1. The Bernoulli equation is an example of the law of conservation of
   A. Mass
   B. Energy
   C. Momentum
   D. Charge

2. The aortic valve has a systolic measured area of 0.7 cm². How would you grade the severity of stenosis?
   A. Normal
   B. Mild
   C. Moderate
   D. Severe

3. Enlargement of which cardiac structure would be the most reliable sign of pulmonary valve stenosis?
   A. Right ventricle
   B. Main pulmonary trunk
   C. Main trunk and left pulmonary artery
   D. Right and left pulmonary arteries

4. Which of the following valvular abnormalities have the worst acute prognosis?
   A. Bicuspid aortic valve
   B. Drug-induced tricuspid valvulopathy
   C. Infarcted papillary muscle with rupture
   D. Multivalvular rheumatic fever

5. Which is the most common cause of mitral stenosis worldwide?
   A. Rheumatic heart disease
   B. Myxomatous degenerative disease
   C. Carcinoid syndrome
   D. Congenital mitral stenosis
6. What would be the primary contributor to this patient’s mitral insufficiency?

![Image]

A. Mitral valve prolapse  
B. Annular dilation  
C. Congenital mitral stenosis  
D. Infective endocarditis

7. Which is the most common cause of pulmonic stenosis?

A. Congenital stenosis  
B. Rheumatic disease  
C. Degenerative thickening  
D. Carcinoid syndrome

8. Rheumatic disease involving the aortic valve is most commonly associated with

A. Aortic insufficiency  
B. Isolated involvement  
C. Bicuspid aortic valve  
D. Aortic stenosis

9. The classic diagnostic criteria for mitral valve prolapse include displacement of the mitral leaflets of

A. >1 mm beyond the annulus into the left ventricle and leaflet thickening of >3 mm  
B. >5 mm beyond the annulus into the left ventricle and leaflet thickening of >2 mm  
C. >3 mm beyond the annulus into the left atrium and leaflet thickening of >1 mm  
D. >2 mm beyond the annulus into the left atrium and leaflet thickening of >5 mm

10. Complications in infective endocarditis of the aortic valve include

A. Cardiac arrhythmias  
B. Septic pulmonary emboli  
C. Valvular stenosis  
D. Rasmussen aneurysm
Patient presents with severe left atrial enlargement and new atrial fibrillation. Given the clinical history and imaging findings, what hemodynamic consequences can occur?

A. Elevated right atrial pressure
B. Blunting of hepatic vein waveforms
C. Blunting of pulmonary venous waveforms
D. Increased pulmonary arterial flow

After obtaining a preoperative contrast-enhanced CT, an abnormality was incidentally noted on the aortic valve (below). Patient has no history of endocarditis or septicemia.

Given the clinical history and imaging findings, the most likely etiology would be

A. Fibroma
B. Metastasis
C. Rhabdomyosarcoma
D. Papillary fibroelastoma
A 59-year-old with chronic mitral insufficiency now presents with acute decompensation and pulmonary edema.

What is the most likely diagnosis?
A. Flail leaflet
B. Rheumatic mitral valve disease
C. Mitral stenosis
D. Mitral valve prolapse

What is the most likely diagnosis?
A. Flail leaflet
B. Rheumatic mitral valve disease
C. Mitral valve prolapse
D. Mitral regurgitation
15 A 36-year-old man with severe aortic calcification and valvular stenosis is referred for preoperative coronary CT angiography. Which of the following CT imaging findings are most likely to be observed?
A. Asymmetric LV hypertrophy
B. Normal aortic valve area
C. Left atrial enlargement
D. Bicuspid valve

16 Horizontal long-axis images from a cardiac MR demonstrating end-diastolic (left) and end-systolic (right) MR images of the mitral valve.

What is the most likely diagnosis?
A. Flail leaflet
B. Rheumatic mitral valve disease
C. Mitral stenosis
D. Mitral valve prolapse

17 An 86-year-old patient with severe aortic stenosis undergoes transcatheter aortic valve implantation. The postoperative course was largely uncomplicated; however, a new left bundle branch block is observed on telemetry. Which of the following is the most likely etiology?
A. Cardiac sarcoidosis
B. Complication of TAVI surgery
C. Acute myocardial infarction
D. Drug toxicity

18 What are the pathologic features that are associated with mitral stenosis?
A. Commissural fusion with subvalvular shortening of chordae
B. Myxomatous degeneration of the valve leaflets
C. Calcific deposits in the annulus fibrosis
D. Inflammatory vegetations with leaflet destruction

19 What hemodynamic effects can be seen with mitral stenosis?
A. Increased left atrial pressure
B. Decreased pulmonary capillary resistance
C. Increased pulmonary venous flow
D. Decreased left atrial volume
20 A clinician calls your office to consult about a cardiac MR for one of her patients. The patient is status post prosthetic mitral valve repair 8 months prior and is unsure whether this will be safe for cardiac MR. What would be your recommendation?
A. Cardiac MR imaging would not be safe to perform with any valve prosthesis.
B. Reviewing the make and model of the valve and date of surgery may be helpful in determining safety.
C. All metallic prosthetic valves are contraindicated, and all biologic valves are considered MR safe.
D. Valve prosthesis placed less than 12 months should not undergo imaging by MR.

21 Which is the most optimal cardiac imaging plane for evaluating the atrioventricular valves?
A. Vertical long axis
B. Short axis
C. Horizontal long axis
D. Coronal

22 A 33-year-old patient with a history of murmur undergoes a cardiac MRI. The MR depicts the following:

Which is the most appropriate diagnosis?
A. Critical aortic valve stenosis
B. Bioprosthetic aortic valve
C. Aortic valve endocarditis
D. Bicuspid aortic valve

23 Mitral valve prolapse may occur in association with which condition?
A. Shone syndrome
B. Carcinoid disease
C. Marfan syndrome
D. Rheumatic heart disease
Patient with fever and chest pain presents with the following imaging. What is the most likely diagnosis?

A. Paravalvular abscess
B. Aortic aneurysm
C. Aortic dissection
D. Pericardial effusion

A 34-year-old presents to the emergency department with atypical chest pain. Images from her CT are provided below.

Which best describes the underlying pathology?

A. Acute aortic syndrome
B. Annuloaortic ectasia
C. Subvalvular aortic stenosis
D. Rheumatic heart disease
25b Including Marfan syndrome and Ehlers-Danlos syndrome, which of the following syndromes may also be a cause of annuloaortic ectasia?
A. Loeys-Dietz syndrome
B. Shone syndrome
C. Williams syndrome
D. Heyde syndrome

26 Patient with severe tricuspid insufficiency presents for a cardiac CT. Previous echocardiogram reports decreased movement of tricuspid valve leaflets.

Given the history and imaging, what would be the most likely etiology?
A. Eisenmenger physiology
B. Mitral annular calcification
C. Carcinoid heart disease
D. Rheumatic heart disease

27 Aortic peak velocity greater than 4 m/sec corresponds to a mean aortic gradient of
A. <20 mm Hg
B. 21 to 40 mm Hg
C. >40 mm Hg

28 The workup for transcatheter aortic valve implantation (TAVI) includes a CTA of chest, abdomen, and pelvis to assess the access vessels. What is the minimal diameter of access vessel required based on the current generation of delivery device?
A. 3 mm
B. 4 mm
C. 5 mm
D. 6 mm
E. 7 mm
Which of the following pathologies most accurately describes the finding?

A. Supravalvular aortic stenosis
B. Valvular aortic stenosis
C. Subvalvular aortic stenosis
D. Valvular aortic insufficiency
ANSWERS AND EXPLANATIONS

1 Answer B. Bernoulli equation describes relationship between potential and kinetic energy. Energy can be transformed and cannot be created or destroyed. In the presence of vessel narrowing, the velocity distal to the point of narrowing must accelerate to maintain energy. Subsequently, a pressure gradient develops between the regions proximal and distal to the point of narrowing.


2 Answer D. Stenosis may be quantified using a variety of techniques including invasive hemodynamics and valve planimetry. However, the absolute value of valve area is not the primary determinant in timing of surgery, but presence/severity of clinical symptoms.

Severity grading:
1. Mild—Valve area exceeds 1.5 cm²; transvalvular velocity is 2.0 to 2.9 m/sec; and mean gradient is <20 mm Hg.
2. Moderate—Valve area is 1.0 to 1.5 cm²; transvalvular velocity is 3.0 to 3.9 m/sec; and mean gradient is 20 to 39 mm Hg
3. Severe—Valve area is <1.0 cm²; transvalvular velocity is ≥4 m/sec; and mean gradient is ≥40 mm Hg.


3 Answer C. Enlargement of the right ventricle or the main pulmonary artery can occur in volume overload, pulmonary hypertension, or tricuspid valvular disease. Enlargement of the pulmonary trunk can also be seen in the setting of pulmonary stenosis. However, as blood crosses the stenotic pulmonic valve, there is acceleration in flow and asymmetric flow toward the left pulmonary artery with resulting asymmetric enlargement of the left pulmonary artery. Because the right pulmonary artery originates at a 90-degree angle from the main pulmonary artery, it is not exposed to this accelerated flow.


4 Answer C. All of the other clinical scenarios are related to chronic valvular disease. Patients in this setting will typically have complaints of progressive dyspnea. Infarction of the papillary muscle with rupture, in the setting of myocardial infarction or trauma, is associated with acute mitral insufficiency, shortness of breath, florid pulmonary edema, significant hemodynamic compromise, and death.


5 Answer A. Rheumatic heart disease (RHD) is the most common cause of mitral valve stenosis, particularly in the developing world. It usually originates as a streptococcal infection of the upper respiratory tract (rheumatic fever). Acute RHD produces a pancarditis, characterized by endocarditis, myocarditis, and pericarditis. Chronic RHD is characterized by repeated valvular inflammation with subsequent leaflet thickening, commissural fusion, and shortening and thickening of the tendinous cords.
Congenital mitral stenosis is very rare. Carcinoid valvulopathy affects primarily tricuspid and pulmonary valves. Myxomatous degeneration results in mitral valve prolapse and insufficiency.


6 Answer B. Balanced steady-state free precession image demonstrates left ventricular enlargement and mitral insufficiency arising centrally from the valve. The valve leaflets are otherwise unremarkable without evidence of thickening, vegetation, or prolapse. Ventricular dilation commonly leads to subsequent annular dilatation and functional insufficiency.

The mitral valve requires coordinated function of the left atrium, mitral annulus, leaflets, papillary muscles, and left ventricle. Mitral insufficiency often results from dysfunction of one or more of these components. In the setting of ischemic cardiomyopathy, mitral annular dilation is frequently associated with alterations in the subvalvular apparatus and regional or global LV dysfunction. Isolated annular dilatation does not usually result in moderate or severe mitral insufficiency.


7 Answer A. Pulmonary stenosis is a congenital disorder in 95% of cases and most often an isolated abnormality. Pulmonary stenosis can also be observed as a component of complex congenital heart disease such as tetralogy of Fallot. Acquired pulmonary stenosis whether degenerative or inflammatory is exceedingly rare. Carcinoid syndrome is also rare and typically causes valvular insufficiency.


8 Answer D. Rheumatic heart disease may result in aortic stenosis or mixed stenosis and insufficiency. Rheumatic involvement of the mitral valve always precedes aortic involvement. Isolated aortic valve disease is very uncommon. Although insufficient valvular disease may result from calcification and fixed positioning of the valve leaflets, most cases of valvular insufficiency are related to damage to the valve leaflets or supporting apparatus.

Bicuspid aortic valves demonstrate early degeneration of the valve leaflets leading to fusion of the commissures, valvular sclerosis, and significant aortic stenosis similar to what one may see in rheumatic heart disease. However, the two entities are not closely associated.


9 Answer D. Mitral valve prolapse is most commonly caused by myxomatous degeneration of the valve leaflets. This is grossly characterized by thickening and redundancy of the leaflets, as well as chordal elongation and annular dilation.

Echocardiographic mitral valve prolapse has since been defined as single or bileaflet prolapse at least 2 mm beyond the long-axis annular plane. Prolapse with thickening of the valve leaflets >5 mm is termed “classic” prolapse, whereas prolapse with lesser degrees of leaflet thickening is regarded as “nonclassic prolapse.”

10 **Answer A.** The complications of infective endocarditis (IE) depend on the virulence of the organism and may include cusp perforation, chordal rupture, aneurysmal bulging of the valve, and perivalvular abscess formation. Uncommonly, this may result in a fistulous connection between major vessels and cardiac chambers or between chambers themselves resulting into congestive heart failure. Infection extending beyond valvular tissue may also result in disruption of the conduction system with electrocardiographic conduction abnormalities and arrhythmias. Stenosis due to IE is uncommon. Septic pulmonary emboli and Rasmussen aneurysms are complications of right-sided cardiac valves.


11 **Answer C.** Contrast-enhanced CT demonstrates significant mitral valve calcification and marked left atrial enlargement consistent with mitral stenosis. Severe mitral stenosis results in a significant increase in left atrial pressure. This pressure is reflected backward, causing blunting of pulmonary venous waveforms and an increase in pulmonary venous, capillary, and arterial pressures and resistance. Ultimately, pulmonary hypertension develops which then eventually leads to right ventricular hypertrophy and enlargement, tricuspid regurgitation, increased right atrial pressure, and the development of right-sided heart failure.


12 **Answer D.** MPR of cardiac-gated CT of the chest demonstrates a small well-circumscribed lesion on the aortic valve. Papillary fibroelastomas are the third most common primary cardiac tumor in adults and the most common tumor of the cardiac valves. Papillary fibroelastomas can become quite large and occur on any valve surface or area of the endocardium. Histologically, they are composed of a core of myxoid connective tissue containing abundant mucopolysaccharide matrix and elastic fibers that is covered by a surface endothelium. Recurrences are rare, and valve-sparing surgery should be considered whenever possible, as regrowth of partially resected lesions does not always occur.

The remaining pathologies rarely involve the valves primarily. Cardiac rhabdomyomas are the most frequently encountered primary cardiac tumor in infants and children. Cardiac rhabdomyoma arises more commonly in the ventricles, although up to 30% of cases can involve either atrium. Patients with tuberous sclerosis have a 40% to 86% incidence of cardiac rhabdomyomas so it is an important association to screen for. Fibromas of the heart are connective tissue tumors derived from fibroblasts and are very similar to soft tissue fibromas. About 90% of the reported cases occur in children before the age of 1 year, although fibromas can occur in any age group. Fibromas are associated with Gorlin syndrome in which patients develop odontogenic cysts, epidermal cysts, multiple nevi, and basal cell carcinomas of the skin.


13 **Answer A.** Balanced steady-state free precession (b-SSFP) cardiac MR demonstrates prolapse of the anterior mitral leaflet into the left atrium consistent with a flail leaflet. This is typically secondary to rupture of a component of the mitral valve tensor apparatus (chordae tendineae and papillary muscles).
Leaflet prolapse and elongated chordae are common in degenerative mitral valve disease. Superimposed chordal rupture may develop from chronic damage resulting in a flail segment and associated severe mitral insufficiency.


14 Answer B. CT of the chest demonstrated thickening and calcification of both mitral and aortic valve leaflets, most consistent with rheumatic heart disease. Rheumatic fever is an immunologically mediated, multisystem inflammatory disorder that occurs after an episode of group A streptococcal pharyngitis. A rheumatic carditis occurs during the active phase of rheumatic fever and may progress over time to chronic rheumatic heart disease. Significant valve thickening and commissural fusion and thickening of the chordae tendineae are characteristic by histology.

The mitral valve is most commonly affected in 65% to 70% of cases and along with the aortic valve in another 25% of cases. Tricuspid valve involvement is infrequent, and the pulmonary valve is very rarely affected.


15 Answer D. The abnormal morphology of a bicuspid aortic valve (BAV) results in valvular dysfunction and hemodynamic derangements. Echocardiographic studies have shown that sclerosis of the aortic cusps begins as early as the second decade of life while calcification becomes prominent in most middle-aged patients. This early degeneration may be related to more aggressive inflammatory changes of the aortic valve, characterized by increased macrophage infiltration and neovascularization.

Chronic aortic stenosis leads to ventricular pressure overload and concentric left ventricular hypertrophy will increased wall thickness and normal LV chamber size.

With worsening AS, diastolic dysfunction with impaired relaxation and increased diastolic filling pressure may result. This can lead to left atrial dilatation; however, this is a late finding in the progression of the disease.


16 Answer D. Balanced steady-state free precession images in the horizontal long axis demonstrate thickening and redundancy of the mitral valve at end diastole (left). End-systolic images (right) show prolapse of the leaflets beyond the annular plane and into the left atrium, consistent with mitral valve prolapse.

Mitrval valve prolapse (MVP) is defined as single or bileaflet prolapse at least 2 mm beyond the long-axis annular plane, with or without thickening of the valve leaflets. The prevalence of prolapse is estimated at 2% to 3% and is equally distributed between men and women. Uncommonly, MVP is associated with heritable disorders of connective tissue including Marfan syndrome.

Although the great majority of persons with MVP have no untoward effects, approximately 3% develop one of four serious complications: (1) infective endocarditis, (2) mitral insufficiency, (3) stroke or other systemic infarct, or (4) arrhythmias, both ventricular and atrial.


17 **Answer B.** Transcatheter aortic valve implantation (TAVI) has become an established treatment option for patients with aortic stenosis at prohibitive risk to undergo conventional surgical aortic valve replacement. Among potential complications that may arise with TAVI surgery, new conduction abnormalities and arrhythmias frequently occur.

New left bundle branch block has been reported in 29 to 65% of patients after Medtronic CoreValve system and in 4% to 18% of patients receiving the balloon-expandable Edwards SAPIEN valve. In the PARTNER study, new-onset atrial fibrillation was present in 41% of patients acutely after TAVI and 9% within 30 days from the procedure.


18 **Answer A.** The most common cause of mitral stenosis is rheumatic heart disease. With acute rheumatic fever, focal inflammatory lesions are found in various tissues including the cardiac valves. The inflammation of the endocardium and the left-sided valves typically results in fibrinoid necrosis within the cusps or along the tendinous cords.

Microscopically, there is organization of the acute inflammation and subsequent diffuse fibrosis and neovascularization that obliterate the leaflet architecture. Subsequent leaflet thickening, commissural fusion and shortening, and thickening and fusion of the chordae tendineae occur, leading to the characteristic changes seen in mitral stenosis.

Myxomatous degeneration is the pathologic hallmark of mitral valve prolapse. Infective endocarditis leads to deposition of inflammatory vegetations and leaflet destruction. Calcification of the mitral valve annulus generally does not affect valvular function or otherwise become clinically important.


19 **Answer A.** The most useful descriptor of the severity of mitral valve obstruction is the mitral valve orifice area. In normal adults, the cross-sectional area of the mitral valve orifice (MVO) is 4 to 6 cm². An MVO of <1 cm² leads to high resistance across the stenotic mitral valve, thereby increasing LA volume and pressure. This elevated left atrial pressure, in turn, raises pulmonary venous and capillary pressures, resulting in exertional dyspnea.

The left ventricle is usually normal and may have normal systolic pressure and end-diastolic function. With increased severity of mitral stenosis, resultant passive backward transmission of the elevated left atrial pressure, and pulmonary arteriolar constriction, may develop leading to pulmonary hypertension. Right ventricular enlargement and even dilatation of the hepatic veins may be seen in the most severe and chronic forms of mitral stenosis but are not common findings.


20 **Answer B.** Investigative studies have demonstrated a lack of substantial magnetic field interactions and negligible heating in heart valve prostheses and annuloplasty rings evaluated during MR testing. These findings indicate that MR procedures may be conducted safely in individuals with these implants using MR systems with static magnetic fields of 1.5 T or less.

With respect to clinical MR procedures, there has never been a report of a patient incident or injury related to the presence of a heart valve prosthesis. An often quoted exception to this used to be the Starr-Edwards Pre-6000 series valves, but these too have now been deemed acceptable for MRI.

Theoretical concerns for patients with heart valves that have metal leaflets undergoing MR procedures on MR systems >1.5 T, although this has never been demonstrated or reported.
For an object that is weakly magnetic, it is typically necessary to wait a period of 6 to 8 weeks prior to performing an MR procedure. In this case, retentive or counterforces provided by tissue in growth, scarring, or granulation serve to prevent the object from presenting a risk or hazard to the patient in the MR environment. In this particular case, it would be fine to image the patient.


21 **Answer C.** The horizontal long axis (4-chamber view) provides a view of both atria, atrioventricular valves, and both ventricles. The short axis may provide a supplemental view of the valves but remains limited since the leaflets move in and out of plane. Vertical long axis may provide depiction of one of the valves, depending upon which ventricle the plane passes through. Coronal projections are also suboptimal in visualizing of the valves.

22 **Answer D.** Balanced steady-state free precession images in three-chamber view (left) and en face view through the valve (right) demonstrate thickening of the aortic valve with “fish-mouth” morphology consistent with a bicuspid aortic valve.

Bicuspid aortic valve (BAV) is the most frequent congenital cardiovascular malformation in humans with a prevalence of approximately 1%. Structural abnormalities of the aortic wall commonly accompany bicuspid valves even when the valve is hemodynamically normal, potentiating aortic dilation or aortic dissection. The other available choices typically present with additional clinical history and complaints.

23 **Answer C.** Mitral valve prolapse (MVP) is a variable clinical syndrome that results from diverse pathogenic mechanisms. MVP occurs as a primary condition that is not associated with other diseases and can be familial or nonfamilial. It can also be associated with heritable disorders of connective tissue including Marfan syndrome, which is usually caused by mutations in fibrillin-1 (FBN-1).

Carcinoid heart disease generally involves the endocardium and valves of the right heart and is the cardiac manifestation of the systemic associated with carcinoid tumors. These changes are restricted to the right side of the heart due to inactivation of both serotonin and Bradykinin during passage through the lungs.

Shone syndrome classically presents with four cardiovascular defects: a supravalvular mitral membrane, valvular mitral stenosis due to a parachute mitral valve, subaortic stenosis (membranous or muscular), and aortic coarctation. Most presenting cases are incomplete with only two or three of these components present.

24 **Answer A.** The case demonstrates thickening of aortic valve leaflets and a paravalvular collection around the aortic root as a result of aortic valve endocarditis. Resulting complications include disruption of the conduction system with electrocardiographic conduction abnormalities and arrhythmias or purulent pericarditis.
Answer B. The image demonstrates dilatation of the aortic root with effacement of the sinotubular junction, consistent with annuloaortic ectasia. Annuloaortic ectasia (AE) is symmetric dilatation of the aortic root and ascending aorta with effacement of the sinotubular junction. AE may cause aortic regurgitation, aortic dissection, and rupture. It is most often associated with Marfan syndrome, but it can also be seen in other conditions, such as Ehlers-Danlos syndrome, osteogenesis imperfecta, or homocystinuria, or be idiopathic. Ascending aortic aneurysm is also seen in syphilis, bicuspid aortic valve, aortitis, and postoperative patients.

Rheumatic heart disease causes thickening of the aortic valve and aortic stenosis. Subvalvular aortic stenosis is the second most common form of AS and refers to narrowing at the outlet of the left ventricle just below the aortic valve.


Answer A. Loeys-Dietz syndrome (LDS) is an autosomal-dominant connective tissue disorder defined as those with mutations in transforming growth factor-β (TGF-β) receptor TGFBR1 (predominantly presenting with craniofacial features) and TGFBR2 (predominantly presenting with cutaneous features). LDS is characterized by the triad of arterial tortuosity and aneurysms, hypertelorism, and bifid uvula or cleft palate. Aortic root aneurysms are present in up to 98% of patients with LDS, with thoracic aortic dissection being the leading cause of death (67%), followed by abdominal aortic dissection (22%) and cerebral hemorrhage (7%).

Shone syndrome is a rare congenital heart disease comprising a series of four obstructive or potentially obstructive left-sided cardiac lesions: supravalvular mitral membrane, parachute mitral valve, subaortic stenosis (membranous or muscular), and coarctation of the aorta.

Heyde syndrome is a syndrome of aortic valve stenosis associated with gastrointestinal bleeding from colonic angiodysplasia.

Williams syndrome is a rare genetic disorder that affects a child’s growth, physical appearance, and cognitive development. Cardiovascular defects include supravalvular aortic stenosis, pulmonary arterial stenosis, aortic coarctation, cardiomyopathy, tetralogy of Fallot, aortic valve defect (aortic stenosis or insufficiency), and mitral valve defect (mitral stenosis or mitral insufficiency).


Answer C. Cardiac CT demonstrates marked enlargement of right-sided cardiac chambers with thickening and tethering of the anterior tricuspid leaflet, consistent with the diagnosis of carcinoid valvular disease. Notably, there is also deviation of the interventricular septum toward the left compatible with elevated right-sided pressures.

Cardiac involvement from carcinoid disease is a rare and unique manifestation typically inducing abnormalities of the right side of the heart. Valvular dysfunction in carcinoid heart disease is caused by proliferation of endocardial fibroblasts in response to chronic inflammation or induced by a number of circulating vasoactive mediators. Plaque deposition leads to thickening, retraction, and impaired leaflet motion. Compared to the right side of the heart, the left-sided valves are rarely affected because of the pulmonary metabolism and deactivation of the hormonal substances.
Eisenmenger syndrome is a complication of uncorrected large intracardiac left-to-right shunts. Long-standing shunts lead to increased pulmonary resistance leading to bidirectional shunting and then to right-to-left shunting. Rheumatic heart disease causes significant thickening of valve leaflets and valvular stenosis; however, superimposed insufficiency may result when leaflets remain fixed in an open position. Calcified deposits on the mitral valve annulus do not typically affect valvular function or otherwise become clinically important.


Answer C. The gradient across a valve can be estimated using the peak velocity and the Bernoulli equation (4*v^2). With a peak velocity of >4.0 m/sec, the mean aortic gradient corresponds to a mean aortic valve gradient of >40 mm Hg. The peak gradient would be estimated at 64 mm Hg.


Answer D. Current generation (2014/2015) of endovascular access sheath requires at least 6 mm diameter for the CoreValve system. The SAPIEN system ranges from 6 to 8 mm for the minimal diameter. Current sheath sizes range from 18 French to 22–24 French.


Answer C. Coronal MPR of a cardiac CT demonstrates a linear but incomplete web arising in the left ventricular outflow tract, below the level of the aortic valve.

Left ventricular outflow tract obstruction includes a spectrum of stenotic lesions that are generally categorized as subvalvular, valvular, or supravalvular. These obstructions to forward flow may present alone or in concert, as in the frequent association of a bicuspid aortic valve with coarctation of the aorta. All of these lesions impose increased afterload on the left ventricle and, if severe and untreated, result in hypertrophy and eventual dilatation and failure of the left ventricle.

Subaortic stenosis (SAS) may be focal, as in a discrete membrane, or more diffuse, resulting in a tunnel leading out of the left ventricle. Fibromuscular SAS is most frequently encountered (90%), but the tunnel-type lesions are associated with a greater degree of stenosis. Congenital valvular stenosis due to bicuspid aortic valve (BAV) occurs with an estimated incidence of 1% to 2%. BAV usually occurs in isolation but is associated with other abnormalities, the most common being coarctation of the aorta, patent ductus arteriosus, or ascending aortopathy. Supravalvular aortic stenosis (SVAS) is obstruction constriction occurring above the level of the aortic valve. SVAS is frequently associated with Williams syndrome. Aortic insufficiency results from malcoaptation of the aortic leaflets due to abnormalities of the aortic leaflets, their supporting structures (aortic root and annulus), or both.