of root disorders. With its versatile implantation capabilities and flexible stitching ring, it is ideal for cases with infective endocarditis or reoperation. This prosthesis has demonstrated mid- and long-term survival rate according to multiple follow-up studies (38).

Implantation Techniques

Freestyle aortic root bioprostheses, made from swine tissue, have three different methods of implantation:

1. Subcoronary valve replacement (removing the graft sinus aorta),
2. Cylinder with the sinotubular junction intact (root inclusion),
3. Complete aortic root replacement.

Subcoronary Implantation Considerations

The choice of technique depends on the surgeon's preference and the pathology encountered.

For most surgeons, the subcoronary technique is employed. Fitting the outflow suture layer becomes extremely problematic in circumstances when the aortic root is dilated due to long-standing aortic stenosis. This is especially true when there are variances in the locations of the coronary ostia . Coronary malperfusion can happen after surgery, particularly if the coronary ostia are ligated, injured, or torsioned. The exact frequency of coronary ostial problems is unknown (39).

Transcatheter Aortic Valve Implantation (TAVI)

In elderly patients, the hazards may outweigh the advantages of surgical aortic valve replacement (SAVR). Numerous studies have indicated that TAVI is preferable to medical therapy in inoperable patients and non-inferior to SAVR since the first percutaneous TAVI was performed by Alain Criblier in 2004. Older adults suffering from AS can greatly benefit from TAVI because it is safer than SAVR. The current guidelines recommend TAVI when the Heart Team decides that a patient with symptomatic AS isn't a good fit for SAVR. Considerations such as aortic annulus size, coronary ostial closeness, substantial valve calcification, bicuspid aortic valve, or unfavorable vascular access make TAVI a challenging procedure to perform in cases where SAVR is recommended, increasing the risk of major surgical complications like thrombosis or aneurysm (40).

Table 3 : Favouring indications for both SAVR and TAVR (41).

Favours SAVR	Favours TAVR
Younger age	Older age
Bicuspid aortic valve	Redo surgery
Femoral access unfavourable	Frailty
Low coronary ostia	High surgical risk
Multivessel CAD	Femoral access available
Aortopathy requiring intervention	Chest radiation
Concomitant significant valvulopathy	Porcelain aorta

Emergency Balloon Aortic Dilatation

Balloon aortic valvuloplasty (BAV) can serve as a bridge between transcatheter aortic valve implantation (TAVI) and surgical aortic valve replacement (SAVR) for patients who have decompensated aortic stenosis or who require urgent high-risk non-cardiac surgery (NCS). Nevertheless, due to the substantial dangers involved, the treatment should not be carried out without first consulting with the Heart team (42).

8. Complications After Aortic Valve Replacement

Despite advancements, complications post-aortic valve replacement remain significant.

9. *Early complications include:

- Coronary artery occlusion due to valve implant-induced obstruction (43).
- Embolic events with an incidence of 3.6-6% within the first 3 months, decreasing to 0.7-1.0% long-term (43).
- Mediastinitis and sternal osteomyelitis which affect 1-3 percent of patients and result in a 29% death rate. Whatever the case may be, it's an uncommon but dangerous issue. Obesity, COPD, advanced age, PVD, reoperation, long operation duration, low cardiac output, prolonged breathing time, and re-exploration for bleeding are all factors that individuals often cite as potential causes of problems (44).

- Acute kidney injury (AKI) is a known complication having a rare incidence but must be considered with serious sequel if happened (45).

10. *Late complications include:

- Prosthetic valve endocarditis more common in late post-operative stages with streptococci as the causative agent (46).
- Obstruction from thrombosis or pannus leading to dyspnea, heart failure, or systemic embolization (47).
- Valve dehiscence often caused by endocarditis or severe valve calcification (48).

Prosthesis-Patient Mismatch (PPM)

When the effective orifice area (EOA) of the prosthetic valve is too tiny in comparison to the patient's body surface area, Prosthesis-Patient Mismatch (PPM) happens. The category of the condition is either moderate (0.65-0.85 cm^2/m^2) or severe (<0.65 cm^2/m^2), according to the respective criteria. Moderate to severe PPM is associated with an elevated risk of heart failure-related morbidity and mortality. A variety of imaging modalities, including multidetector computed tomography (MDCT), transthoracic or transesophageal echocardiography (TTE/TEE), and others, can be employed to assess and predict PPM after SAVR. Preventing PPM and significant mismatch requires surgical procedures like aortic annular enlargement using techniques such as the Manouguian Technique, the Nicks Procedure and the Konno-Rastan Procedure to Implant larger prosthesis (49).

Neglected Rheumatic Aortic Stenosis

Neglected aortic stenosis (AS) often presents with symptoms like dyspnea, chest pain, and syncope, which may progress to heart failure if untreated, increasing morbidity and mortality (50).

The maximal transaortic velocity and the Doppler pressure gradient are two key parameters that may be measured using echocardiography and are useful for assessing valve motion, calcification, and left ventricular function, as well as for diagnosing AS. Untreated AS can lead to left ventricular enlargement, diastolic dysfunction, arrhythmias, and unexpected mortality. Due to its rapid consequences, it is particularly crucial to diagnose and treat aortic stenosis as soon as possible (51).

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