

# The Aortic Valve Regulates the Flow of Blood from the Heart

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**Abstract:** The aortic valve is located between the left ventricle and the aorta. The aortic valve regulates the flow of blood from the heart. In addition, the aortic valve enables the normal exchange of oxygen and carbon dioxide between the heart, lungs and other organs.

**Keywords:** Heart, Aorta, Aortic Valve, Complications, Health

## 1. INTRODUCTION

Different valve pathologies contribute to hemodynamically noteworthy aortic stenosis or aortic regurgitation [1]. When surgical signs are met, the aortic valve disease can be tended to with aortic valve substitution or repair. In any case, the choice of valve substitution or sort of repair can change depending on valve life systems and clinical situation. Small aortic roots, prosthetic valve-patient mismatch, and paravalvular regurgitation are extra contemplations when tending to aortic valve pathology.

## 2. AORTIC VALVE

The normal aortic valve may be a three-leaflet structure comprising of the cleared-out, right, and noncoronary leaflets [2]. It usually is 2.5 to 3.5cm<sup>2</sup> in region. Each pamphlet is related with its respective coronary sinus. In spite of the fact that varieties can occur, the proper coronary artery emerges from the correct coronary sinus, which lies anatomically front within the aortic root. The cleared-out coronary course emerges from the cleared-out sinus and is found moderately posterior. The noncoronary sinus is toward the proper side of the aortic root and lies closest to the specialist when seen within the working room. The bundle of His lies fair underneath the aortic annulus within the right coronary sinus adjoining to its intersection with the noncoronary sinus. This relationship explains the potential for the improvement of heart block related to aortic valvular infection or to complications of aortic valve substitution. Frequently, expanding heart square is an sign of a dynamic aortic root boil within the nearness of endocarditis, indeed on the off chance that the

quiet shows up to be making strides something else, and is an sign for critical surgery.

The mitral valve is anatomically more complex than the aortic valve. The normal valve zone is 4.0 to 6.0 cm<sup>2</sup>. In the cross segment, it looks like a parachute with the bigger front flyer and littler back flyers fastened to the papillary muscles and mitral valve annulus by the chordae tendinae. Disturbance or extending of the chordae or papillary muscle comes about in mitral lacking due to the misfortune of the tethering mechanisms, which at that point licenses prolapse of the valve leaflet back into the chamber.

The right-sided heart valves are comparable to those on the cleared-out side but less inclined to separated auxiliary issues. The pulmonic valve could be a trileaflet valve comparable in appearance to the aortic valve. It does have sinuses but no coronary ostia. The tricuspid valve has three pamphlets of unequal measure with a supporting device comparative to the mitral valve. Critical pneumonic hypertension can lead to auxiliary dilatation of the tricuspid annulus and result in tricuspid insufficiency.

## 3. ARTERIAL WAVEFORM

The waveform gives extra data counting cardiac contractility, vascular resistance, stroke volume at the side the dicrotic indent, which speaks to closure of the aortic valve [3]. The arterial waveform could be a complex sine wave, which can be regarded to be the entirety of an arrangement of sine waves of distinctive amplitudes and frequencies. Fourier investigation changes over complex wave forms into an arrangement of sine waves. The

elemental recurrence (or to begin with consonant) is rise to the warm rate and consequent sounds (up to 10) contribute to the waveform.

The upstroke portion of the wave reflects cardiac contractility, the crest of the upstroke speaks to systolic pressure, the downstroke slope demonstrates resistance, and the dicrotic score on the downstroke speaks to the closure of the aortic valve. Where the downstroke straightens, this demonstrates diastolic weight. The zone from the starting of the upstroke to the dicrotic score gauges the stroke volume.

Mistakes of the arterial waveform and arterial pressure readings can be caused by either resonance or damping. Resonance happens when the recurrence of the sounds within the pressure waveform is comparable to the common recurrence of the estimation framework. Expanded reverberation will elevate the systolic blood pressure reading and a lowering of the diastolic blood pressure reading. Mistake due to reverberation can be dodged by utilizing components with a normal recurrence divergent to arterial pressure waves. In none, this includes utilizing solid, brief, and wide tubing.

Damping is the misfortune of vitality and the diminished sufficiency of motions due to frictional strengths. Overdamping thinks little of systolic blood pressure and overestimates diastolic blood pressure, with loss of detail within the arterial waveform. Causes of overdamping incorporate clots, discuss bubbles, or wrinkles inside the pressure checking set. When utilizing the spiral course as a cannulation location, the position of the wrist can moreover cause overdamping. Underdamping overestimates systolic blood pressure and underestimates diastolic blood pressure, with an overstated or spiking of the arterial waveform.

It is vital to preserve an ideally hosed arterial waveform something else there's a chance of wrong blood pressure readings, and treatment alternatives seem have an unfavorable impact on the security of the persistent. In both reverberation and damping, the MAP (mean arterial pressure) remains consistent and so numerous divisions select to incorporate recordings of MAP on their anesthetic charts.

#### 4. TAVI

The move from cardiac surgery provided coronary grafting to endovascular stenting for fundamentally limited coronary arteries is nearly total as a to begin with line treatment [4]. The

larger part of these cases are managed with as crises by the cardiology groups with small input from anesthesia unless coronary course break or misplaced stents require quick thoracotomy and protect. Be that as it may, the scope of interventional cardiology hone has kept on extend. One development range is transcatheter aortic valve implantation (TAVI).

The TAVI method, to treat extreme tall- hazard aortic stenosis, is supported in patients with other extreme comorbidities that are contraindications to open surgery (e.g. cirrhosis and/or past surgery), but who are anticipated to have at slightest a 1 - year life hope. In any case, since of the quality of the comes about right now distributed, this negligibly intrusive method shows up like a genuine challenger to open cardiac surgery in elderly patients, indeed in those with few comorbidities. It isn't prescribed where there has been past valve surgery, coronary bypass surgery, or endocarditis. Get to to the aortic valve is either retrograde through the femoral artery (most of the time) or, once in a while, through a little thoracotomy and a transapical route. When the femoral route is chosen, it can be performed beneath common anesthesia, but these days is more frequently performed beneath sedation, for case, with a regional ilioinguinal or transversus abdominis plane (TAP) piece related with low-concentration remifentanil target- controlled infusion (TCI). The situation of the valve embed is more often than not performed under ventricular stop, accomplished through over pacing of the proper ventricle to actuate ventricular tachycardia. The arrangement itself may unstick parts of calcified plaques, driving to stroke or myocardial infarction, dissecting of the aorta, or crack of the aortic root itself. Multidisciplinary arranging is fundamental, and both transoesophageal echocardiography (TOE) appraisal and back utilizing extracorporeal membrane oxygenation (ECMO) can be utilized beneath common anesthesia. Another complication is the appearance of a total atrioventricular piece requiring the crisis arrangement of a pacemaker.

#### 5. INJURY

Valve injury has been recorded overwhelmingly within the setting of limit injury, ordinarily engine vehicle crashes, with a rate in dissection considers of 5%. By and large, in clinical arrangement, aortic valve wounds prevail whereas within the dissection arrangement

mitral valve damage prevails [5]. Instruments attributed have included coordinate harm, compression and intense weight against a closed valve, and/or postponed ischemic rot from hematoma or coronary harm. Within the uncommon setting of limit harm to the rising aorta, a few agents have cited up to 26% frequency of aortic valve/annulus disturbance, generally affecting the proper or non-coronary cusps. Valve harm after entering injury is indeed more uncommon. Typically, they are analyzed in a deferred design and frequently with an related septal imperfection.

The diagnosis may be made intensely at investigation, with substantial excite over the aortic valve, evidence of ventricular distention (e.g cleared out for acute aortic insufficiency, right ventricle for acute mitral insufficiency and right atrial distension for tricuspid insufficiency). In any case, within the larger part of cases, the diagnosis is made in a deferred fashion either since of the advancement of aspiratory edema, cardiac insufficiency or simply screening echocardiography. TEE (Transesophageal Echo cardiography) shows up to have superior visualization than TTE (Transthoracic Echo cardiography) for the reason of diagnosing and characterizing the degree of the valve harm and is especially vital intra-operatively on the off chance that repair is endeavored to evaluate competence.

Timing of repair depends on related wounds and degree of cardiac compromise, but in case it can be deferred until scar tissue shapes, the comes about show up way better. Atrioventricular valve wounds can be temporized with mechanical support (predominantly intra-aortic balloon pump) but noteworthy aortic spewing forth closes to preclude this.

Aortic valve harm as a rule comes about in early critical spewing forth that requires repair. Since of the degree of disruption, particularly in the event that the annulus is included, the majority of patients will require aortic valve replacement. Be that as it may, a little number of patients may be able to undergo valve repair.

Cardiac valve injury after blunt chest trauma is much less visit than CC (Cardiac contusion) [6]. Aortic valve injury is the foremost visit taken after by mitral and tricuspid valves. Rupture of cardiac valves after closed chest trauma may be decided by intense compression of the heart between the sternum and the vertebral column coming about in expanded cardiac pressure. At that point, the heart, which is suspended within

the mediastinum by the incredible vessels, can move forward during a deceleration injury, and the push is localized, especially at the atrial and valvular levels, causing lacerations of these structures. In expansion, during deceleration, the blood interior the ventricles is savagely moved against the valves that are closed at the minute of trauma, contributing to valvular damage. Atrioventricular valve device injuries may happen in early systole during isovolumetric ventricular contraction when the deceleration powers can essentially increment intraventricular pressure: the result can be laceration of the chordae tendineae, papillary muscle crack, and leaflet disruption. Another instrument of valvular injury, in most cases postponed, may be a primitive papillary muscle wound taken after by necrosis and valve insufficiency.

A cardiac valve rupture ought to be suspected in patients who have experienced severe limit injury and after that have created congestive heart failure. The indications of valvular damage may show up promptly after the injury or after a generally asymptomatic period of days or indeed a long time. In case of (a) history of injury, (b) typical heart before injury, and (c) sudden onset of valvular spewing forth, traumatic valvular harm ought to continuously be suspected in patients who display with heart mumbles after blunt chest injury.

Aortic valvular damage ordinarily presents with a sudden cardiovascular instability or cardiogenic shock. Intense mitral valve damage ordinarily shows itself as intense aspiratory edema and hypotension. These cases are taken care of by afterload reduction as a bridge to surgery.

## 6. COMPLICATIONS

Stroke, myocardial infarction, pneumonic embolus, pneumonia, valve failure, intrathoracic bleeding, and serious arrhythmias represent serious complications which are fortunately rare but can be fatal [7]. Aortic valve surgery essentially requires control near to the conduction framework, particularly in redo surgery, and pacemaker inclusion may be required on the off chance that damage to the conduction framework happens. Modified mental function, DVT, chronic pain, anticoagulation instability, reoperation, and sternal osteomyelitis are ordinarily less life-threatening but frequently seriously weakening complications. Reoperation may be required acutely (<7 days) most frequently due to

bleeding or chronically (>2 months) due to prosthetic failure; both are serious complications related with expanded horribleness and mortality. Hemolysis can be a serious issue regularly related with para-valvular leakage. Multisystem organ failure prolongs ICU care and is the normal prodrome to death related with complications of valve surgery, regularly related to fundamental dreariness. Renal failure may require dialysis, and pneumonic complications may require delayed mechanical ventilation. Wound contamination, sternal osteomyelitis, mediastinitis, lung disease, and once in a while endocarditis are exceptional but can be serious complications. Gastrointestinal complications are uncommon but may be serious counting ulceration, bleeding, bowel ischemia, biliary colic/stasis, pseudo-obstruction/ileus, and pancreatitis. Mortality hazard is expanded (with or without operation) by existing preoperative comorbidities, such as diabetes, renal failure, cardiac failure, aortic disease, lung disease, progressed age, and recent smoking history. Noteworthy hazard of extreme complications may happen without any surgery.

### 7. AS

Aortic Stenosis (AS) is the foremost predominant valvular heart disease in adults in developed countries [1]. AS is present in 5% of the populace by the age 65 with expanding predominance with age. Obtained AS is more often than not caused by degenerative calcification of the aortic valve. Calcium stores include the aortic valve leaflets and may expand into the aortic annulus. Bicuspid aortic valves speak to the foremost common shape of innate AS, displaying in 1-2% of the general populace. Progressive calcification of the bicuspid AV comes about in critical stenosis. Rheumatic aortic stenosis is the least common frame of AS in adults within the created world, in spite of the fact that predominance is higher in creating nations. Rheumatic aortic valves are regularly thickened and fibrotic with rolled edges and related cusp fusion.

### 8. AR

The pathophysiology of aortic regurgitation (AR) can be differentiated by onset and term of disease [1]. Acute AR can happen within the setting of endocarditis, dissection, or injury. Hemodynamically critical intense AR ordinarily requires surgery. Constant AR happens due to mutilation of valve leaflets or widening of the aortic root. Mutilation of the valve pamphlets and disgraceful coaptation can be caused by

aortic leaflet calcific degeneration, myxomatous degeneration, infective endocarditis, rheumatic illness, or bicuspid aortic valve. Enlargement of the aortic root can moreover disturb the integrity of the aortic valve. Aortic dismemberment, injury, connective tissue infection can expand the aortic root and annulus, driving to disgraceful coaptation. A blended aortic spewing forth and aortic stenosis are regularly seen in combination due to calcification or rheumatic disease.

### 9. AORTIC DISSECTION

Type A dissection, constituting 60-70% of all aortic dissections, is generally seen in more youthful patients with a few versatile and connective tissue variation from the norm [8]. It characteristically begins with a essential intimal tear fair distal to the sinotubular edge within the climbing aorta. This area is within the region of the cephalad expansion of the aortic valve commissures. The tear is commonly transverse and includes a length comparing to 50-60% of the aortic circumference. The dissection prepare begins within the intimal tear and its extension and course shift, as does the speed with which it propagates.

Regularly, a type A dissection influences the correct sidelong wall of the more prominent ebb and flow of the rising aorta. The dissection is more often than not coordinated antegradely, but retrograde expansion is additionally moderately common. A essential passage within the ascending aorta is related with a awesome hazard for bleeding into the pericardium, causing cardiac tamponade.

Type B dissection more often than not begins with a essential intimal tear within the plummeting thoracic aorta fair distal to the root of cleared out subclavian supply route. This sort constitutes around 25% of all aortic dissections. A persistent with a type-B dissection is regularly more seasoned, within the 6th-7th decade of life, and has thoracic aortic degeneration and hypertension.

Other conceivable but less common destinations of the essential tear are the aortic arch, happening in roughly 10% of cases, and the abdominal aorta, happening in as it were 2%. As as of now specified, the dissection within the aortic media can travel in a retrograde as well as an antegrade direction, causing two stream channels with a wrong and a true lumen. Secondary tears and reentries as a rule happen

distally, permitting stream from the untrue into the true lumen.

Rupture is the foremost common cause of death in patients with aortic dissection and is for the most part found close the location of the essential intimal tear. Thus, a type-A dissection ordinarily cracks into the pericardial sac, causing cardiac tamponade, or an aortic arch rupture that drains into the mediastinum. In expansion, the near connection to the aortic valve commissures can result in intense valve regurgitation due to prolapse of the commissural connections. Dissection into the aortic root may moreover include the coronary supply routes, driving to myocardial ischemia or infarction. A type-B descending aortic dissection ordinarily cracks into the cleared out pleural depression, and less frequently into the right.

As the dissection expands along the aorta it'll in this way lock in major vital cerebral and visceral branches, conceivably coming about in undermining end-organ ischemia. The instruments behind this are compression of the true lumen by the false lumen or shearing of the branch by the dissection process. A third possibility is disruption of a critical dissection membrane, causing an intimal fold covering the hole of a branch. Such fringe vascular complications happen in 25-30% of patients with aortic dissection and can basically influence cerebral, renal, visceral, and lower limit perfusion. Since the dissection within the descending aorta primarily engages its left perimeter, the cleared-out renal and cleared out iliac arteries are at higher hazard than the right ones.

### 10. AORTIC VALVE DISEASE

The aortic valve isolates the outflow tract of the cleared out ventricle with the ascending aorta [9]. It may be a trileaflet structure, with three semilunar cusps named for the coronary supply routes that emerge inside the underlying sinuses. The cleared out and right coronary courses begin inside these individual sinuses, with no coronary supply route emerging inside the noncoronary sinus. The free edges of the cusps are thickened at districts called the knobs of Arantius. The valve pamphlets join to the divider of the aorta at the annulus, and the areas where two adjoining cusps meet are the commissures. Imperative structures can be identified under these triangular-shaped zones. The commissure between the correct and

noncoronary cusp serves as the predominant border to the membranous interventricular septum and the atrioventricular conduction center. The non-left commissure watches the aortomitral shade and the center of the front leaflet of the mitral valve. The left-right commissure overlies the solid interventricular septum and the average border of the correct ventricular outpouring tract. These insinuate intracardiac connections are no more clear than inside the cleared out ventricular outpouring tract.

The thin-walled aortic valve leaflets effectively open and near during the cardiac cycle, simply taking after the pressure changes and blood stream way. Beneath typical circumstances, opening offers exceptionally small resistance to stream. The aortic sinuses have an vital part during valve closure, as the volume of blood inside the space between the opened valve cusp and the aortic divider create vortices as blood speed falls. These vortices apply central pressure and starts valve closure. The sudden inversion of stream from deceleration completes the diastolic closure.

Most patients with aortic valve disease require aortic valve replacement (AVR) [9]. Mechanical valves are strong but require long lasting anticoagulation with warfarin sodium to avoid valve thrombosis and thromboembolism. There are a few tissue valves: aortic valve homograft, pneumonic autograft (Ross method) and commercially accessible bioprosthetic valves. Bioprosthetic valves are ordinarily made from porcine aortic valves or developed from bovine pericardium. In either case, the xenograft tissue is chemically treated with glutaraldehyde to render it less antigenic and more safe to fatigue. Aortic valve homograft and bioprosthetic valves have restricted solidness, but they don't require anticoagulation with warfarin sodium.

Patients with AI (aortic insufficiency) and ordinary or negligibly unhealthy aortic cusps are candidates for aortic valve repair. This can be where utilitarian life structures of the aortic valve plays an imperative part within the choice of operative strategy. Preoperative transesophageal echocardiography is the leading demonstrative apparatus to distinguish reasonable cases for aortic valve reproduction. Since dilatation of the aortic root is the foremost common cause of AI, the aortic root may too got to be supplanted at the time of aortic valve

repair; these operations are alluded to as aortic valve saving operations.

### 11. AORTIC VALVE REPLACEMENT

The aorta can be opened through a transverse entry point 1 cm over the sinotubular junction or through a hockey-stick entry point amplified into the non-coronary sinus[10]. The infected aortic cusps are totally extracted and the aortic annulus is debrided to expel all calcified tissue. The aortic annulus is measured with particular manufacturer's valve sizers. The prosthetic valve is secured to the aortic annulus concurring to the sort of valve embedded. Restorative experts lean toward to secure mechanical valves with 20-30 basic hindered sutures of 2-0 polyester. As of now utilized stented bioprosthetic valves are outlined to be embedded on a supra-annular position and, for this reason, 10-12 horizontal mattress polyester sutures with pledgets on the ventricular side of the annulus are utilized.

During the past decade, transcatheter aortic valve implantation (TAVI) has ended up an alternative to surgical AVR for the treatment of AS, and it is especially valuable in high and medium risk patients. TAVI is additionally valuable in patients with failed bioprosthetic aortic valves; however, the failed bioprosthesis must be expansive sufficient to allow the sending of a valve of reasonable size.

### 12. VALVULAR HEART DISEASE

The patient with valvular heart disease has critical dangers for perioperative complications within the perioperative period [11]. Suspected patients with valvular heart illness ought to experience echocardiography assessment for evaluation of seriousness of stenosis or regurgitation, systolic function, and heart pressures in the event that there has been no earlier echocardiography performed inside the past year or there's a alter in clinical status since final assessment. Patients ought to too experience fitting assessment for the degree of the CAD (coronary supply route malady). Over the past decades, advancements in anesthetic and surgical procedures have seen a noteworthy diminish in 30-day perioperative dreariness and mortality from 13% to 2.1%. The instrument of an intense perioperative occasion is likely related with anesthetic specialists and surgical stretch driving to hemodynamic precariousness, decreased coronary perfusion with myocardial ischemia, arrhythmias, heart failure, and possible death. Chance for perioperative complication in patients experiencing NCS

(noncardiac surgery) with direct aortic stenosis (AS) (valve region: 1.0-1.5 cm<sup>2</sup>) or serious AS (valve region: <1.0 cm<sup>2</sup>) from an echocardiographic database. Utilizing penchant score investigation, they gotten four coordinated control patients without AS for each persistent with AS experiencing NCS, coordinating 634 patients with AS experiencing NCS to 2536 controls. There were 244 patients with serious AS and 390 patients with direct AS. The 30-day mortality was 2.1% for AS patients compared with 1.0% in non-AS controls (P = .036). Postoperative myocardial localized necrosis was more visit in patients with AS compared with controls (3.0% vs. 1.1%; P = .001). High-risk surgery, symptomatic extreme AS, coexisting mitral spewing forth (MR), and preexisting coronary illness were noteworthy indicators of essential result in patients with AS.

Patients who are candidates for aortic valve replacement (AVR) some time recently lung resection surgery have a few choices accessible depending on their chance criteria. Alternatives incorporate AVR, transcatheter aortic valve replacement (TAVR), or percutaneous swell expansion, as a bridge to conclusive treatment after lung resection surgery. In case they are considered tall hazard or ineligible, these patients may continue with lung resection surgery with intrusive checking for ideal hemodynamic observing. At the same time performed AVR and lung resection surgery on bypass have been carried out with success.

Patients with moderate to extreme MR experiencing NCS had the next perioperative mortality rate (1.7%) than those without MR (<1%). The 30-day essential results, counting postoperative death, MI, heart failure, and stroke, were 22.2% in those with MR compared with 16.4% without MR. Imperative indicators of dismalness in these patients were cleared out ventricular discharge division less than 35%, ischemic etiology of MR, a history of diabetes mellitus, and a history of carotid endarterectomy. Perioperative administration ought to incorporate obtrusive hemodynamic observing and echocardiography and confirmation to the seriously care unit for postoperative administration and care.

Dysfunctional cardiac valves can be classified as either narrow (stenosis) or leaky (regurgitation) [12]. In spite of the fact that the tricuspid and aspiratory valves can ended up dysfunctional in patients with endocarditis, congenital lesions, or carcinoid syndrome,

essential right-sided valvular variations from the norm are generally uncommon and are not examined assist here. In this area, the pathophysiologic components of stenotic and regurgitant aortic and mitral valves are addressed.

Any illness prepare that makes turbulent stream within the heart or awesome vessels can cause a mumble. For instance, ventricular septal deformity is related with a systolic murmur because of the unusual interventricular association and the pressure difference between the cleared-out and right ventricles; obvious ductus arteriosus is related with a persistent mumble since of a diligent association between the aspiratory supply route and the aorta. However, valvular injuries are the foremost cause of heart murmurs. Hence, an understanding of heart murmurs gives knowledge into the fundamental pathophysiologic forms of particular valvular injuries.

Heart murmurs can be either systolic or diastolic. During systole, whereas the cleared out ventricle is contracting, the aortic valve is open and the mitral valve is closed. The turbulent stream can happen either since of an incompetent mitral valve, driving to regurgitation of blood back into the chamber, or from a contracted aortic valve. In diastole, the circumstance is turned around, with filling of the cleared out ventricle through an open mitral valve whereas the aortic valve is closed. Turbulent stream happens when there's narrowing of the mitral valve or ineptitude of the aortic valve. Stenosis of valves more often than not creates gradually over time; injuries that cause valvular spewing forth can be either chronic or acute.

### 13. CONCLUSION

The heart has two atria and two ventricles. Each ventricle has a valve through which blood enters and a valve through which blood leaves. Sometimes the valves do not open and close properly, thus disrupting the flow of blood through the heart and body. Heart valves are complex structures that function as valves, and are located between the atrium and the ventricle, that is, between the ventricle and the artery that exits the heart. Aortic valve disease is a condition in which the valve between the main pumping chamber of the heart and the main artery in the body does not function properly. As a result, the heart works under a greater load.

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