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Expert Review

The 2020 ACC/AHA Guidelines for Management of Patients With Valvular Heart Disease: Highlights and Perioperative Implications

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Valvular heart disease contributes to a large burden of morbidity and mortality in the United States. During the last decade there has been a paradigm shift in the management of valve disease, primarily driven by the emergence of novel transcatheter technologies. In this article, the latest update of the American College of Cardiology/American Heart Association valve heart disease guidelines is reviewed.

Key Words: American Heart Association; American College of Cardiology; valvular heart disease; guidelines

APPROXIMATELY 2.5% of the US population has valvular heart disease (VHD), and 25,000 deaths a year are attributable to nonrheumatic heart disease.[1,2] There has been a paradigm shift in the understanding and management of VHD over the last decade, primarily as a result of the emergence of transcatheter technologies for management of aortic stenosis; mitral regurgitation; and, very recently, tricuspid regurgitation.[3-5] In December 2020, the American College of Cardiology (ACC)/American Heart Association (AHA) Joint Committee published the most recent report for the management of patients with VHD.[6] The present review aims to summarize the guidelines and to compare the current version of the guidelines with the 2014 ACC/AHA guidelines, the 2017 ACC/AHA focused update, and the 2017 European Society of Cardiology (ESC)/European Association for Cardio-Thoracic Surgery (EACTS) guidelines for management of VHD.[7-9]

Infective Endocarditis

The prevalence of infective endocarditis (IE) is 15 per 100,000 people in the United States, with an inpatient mortality of 15%-to-20% and an overall one-year mortality rate of ~ 40%.[6,10] Consistent with previous guidelines, it is recommended that patients with IE be evaluated by a multidisciplinary medical team, including an infectious disease specialist, cardiologist, cardiothoracic surgeon, and a neurologist if a neurologic event is present.[6,9] Once a diagnosis is made, if a patient with IE has valve dysfunction resulting in heart failure, left-sided IE caused by *Staphylococcus aureus* or a fungus or other highly resistant organism, a heart block or valvular abscess, or persistent bacteremia with fevers >five days,

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surgical intervention during the initial hospitalization before completion of medical therapy is recommended. Otherwise, optimal medical therapy with the appropriate antibiotics sensitive to the organism is recommended.[6]

With regard to antibiotic prophylaxis for IE prevention during high-risk dental procedures (gingival or periapical manipulation), the 2020 ACC/AHA guidelines clearly stated the continuing need for randomized clinical trials to address this gap in knowledge, a message also stated in the 2017 ACC/AHA update.[6,9] The consensus statement for prophylaxis remains, from a pathophysiologic consideration, that antibiotic prophylaxis is reasonable for high-risk populations undergoing dental procedures that involve manipulation of gingival tissue, manipulation of the periapical region of teeth, or perforation of the oral mucosa (class 2a).[6] Similar to previous guidelines, the high-risk population was defined as those with prosthetic valves, prosthetic material for valve repair, previous IE, unrepaired congenital heart disease, or cardiac transplantation with valvular regurgitation from a structurally abnormal valve.[8,9] However, the 2020 ACC/AHA guidelines remained clear that transient bacteremia is common in routine dental interventions such as brushing teeth, flossing, toothpick use, or even food chewing, and the incidence of IE from most dental procedures is low, with no controlled trial data available to support antibiotic prophylaxis.

Atrial Fibrillation

The risk of an ischemic stroke is four-fold greater in patients with atrial fibrillation (AF) than those without the diagnosis and is even higher in patients with AF and valvular diseases.[11] Given the increasingly evident safety and efficacy of non-vitamin K oral anticoagulants (NOACs), the guidelines recommended that for all patients with native valve disease (except those with rheumatic mitral stenosis [MS]) or those who have received a bioprosthetic valve >three months ago, an NOAC is an effective alternative to a vitamin K antagonist (VKA) and should be administered on the basis of the patient's CHA2DS2-VASc score (class 1).[6,7,11,12] For patients with rheumatic MS, VKAs are recommended for anticoagulation (class 1).[6]

Aortic Stenosis

For aortic stenosis (AS), the 2020 ACC/AHA guidelines retained the severity classification scheme of the prior guidelines.[7] The guidelines retained a class 2a recommendation for exercise testing for asymptomatic patients with severe AS.[6] They also continued to recommend medical treatment of hypertension and dyslipidemia. In addition, based on observational data, the new guidelines made note of a class 2b recommendation for use of renin-angiotensin system blocker therapy after transcatheter aortic valve replacement (TAVR) to decrease the long-term risk of all-cause mortality.[6,7,13,14] The current guidelines provided a class 1 recommendation for aortic valve replacement (AVR) in those with severe high-gradient AS and symptoms by either history or on exercise testing. Asymptomatic patients with severe AS and a left ventricular ejection fraction (LVEF) <50% or those undergoing other cardiac surgery also have a class 1 indication for AVR. This remained unchanged from the previous version of the guidelines. Similar to prior guidelines, the 2020 guidelines provided for a class 1 recommendation for AVR in patients with severe symptomatic low-flow AS with a reduced ejection fraction and severe symptomatic low-flow AS with a normal ejection fraction (if AS is the most likely cause of the symptoms).[6,15] In asymptomatic patients, the guidelines provided for a class 2a recommendation for AVR in patients with low surgical risk with (1) an abnormal exercise stress test, (2) very severe AS (aortic velocity ≥5 m/s), (3) very high brain natriuretic peptide (>three times normal), or (4) a progressive increase in aortic velocity (≥0.3 m/s per year). The guidelines also provided for a class 2b recommendation for AVR in patients with (1) severe AS with a progressively decreasing LVEF and (2) moderate AS and undergoing cardiac surgery for another indication. The guidelines stressed shared decision-making when deciding the type of valve to implant (bioprosthetic *v* mechanical). In addition, they recommended the use of a bioprosthetic valve in patients with contraindications to anticoagulation. (Fig 1).[6]

One of the main areas of change in the updated guidelines was the use of TAVR versus surgical aortic valve replacement (SAVR). The 2014 ACC/AHA guidelines provided a class 1 recommendation for TAVR in patients with prohibitive surgical risk and recommended a multidisciplinary approach for patients with high surgical risk. Incorporating new evidence, the 2017 ESC/EACTS guidelines recommended TAVR for symptomatic patients who were not suitable for SAVR or for symptomatic patients with increased surgical risk after discussion with a heart team.[8] Although there is new evidence to support the role of TAVR in low- to- intermediate risk patients, this is offset by limited data on long-term durability of TAVR valves.[16,17] The new ACC/AHA guidelines, therefore, suggested the following steps in deciding between SAVR and TAVR.[6] The first step is assessment of surgical risk. If the patient is at a prohibitive risk for surgery, then as long as expected survival (with acceptable quality of life) is >one year, TAVR is the preferred approach (class 1). For any patient with an expected survival <12 months, palliative care is recommended after shared decision- making with the patient (class 1). For any patient for whom a bioprosthetic valve is planned and who is not at prohibitive surgical risk, the next step is to assess whether the patient has a class 1 indication for AVR (severe symptomatic AS or asymptomatic severe AS with LVEF <50%) and if the anatomy is suitable for transfemoral TAVR. If both of these conditions are satisfied, then the age of the patient should be considered. If the patient is (1) >80 years old, TAVR is preferred (class 1); (b) between 65 and 80 years old, the decision between SAVR and TAVR is based on shared decision-making with the patient (class 1); or (3) <65 years old and life expectancy >20 years, SAVR is the preferred method of AVR (class 1). Although this approach does not replace the role of a heart valve team–based discussion, it provides more clarity in the decision-making process and, hopefully, will standardize the use of TAVR across the

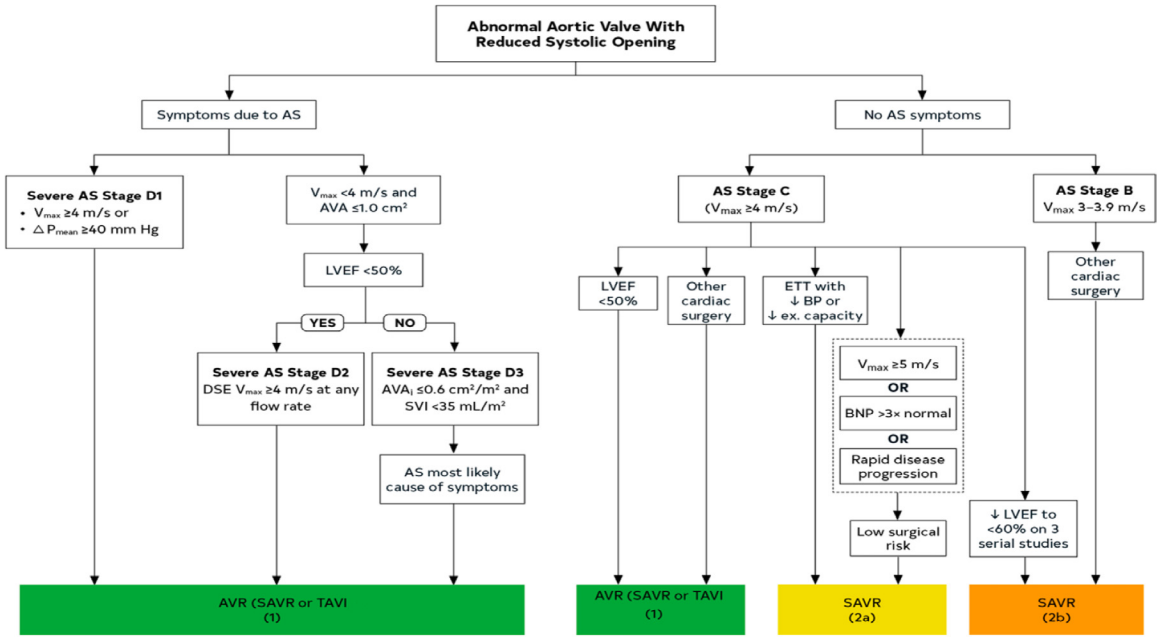

Fig 1. Timing of intervention for aortic stenosis. AS, aortic stenosis; AVA, aortic valve area; AVAi, aortic valve area index; AVR, aortic valve replacement; BNP, B-type natriuretic peptide; BP, blood pressure; DSE, dobutamine stress echocardiography; ETT, exercise treadmill test; LVEF, left ventricular ejection fraction; ΔPmean, mean systolic pressure gradient between the left ventricle and aorta; SAVR, surgical aortic valve replacement; SVI, stroke volume index; TAVI, transcatheter aortic valve implantation; TAVR, transcatheter aortic valve replacement; Vmax, maximum velocity. Adapted from Otto et al.[6]

country. Lastly, the guidelines provided for a very limited role of percutaneous balloon valvuloplasty. This may be considered in critically ill patients as a bridge to SAVR or TAVR (class 2b).

Aortic Regurgitation

Aortic regurgitation (AR) may be acute or chronic. Acute AR results from endocarditis, aortic anomalies such as aortic dissection or as a complication of transcatheter procedures, or blunt chest trauma. Although medical therapy can be temporizing, surgery should not be delayed for acute AR, especially if there are hypotension, pulmonary edema, or evidence of low flow.[6,18-21]

Chronic AR may result from bicuspid aortic valve (BAV) disease, aortic disease, or rheumatic heart disease. The role of medical therapy is limited to control of hypertension in asymptomatic patients and use of guideline-directed medical therapy for reduced LVEF in patients with severe AR who have symptoms and/or left ventricular (LV) dysfunction and are at a prohibitive risk for surgery (class 1). The 2020 ACC/AHA guidelines recommended aortic valve surgery for all patients with severe symptomatic AR. In asymptomatic patients with severe AR, aortic valve surgery gets a class 1 recommendation for those with LVEF <55% or in those undergoing cardiac surgery for another indication. In patients with severe asymptomatic AR, the current guidelines provided for a class 2a recommendation for surgery in patients with a normal LVEF if the left ventricle is severely enlarged (defined as LV end-systolic dimension >50 mm or indexed dimension >25 mm/m^2). In addition, the guidelines provided a 2b recommendation for surgery in asymptomatic patients with severe AR and normal LV systolic function at rest (LVEF >55%; stage C1) and low surgical risk when there is a progressive decline in LVEF on at least three serial studies to the low-to-normal range (LVEF 55%-60%), or when there is or a progressive increase in LV dilation into the severe range (LV end-diastolic dimension >65 mm). There was very little change in the guidelines for chronic AR from 2014, with the exception of a higher LVEF cutoff (previously 50%) to define LV systolic dysfunction.[6,15] There were minor differences between the ESC/EACTS valve guidelines for AR and the new iteration of the ACC/AHA guidelines. Chronic AR with preserved LV function and LV end-systolic dimension >50 mm earned a class 1 indication for surgery in the ACC/AHA guidelines as opposed to a class 2a indication in the ESC guidelines. In addition, the LV end-diastolic dimension cutoff was different (65 mm in the ACC/AHA guidelines *v* 70 mm in the ESC guidelines). These differences notwithstanding, both guidelines urged surgical referral for severe AR in the presence of symptoms or LV dilation and/or LV dysfunction.[6,8]

Bicuspid Aortic Valve (BAV) and Aortopathies

BAV is a common congenital abnormality that affects up to 2% of the population and has a 3:1 male- to-female ratio. About 20%-to-40% of patients have aortic aneurysms based on a systematic review of BAV literature.[22] The guidelines recommended routine lifelong screening of patients with BAV (regardless of prior AVR) if the aortic dimension is ≥4.0 cm (class 2a). Even though the imaging modality of choice is driven by local expertise, it is important to note that transthoracic echocardiography (TTE) does not adequately image the sinuses or the proximal 5-to-6 cm of the ascending aorta.[6]

Cutoffs for replacement have been controversial, with differences in practice patterns across the country. The guidelines recommended surgery if the following are present: (1) the aortic dimension is ≥5.5 cm (class 1); (2) the aortic dimension is between 5 and 5.5 cm and patients have additional risk factors for dissection (family history of aortic dissection, aortic growth rate >0.5 cm per year, aortic coarctation) (class 2a); and (3) if patients with BAV have indications for SAVR and an aortic diameter ≥4.5 cm (provided that the surgery is performed at a Comprehensive Valve Center [CVC]) (class 2a). The guidelines provided a lower recommendation (class 2b) for valve-sparing surgery in BAV and for aortic surgery, with dimensions between 5 and 5.5 cm and low surgical risk (without additional risk factors), and limited this recommendation to surgeries being performed at a CVC. Of note, the guidelines divided centers performing valve interventions into primary valve centers and CVCs depending on the type of surgical and percutaneous procedures available at these centers, with the latter performing more complex procedures, such as valve-sparing aortic root procedures, septal myectomy with AVR, and transcatheter valve-in-valve procedure.

Mitral Stenosis

Although rheumatic MS is a major cause of valve disease worldwide, the incidence is low in developed countries. The usual presentation is in older patients (aged 50-70 years) who present years after the initial rheumatic fever episode and with multiple comorbidities and calcified fibrotic leaflets.[6] At the same time, with increasing life expectancy, calcific MS, which is believed to result from mitral annular calcification, has become increasingly prevalent.[6,23,24] The guidelines provided a class 1 indication for exercise testing in rheumatic MS if there is a discrepancy between resting echocardiographic findings and clinical symptoms.[6] The guidelines recommended anticoagulation with a VKA in patients with rheumatic MS and (1) AF, (2) prior embolic events, or (3) left atrial thrombus (class 1). In patients with rheumatic MS and (1) AF with rapid ventricular rates or (2) sinus tachycardia, heart rate control was recommended (class 2a).[6] The mainstay of treatment for rheumatic MS is percutaneous mitral balloon commissurotomy (PMBC). For all recommendations, it is important to keep in mind that PMBC, in general, should be performed in the presence of favorable valve morphology (mobile and relatively thin valve leaflets, which are free of calcium, in the absence of significant subvalvular fusion); absence of ≥ moderate mitral regurgitation (MR); and absence of a clot in the left atrium.[6,25-28] The guidelines recommended PMBC at a CVC in (1) patients with severe symptomatic (New York Heart Association [NYHA] class ≥II) rheumatic MS (class 1), (2) asymptomatic severe rheumatic MS with pulmonary artery systolic pressure (PASP) >50 mmHg (class 2a), (3) asymptomatic patients with severe rheumatic MS and new AF (class 2b), and (4) symptomatic patients with nonsevere (valve area >1.5 cm^2) rheumatic MS, if there is evidence of hemodynamically significant rheumatic MS (pulmonary artery wedge pressure >25 mmHg and mean mitral gradient >15 mmHg) during exercise (class 2b). In severely symptomatic patients (NYHA III or IV) who are not candidates for PMBC, have failed PMBC, or require other cardiac procedures, surgery is reasonable (class 1). In rare situations, when patients are suboptimal candidates for PMBC but have high surgical risk, PMBC still may be considered at a CVC (class 2b). In a change from the 2014 guidelines, the current version no longer recommended PMBC for asymptomatic patients with very severe MS (valve area <1 cm^2) without additional risk factors.[6,7] In addition, surgery for moderate MS in patients undergoing cardiac surgery for another indication was no longer mentioned in the guidelines.[6]

Mitral Regurgitation

Acute MR is caused by disruption of the mitral valve apparatus, be it from IE causing leaflet perforation or chordal rupture, myxomatous mitral valve disease causing spontaneous chordal rupture, or papillary muscle rupture in the setting of a myocardial infarction. Acute MR can cause deleterious hemodynamic derangements as a result of severe pulmonary congestion and cardiogenic shock secondary to the acute volume overload of the left ventricle and left atrium and inability for ventricular compensation. Treatment of acute MR consists of afterload reduction to reduce the regurgitant volume by way of vasodilator therapy to improve hemodynamic compensation and utilization of an intra-aortic balloon pump followed by prompt mitral valve surgery.[6]

Chronic MR is divided into primary (a disease of the mitral valve apparatus) and secondary (a disease of the ventricle or atria).[6] For chronic primary MR, the guidelines recommended surgery for all patients with symptomatic severe MR (class 1). For asymptomatic patients with severe primary MR, surgery was indicated if (1) there is LV systolic dysfunction (LVEF ≤60%; LV end-systolic dimension ≥40 mm) (class 1); (2) if LV function is normal but the patient has a low risk for mortality and there is a >95% probability of a durable and successful repair (class 2a); and (3) in patients with normal LV function who have a progressive increase in LV size and decrease in function (class 2b). Compared with the previous versions of the guidelines, the 2020 ACC/AHA guidelines no longer provided a lower limit for LVEF (previously 30%) for intervention in patients with severe MR.[6,7,9] The guidelines also, for the first time, provided recommendations with regard to transcatheter edge-to-edge repair (TEER) in patients with primary MR. They stated that in severely symptomatic patients with primary severe MR and high/prohibitive surgical risk, TEER is reasonable (class 2b). Figure 2 provides an algorithm for management of primary MR.

The new guidelines also provided a detailed approach to chronic secondary MR. It is noteworthy that the guidelines stressed (and provided a class 1 recommendation for) standard guideline-directed medical therapy for heart failure in these patients. In patients with chronic severe secondary MR related to LV systolic dysfunction (LVEF <50%) on guideline-directed medical therapy and with persistent symptoms, (1) TEER is reasonable in patients with appropriate anatomy,

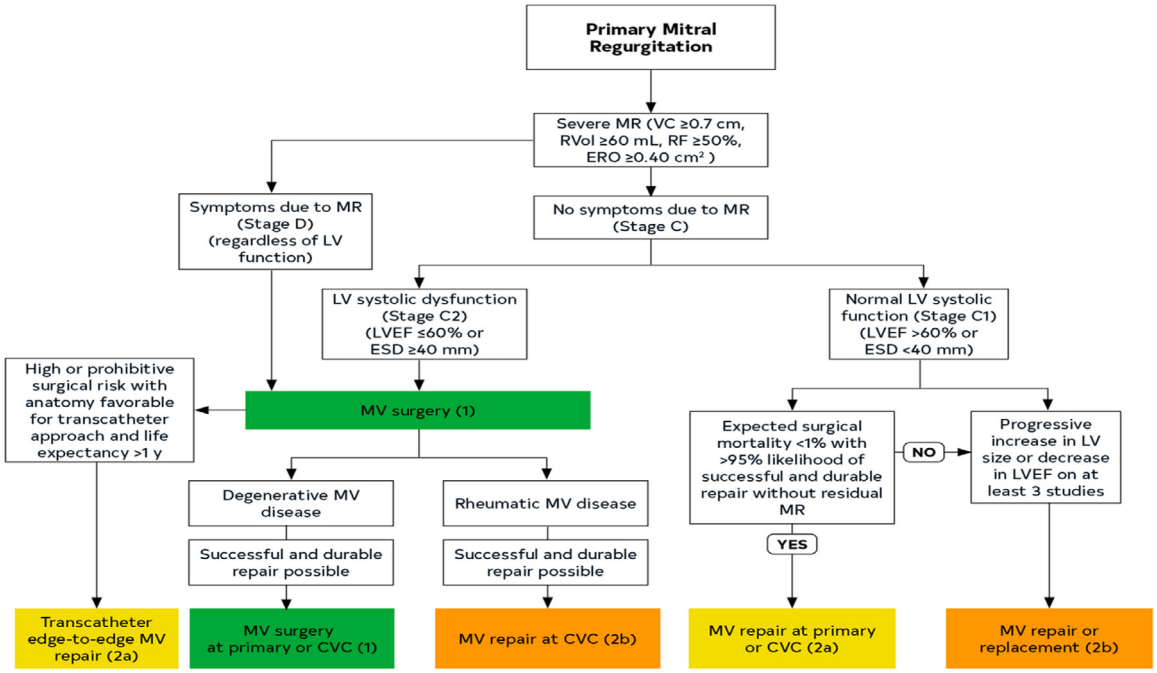

Fig 2. Timing, indications, and choice of intervention for primary mitral regurgitation. CVC, Comprehensive Valve Center; ERO, effective regurgitant orifice; ESD, end-systolic dimension; LV, left ventricular; LVEF, left ventricular ejection fraction; MR, mitral regurgitation; MV, mitral valve; MVR, mitral valve replacement; RF, regurgitant fraction; RVol, regurgitant volume; VC, vena contracta. Adapted from Otto et al.[6]

LVEF between 20% and 50%, and PASP ≤70 mmHg (class 2a) and (2) surgery also can be considered (class 2b). Figure 3 provides an algorithmic approach to intervention in chronic secondary MR.

Tricuspid Regurgitation

Primary tricuspid regurgitation (TR) results from a structurally abnormal valve, such as after IE, rheumatic heart disease, trauma, carcinoid syndrome, Epstein's anomaly, endomyocardial biopsy–related trauma, or pacemaker/implantable cardiac defibrillator–related valve dysfunction. On the other hand, functional TR occurs secondary to annular dilation and leaflet tethering as a result of right ventricular remodeling from either volume or pressure overload.[5,7,29] The 2020 ACC/AHA guidelines noted the importance of cardiac magnetic resonance imaging, computed tomography (CT), and three-dimensional (3D) echocardiography for right-sided valve assessment if TTE imaging is inadequate.[6] Unchanged from prior guidelines, when evaluating patients with TR, TTE was indicated to evaluate the presence, etiology, and severity of TR; measure the sizes of the right-sided chambers and inferior vena cava; assess right ventricular systolic function; estimate PASP; and characterize any associated left-sided heart disease (class 1). Invasive measurement of the cardiac index, right-sided diastolic pressures, pulmonary artery pressures, pulmonary vascular resistance, and right ventriculography can be useful when clinical and noninvasive data are inadequate or discordant (class 2a). In patients with signs and symptoms of right-sided heart failure attributable to severe TR (stages C and D), diuretics can be useful (class 2a).

Surgery for TR can be divided into concomitant surgery for those undergoing left-sided surgery and isolated valve surgery in the absence of left-sided surgery. These can be divided further into indications for primary and secondary (or functional) TR (Fig 4). In patients undergoing left-sided valve surgery, tricuspid valve surgery is recommended for patients with severe TR (class 1) or progressive TR if there is presence of (1) tricuspid annular dilation (end-diastolic diameter >4 cm) or (2) prior right-sided heart failure (class 2b). Isolated valve surgery may be reasonable in patients with right-sided heart failure and (1) severe primary TR (class 2a) or (2) severe isolated secondary TR attributable to annular dilation (in the absence of pulmonary hypertension or left-sided disease) in patients who are poorly responsive to medical therapy (class 2a). It also may be considered in asymptomatic patients with severe primary TR and progressive right ventricular dilation and dysfunction (class 2b). Lastly, it may be considered in patients who have undergone prior left-sided surgery and have severe right-sided heart failure and severe TR (without severe right-sided heart dysfunction or pulmonary hypertension) (class 2b). The recommendation to consider isolated tricuspid surgery for those with secondary TR and right-sided heart failure was new from the prior guidelines. In general, the guidelines were more detailed than the 2014 version and were very similar to the 2017 ESC/EACTS guidelines.[6-8] Transcatheter technologies still are not mentioned in the guidelines.[5,6]

Prosthetic Valves

In choosing between mechanical and bioprosthetic valve replacement, a shared decision-making process is required that

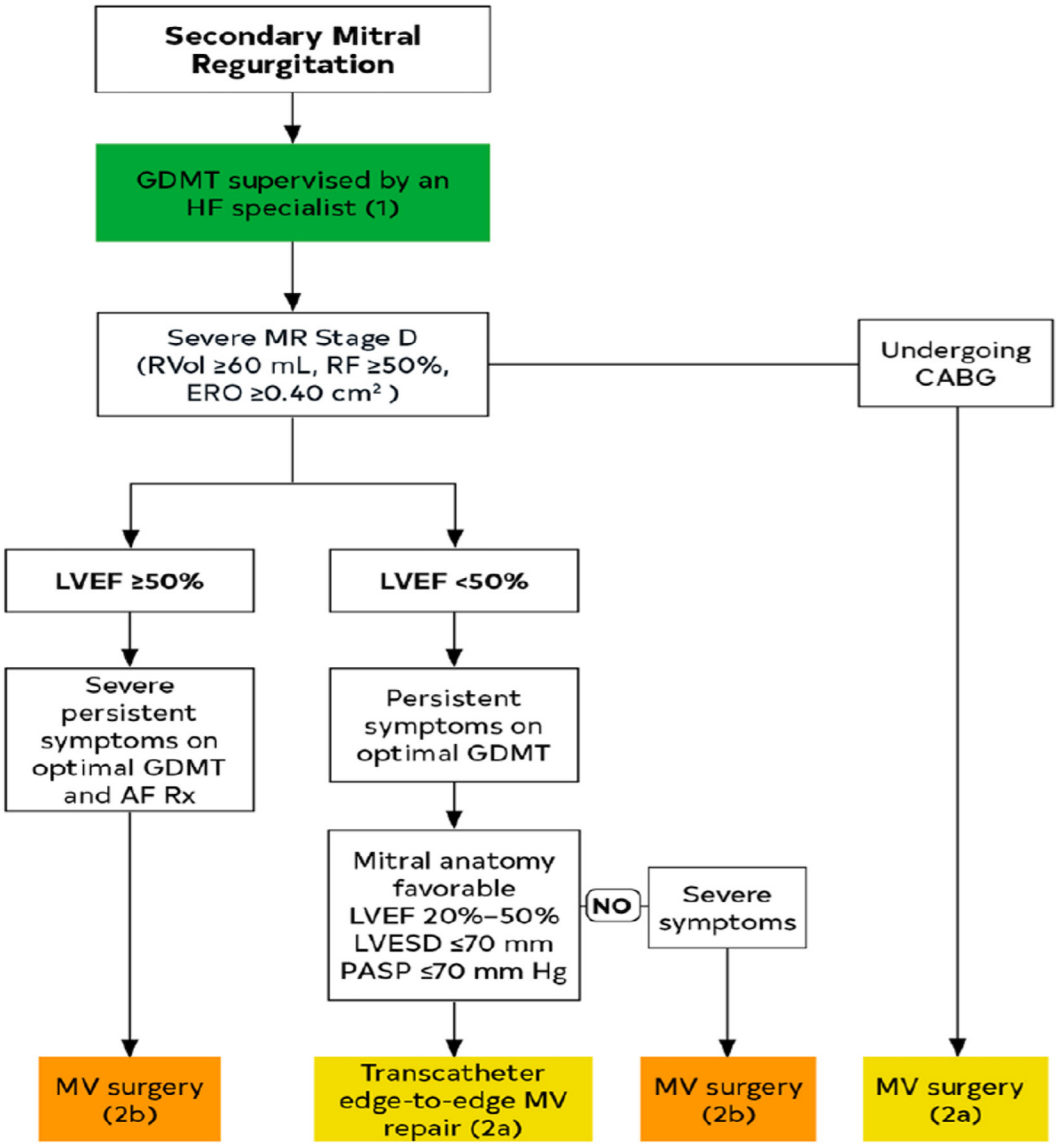

Fig 3. Timing, indications, and choice of intervention for secondary mitral regurgitation. AF, atrial fibrillation; CABG, coronary artery bypass graft; ERO, effective regurgitant orifice; GDMT, guideline-directed management and therapy; HF, heart failure; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic dimension; MR, mitral regurgitation; MV, mitral valve; PASP, pulmonary artery systolic pressure; RF, regurgitant fraction; RVol, regurgitant volume; Rx, medication. Adapted from Otto et al.[6]

accounts for the patient's preferences as well as the risks of anticoagulation and potential need for valvular reintervention (class 1). A bioprosthetic valve is recommended for patients of any age who require a valve replacement and in whom anticoagulation is not desired, cannot be managed appropriately, or is contraindicated (class 1). For patients younger than 50 years old who require an AVR and do not have a contraindication to anticoagulation, it is reasonable to consider a mechanical valve over a bioprosthetic valve (class 2a). For patients between 50 and 60 years old who require an AVR and do not have a contraindication to anticoagulation, it is reasonable to consider either a mechanical or bioprosthetic valve replacement (class 2a). For patients >65 years old who require an AVR, it is reasonable to choose a bioprosthetic valve over a mechanical prosthesis (class 2a). In select patients <50 years old who prefer a bioprosthetic aortic valve, replacement of the aortic valve by a pulmonic autograft (Ross procedure) may be considered at a CVC if the patient has the appropriate anatomy (class 2b). In patients who require a mitral valve replacement who are <65 years old, unable to undergo mitral valve repair, and do not have a contraindication to anticoagulation therapy, it is reasonable to choose a mechanical valve over a bioprosthetic valve (class 2a). A bioprosthetic mitral valve is a reasonable choice over a mechanical prosthesis if patients are ≥65 years old (class 2a).[6] All the guideline recommendations regarding choosing between mechanical and bioprosthetic valves have remained consistent since the ACC/AHA 2017 guideline update, with similar levels of evidence. However, the new ACC/AHA guidelines used the age of 65 (as opposed to age 70) as a decision point regarding bioprosthetic versus mechanical valve consideration.[6,9]

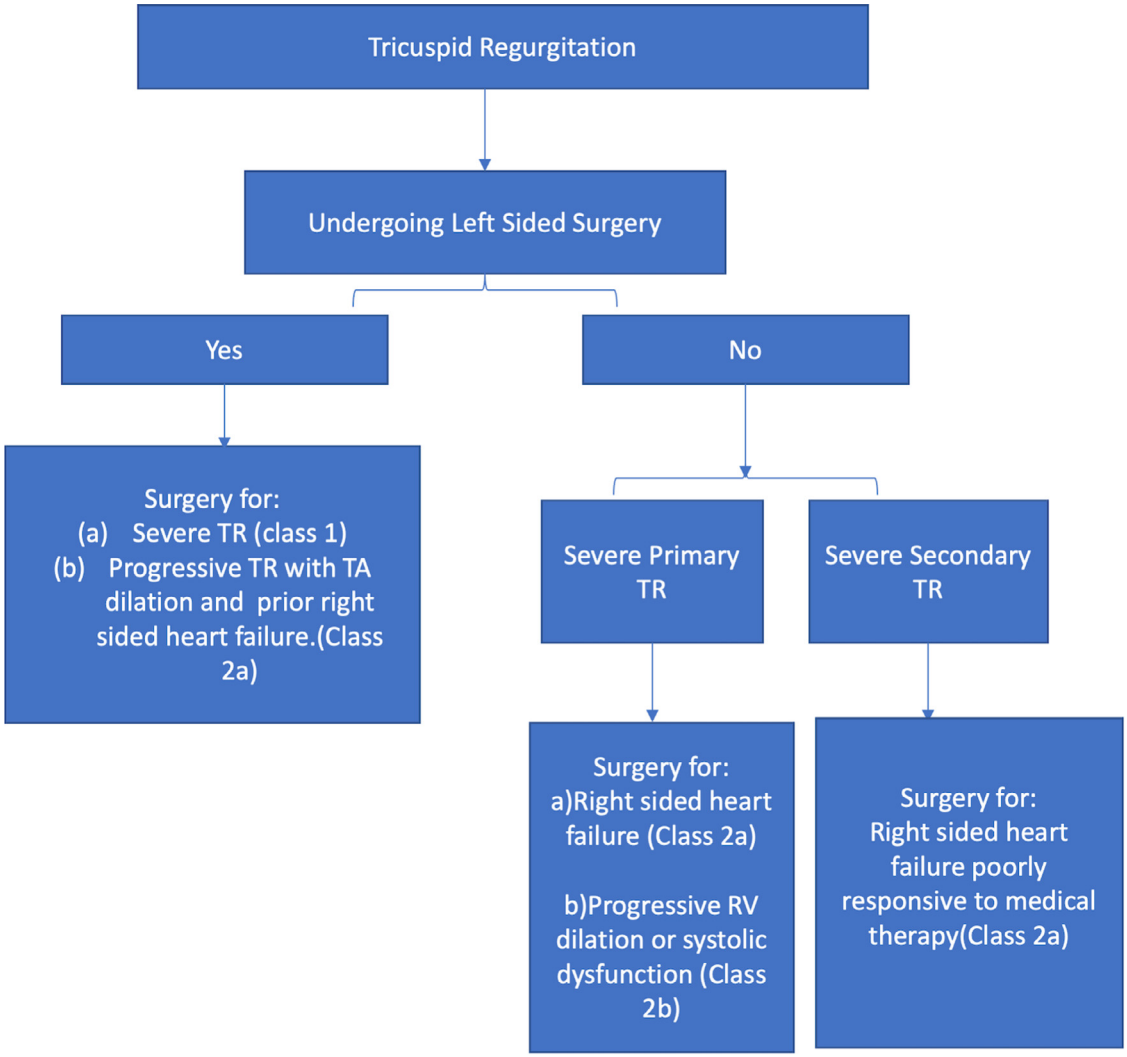

Fig 4. Timing and indications for intervention in tricuspid regurgitation. RV, right ventricular; TA, tricuspid annulus; TR, tricuspid regurgitation. Adapted from Otto et al.[6]

Anticoagulation Therapy for Prosthetic Valves

In all patients with mechanical valves, anticoagulation with a VKA is recommended (class 1). In patients with mechanical AVR with bileaflet or single-tilting disk prostheses and no risk factors for thromboembolism, anticoagulation to achieve an international normalized ratio (INR) of 2.5 is recommended. If a mechanical AVR patient has an older-generation prosthesis (eg, ball-in-cage) or has additional risk factors for thromboembolism (eg, AF, prior thromboembolism, LV dysfunction, hypercoagulable state), then an INR level of 3.0 is recommended (class 1). For mechanical mitral valves, an INR goal of 3.0 is indicated (class 1). For bioprosthetic surgically replaced aortic or mitral valves, aspirin, 75-to-100 mg daily is reasonable if there are no other indications for anticoagulation (class 2a). For patients with a bioprosthetic SAVR or mitral valve replacement who are at low risk of bleeding, anticoagulation with a VKA to achieve an INR of 2.5 is reasonable for at least three months and for as long as six months after surgical replacement (class 2a). For patients with a mechanical On-X (CryoLife, Kennesaw, GA) AVR and no thromboembolic risk factors, use of a VKA targeted to a lower INR (1.5-2.0) may be reasonable starting ≥three months after surgery, with continuation of aspirin, 75-to-100 mg daily (class 2b). These recommendations are consistent with the 2017 ACC/AHA valvular disease guideline update, with minimal changes in the level of evidence for the recommendations.[6,9]

Previously, the 2014 and 2017 ACC/AHA updates recommendeded that aspirin be given to all patients with mechanical valve in addition to VKA anticoagulation (class 1).[7,9] This recommendation has been updated to consider aspirin (75-100 mg daily) in patients with a mechanically replaced aortic or mitral valve who have an indication for antiplatelet therapy and when the risk of bleeding is low (class 2b).[6] Anticoagulation with dabigatran in patients with mechanical valve is contraindicated, and the use of anti-Xa direct oral anticoagulants has not been assessed and is not recommended (class 3).[6]

Bridging Therapy for Prosthetic Valves

With regard to bridging anticoagulation therapy for prosthetic valves, there has been little change between the 2014 ACC/AHA guidelines and the 2017 ACC/AHA update.[6,7,9] It still stands that in patients with mechanical heart valves who undergo minor procedures (eg, dental extractions or cataract removal) for which bleeding is easily controlled, it is recommended to continue VKA anticoagulation with a therapeutic INR (class 1). For patients with a bileaflet mechanical AVR and no other risk factors for thromboembolism who are undergoing invasive procedures, temporary interruption of VKA anticoagulation, without bridging agents while the INR is subtherapeutic, is recommended (class 1). The administration of four-factor prothrombin complex concentrate (or its activated form) is reasonable for patients with a mechanical valve receiving VKA therapy who require immediate/emergency noncardiac surgery or an invasive procedure (class 2a). For patients who are undergoing invasive procedures and have (1) a mechanical AVR and any thromboembolic risk factor, (2) an older-generation mechanical AVR, or (3) a mechanical mitral valve replacement, bridging anticoagulation therapy during the preoperative time interval when the INR is subtherapeutic is reasonable on an individualized basis, with the risks of bleeding weighed against the benefits of thromboembolism prevention (class IIa, C-LD).[6]

One new recommendation in the 2020 ACC/AHA guideline was regarding patients with bioprosthetic heart valves or annuloplasty rings who are receiving anticoagulation for AF. In these patients, it is reasonable to consider the need for bridging anticoagulant therapy around the time of invasive procedures based on the CHA2DS2-VASc score weighed against the risk of bleeding (class IIa, C-LD).[6]

Management of Excessive Anticoagulation and Serious Bleeding in Patients with Prosthetic Valves

There have been several new updates from previous ACC/AHA guidelines regarding the management of patients with prosthetic valves and excessive anticoagulation and/or serious bleeding. It still is considered reasonable, with an increased level of evidence, that patients with mechanical valves and uncontrollable bleeding who require immediate reversal of anticoagulation be given four-factor prothrombin complex (or its activated form) (class 2a).[6]

New guidelines regarding the use of vitamin K and reversal agents for NOAC therapies have been included in the 2020 ACC/AHA update. For patients with mechanical valves and uncontrollable bleeding who have received four-factor prothrombin concentrate complex, adjunctive use of intravenous vitamin K is reasonable if resumption of VKA therapy is not anticipated for seven days (class 2a). The benefit of individualized treatment with oral vitamin K, in addition to temporary withdrawal of the VKA, is unclear for patients with a mechanical prosthetic valve and supratherapeutic INR (>5.0) who are not actively bleeding (class IIb, C-LD). In patients with bioprosthetic valves or annuloplasty rings who are receiving a direct oral anticoagulant and who require immediate reversal of anticoagulation because of uncontrollable bleeding, treatment with idarucizumab (for dabigatran) or andexanet alfa (for anti-Xa agents) is reasonable (class 2a).[6]

Management of Thromboembolic Events with Prosthetic Valves

Similar to prior guidelines, for patients with suspected mechanical prosthetic valve thrombosis, urgent evaluation with TTE, transesophageal echocardiogram (TEE), fluoroscopy, and/or multidetector CT imaging is indicated to assess valve function, leaflet motion, and the presence and extent of thrombus (class I, B-NR). It is now recognized that 3D TEE or four-dimensional CT imaging can be useful to rule out leaflet thrombosis in patients with suspected bioprosthetic valve thrombosis (class 2a).[6,7,9]

The 2020 ACC/AHA guidelines contained several new recommendations for the management of patients with thrombosed prosthetic valves. Initial treatment with a VKA is reasonable in patients with suspected or confirmed bioprosthetic valve thrombosis who are hemodynamically stable and have no contraindications to anticoagulation (class 2a). Urgent initial treatment with either slow-infusion, low-dose fibrinolytic therapy or emergency surgery is recommended for patients with a thrombosed left-sided mechanical prosthetic heart valve who present with symptoms of valve obstruction (class 1). In patients with a bioprosthetic surgical or transcatheter aortic valve or bioprosthetic mitral valve who experience a stroke or systemic embolic event while on antiplatelet therapy, VKA anticoagulation, instead of antiplatelet therapy, may be considered after assessment of bleeding risk (class 2b). For patients with a mechanical mitral valve replacement who experience a stroke or systemic embolic event while in the therapeutic range on VKA anticoagulation, increasing the INR goal from 3.0 (range, 2.5-3.5) to 4.0 (range, 3.5-4.0) or adding daily low-dose aspirin (75-100 mg), with an assessment of bleeding risk is reasonable (class 2a). In patients with a mechanical AVR who experience a stroke or systemic embolic event while in the therapeutic range on VKA anticoagulation, it is reasonable to increase the INR goal from 2.5 (range, 2.0-3.0) to 3.0 (range, 2.5-3.5) or add daily low-dose aspirin (75-100 mg), with assessment of bleeding risk (class 2a).[6]

Diagnosis and Intervention of Prosthetic Valve Stenosis

There are several new recommendations in the 2020 ACC/AHA update with regard to imaging modalities for the assessment of prosthetic valve stenosis. In patients with suspected mechanical or bioprosthetic valve stenosis, TTE and TEE are recommended to diagnose the cause and severity of valve obstruction, assess ventricular function, and estimate PASP pressure (class 1). Fluoroscopy or cine-CT is recommended to assess motion of valve leaflets in patients with mechanical valve stenosis (class 1). Four-dimensional CT or 3D TEE imaging can be useful to rule out leaflet thrombosis in patients with bioprosthetic valve stenosis (class 2a).[6]

The management of prosthetic valve stenosis remains similar to previous versions of the ACC/AHA valvular guidelines. For patients with significant bioprosthetic valve stenosis attributable to suspected or documented valve thrombosis, oral anticoagulation with a VKA is reasonable (class 2a). Repeat surgical intervention is indicated unless surgical risk is high or prohibitive for patients with symptomatic severe stenosis of a bioprosthetic or mechanical prosthetic valve (class 1). A transcatheter valve-in-valve procedure is reasonable when performed at a CVC for severely symptomatic patients with bioprosthetic aortic valve stenosis and high or prohibitive surgical risk (class 2a).[6]

Diagnosis and Intervention of Prosthetic Valve Regurgitation

This updated set of ACC/AHA VHD guidelines contains more comprehensive recommendations for prosthetic valve regurgitation compared with prior guideline iterations. In patients with suspected mechanical or bioprosthetic valve regurgitation, TTE and TEE are recommended to determine the cause and severity of the leak, assess ventricular function, and estimate PASP (class 1). Surgery is recommended in patients with intractable hemolysis or heart failure attributable to prosthetic transvalvular or paravalvular leak unless surgical risk is high or prohibitive (class 1). Surgery is reasonable in asymptomatic patients with severe prosthetic regurgitation and low surgical risk (class 2a). Percutaneous repair of paravalvular leak is reasonable when performed at a CVC for patients with prosthetic paravalvular regurgitation with the following: (1) either intractable hemolysis or NYHA class III or IV symptoms, (2) high or prohibitive surgical risk, and (3) anatomic features suitable for catheter-based therapy (class 2a). For patients with severe heart failure symptoms caused by bioprosthetic valve regurgitation who are at high-to-prohibitive surgical risk, a transcatheter valve-in-valve procedure is reasonable when performed at a CVC (class 2a).[6] This last recommendation was updated from the 2017 guideline update to include all bioprosthetic valves (previously only aortic valves were addressed), providing a more inclusive recommendation statement.[6,9]

Considerations for Noncardiac Surgery

The guidelines stated that any patient who meets standard indications for intervention for VHD should be considered for intervention before elective noncardiac surgery depending on the urgency and risk of the surgery (class 1).[6] Patients with severe symptomatic AS who undergo noncardiac surgery have the highest risk for complications. Therefore, AVR should be considered before noncardiac surgery in these patients. The role of TAVR is unclear but certainly should be considered.[6,30]

Aortic Stenosis

The guidelines stated that it is reasonable to perform elective noncardiac surgery in patients with moderate or greater degree of AS and normal LV function (class 2a). For these patients, preoperative evaluation should include exclusion of severe coronary artery disease, and periprocedural optimization involves avoiding hypotension and tachycardia. Intraoperative monitoring with right-sided heart catheterization/pulmonary artery catheter and TEE should be performed as the case dictates. General anesthetics are well- tolerated, and the guidelines recommended the use of phenylephrine or norepinephrine as vasopressors in the absence of significant coronary artery disease.[31,32] Epidural or spinal anesthetic interventions should be modified to avoid rapid changes in blood pressure. High-dilution neuraxial local anesthetic agents should be used in combination with opioids.[6,33,34]

Mitral Stenosis

The guidelines stated that it is reasonable to perform elective noncardiac surgery in patients with moderate or greater degree of rheumatic MS with a PASP <50 mmHg (class 2a). The guidelines recommended invasive hemodynamic monitoring, avoidance of tachycardia (to maintain time in diastole), and careful maintenance of LV preload. The preload should be high enough to allow forward flow and be titrated carefully to avoid pulmonary edema.[6,35,36]

Mitral Regurgitation and Aortic Regurgitation

Regurgitant lesions are, in general, better tolerated than stenotic lesions. In asymptomatic patients with a moderate or greater degree of MR with a PASP <50 mmHg and normal LV function, noncardiac surgery is reasonable (class 2a). Similarly, in asymptomatic patients with a moderate or greater degree of AR and normal LV function, noncardiac surgery is reasonable (class 2a). In both these conditions, careful intraoperative invasive hemodynamic monitoring and TEE are recommended. In addition, the goal of anesthesia should be to avoid bradycardia (for both MR and AR) and increased afterload (for MR).[6]

Conflict of Interest

None.

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