The clinical challenge of concomitant aortic and mitral valve stenosis

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Abstract

The coexistence of mitral and aortic stenosis is not exceptional. Whereas rheumatic fever is currently plummeting in the Western countries, the incidence of degenerative disease is inversely increasing. The haemodynamic interactions which may interfere both with the usual echocardiographic parameters and with the invasive assessment may render the diagnosis difficult. The therapeutic challenges ensuing to the entity should not be underestimated. The nonuniformity and variability of multiple valve surgery has to be balanced with the risk of a second operation from the first valve surgery. The increased morbidity and mortality of multivalvular surgery has to be balanced with the risk of a second operation down the line if one valvular involvement, deemed of a lesser importance, is neglected. This complex situation requires the multidisciplinary approach of a heart team involving surgeons, cardiologists, geriatrists if need be and imaging specialists.

Keywords


INTRODUCTION

Multivalvular heart disease is a frequent situation, but there is still scarce medical literature about its management. Diagnosis can be difficult because of hemodynamic interactions that may interfere with the usual echocardiographic parameters, most of which have been validated only in patients presenting with an isolated mono-valvular dysfunction. Similarly, the invasive haemodynamic assessment that is usually recommended in the event of inconclusive or confusing non-invasive tests can be also difficult to interpret or even misleading due to diagnostic pitfalls. Finally, the therapeutic decision can be challenging in the heart team, and requires to balance the increased risk of multiple valve surgery against that of a second operation in case of an initially and less significant valve dysfunction is left untreated.

The combination of aortic (AS) and mitral stenosis (MS) is a particularly illustrative example. This situation is far from being exceptional. It was reported in 17% of 170 consecutive patients undergoing combined mitral-aortic surgery at the Zurich University Hospital.

Demographics vary between different regions of the world. In the so-called industrialized countries, coexisting severe or critical AS and MS are less frequently observed since this combination is usually very poorly haemodynamically tolerated, and access to care is usually sought before the occurrence of full-blown deterioration. Similarly, improved access to healthcare for young and ageing populations together have led to a paradigm shift in the epidemiology of multiple heart valve disease.

Typically rheumatic MS is associated with degenerative, “stiffening” of the mitral valve and eccentric fusion of the commissures, whereas degenerative AS usually results from progressive annular calcifications reaching the base of the leaflets and progressively reducing the leaflet mobility. Optimal medical and surgical treatments, however, sometimes fail to reach adequate haemodynamic results in rheumatic valve disease; thus, increasing the question of a prophylactic intervention on a moderately dysfunctional valve.

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can suppress the AS-related 4th heart sound, and both in the absence of atrial fibrillation, the presence of MS will be blunted by the decreased transvalvular flow. Echo cardiography usually provides the diagnosis, and the pressure half-time (≤ 10 mmHg) is also not exceptional even when mitral valve area is below 0.8 cm², and a relatively low pressure gradient (< 30 mmHg) is not.

Importantly, the rheumatic or degenerative aetiology of valve thickening should always be suspected. Echocardiography usually provides the diagnosis clues, and “protected” from coronary, MS, and AS can occasionally be recorded. However, several pitfalls should be kept in mind.

Because of an excellent correlation with the anatomical surface of explanted valves, echocardiographic two-and three-dimensional planimetry are usually considered as the gold-standard measurements to evaluate mitral valve area. The continuity equation remains accurate to assess both valvular areas because a low pressure gradient does not impair the accuracy of planimetry. Moreover, whereas the proximal isovelocity surface area method (Shone’s complex, mucopolysaccharidosis), drug-induced or post-infarction rupture are exceptional.

**DIAGNOSTIC PITFALLS**

The typical high pressure gradients of isolated severe MS causes of combined AS and MS such as congenital (dysplasia, complex, periocardial restrictive constrictive, drug-induced or post-infarction rupture) are exceptional.

In the absence of atrial fibrillation, the pressure half-time (> 10 mmHg) is also not exceptional even when mitral valve area is below 0.8 cm², and a relatively low pressure gradient (< 30 mmHg) is not exceptional. Therefore, multiple pitfalls should be kept in mind, as described in the early sections. The occurrence of a low flow situation can account for smaller pressure gradients in the case of severe mitral insufficiency. Therefore, a low pressure half-time (< 10 mmHg) is not exceptional even when mitral valve area is below 0.8 cm², and a relatively low pressure gradient (< 30 mmHg) is not.

If uncertainty about one or the other measure persists, the continuity equation remains useful to quantify mitral valve area in patients with bivalvular rheumatic disease, but it has yet not been validated in degenerative valvulopathy and mitral or aortic valve replacements.

**RAPEUTIC ISSUES**

According to the Society of Thoracic Surgeons database, the operative mortality is three times higher for myocardial revascularization and/or the presence of pulmonary hypertension as risk factors. In double valve replacement, although the risk of a thromboembolic hazard is higher after double mechanical than after single replacement, the latter will be reduced in situations where left ventricular compliance is impaired, leading to an overestimation of mitral valve area. The pressure half-time method that is commonly used as an alternative to the Gorlin formula underestimates aortic and mitral valve area, even in the presence of AS. However, the pressure half-time method is less appropriate when the pressure half-time exceeds 30 mmHg.

According to the Society of Thoracic Surgeons data-base, the operative mortality is three times higher for double valve replacement when compared to isolated aortic valve surgery (5.1% vs 1.7%), long-term post-operative survival after double valve surgery is lower than after single valve surgery (5-year survival rates of 78% vs 88%), and a high New York Heart Association class, a lower left ventricular ejection fraction and an indexed left ventricular end-diastolic volume, an overestimation of mitral valve area, but it cannot be used to assess the mitral valve area in the presence of a commissural fusion. Additionally, the presence of a commissural fusion is a contraindication to mitral valve replacements. Occasionally, the combination of a mitral valve replacement with aortic valve replacement is also performed. In such cases, the ATS/ESC/TS guidelines recommend aortic and mitral valve replacements.

The importance of a correct diagnosis is such that a left and right heart catheterization may be warranted. However, in this case, the occurrence of a low flow situation can account for smaller pressure gradients in the case of severe mitral insufficiency. Therefore, a low pressure half-time (< 10 mmHg) is not exceptional even when mitral valve area is below 0.8 cm², and a relatively low pressure gradient (< 30 mmHg) is not.

The physical examination can be misleading. Even if the absence of atrial fibrillation, the presence of MS may overestimate the aortic valve area and, conversely, the presence of AS may overestimate the mitral valve area. The continuity equation remains useful to quantify mitral valve area in patients with bivalvular rheumatic disease, but it has yet not been validated in degenerative valvulopathy and mitral or aortic valve replacements.

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Concomitant aortic and mitral stenosis

The American Heart Association/American College of Cardiology Guidelines on Valvular Heart Disease mainly address isolated valve disease and rheumatic strategies may be different in the presence of degenerative valvular disease (table 13). For example, transcatheter aortic valve implantation is usually staged at a patient with AS of degenerative etiology when additional indications for surgery coexist with severe aortic stenosis and a moderate or severe AS. In case of severe AS requiring surgery, including a surgical AVR, AVRs may be considered in the presence of severe MS requiring surgery including a surgical mitral valve replacement. The latter can also indirectly address rheumatic valve disease and therapeutic strategies may be different in the presence of degenerative mitral valve disease.

Rheumatic mitral valve

Double-valve surgery is preferable in patients with severe MS combined with severe AS. In case of severe AS, the leaflets usually do not preclude balloon dilatation and surgical mitral valve replacement. Therefore, in case of severe AS requiring surgery, a "passing" mitral valve replacement according to the American guidelines (Class IIb, level of evidence C). According to the same guidelines, a "passing" aortic valve replacement can be contemplated in the presence of severe MS requiring surgery, including a surgical AVR (Class IIa, level of evidence B). Only in case of an evident decalcification at the fragile level of the posterior atrioventricular groove, with an increased risk of the lethal complication of atrioventricular dehiscence, especially in multivalvular and previously irradiated patients, where extensive calcifications must be removed.

Concomitant mitral valve surgery may be considered for patients with severe mitral valve disease at the time of aortic valve replacement. The absence of commissural fusion and the calcification of the mitral annulus may hamper the performance of a transcatheter mitral valve implantation (Class IIa, level of evidence C). In case of a non-severe mitral stenosis and severe aortic stenosis, the US Food and Drug Administration (FDA) approval of the Edwards SAPIEN XT and the Edwards SAPIEN 3 transcatheter heart valves with a balloon-expandable metal stent, now only recommended for patients with severe mitral stenosis and a medium to severe AS, is an option (Class IIb, level of evidence C). The latter can also indirectly address rheumatic valve disease and therapeutic strategies may be different in the presence of degenerative mitral valve disease.
procedure, and it is not unlikely that rejecting patients for principle for the same reason may be a redundant error. The advent of transcatheter aortic valve replacement has significantly impacted this paradigm, allowing treating high-risk patients with severe AS despite concomitant moderate MS. Transcatheter mitral valve implantation is a validated initial option in currently high-risk patients with severe MS who have only mildly elevated risk and who prove to be fit for a percutaneous mitral valvuloplasty.

In the case of a viable mitral and aortic anatomy and candidates range of risk, a percutaneous treatment combining mitral balloon valvuloplasty and transcatheter aortic valve implantation can be considered, but the increased risk of major complications has to be balanced with the low risk of second surgical operation down the line if one valve for implantation is denied surgery. These complex situations require the multidisciplinary approach of a heart team involving surgeons, cardiologists, and imaging specialists.

CONCLUSIONS

The coexistence of MS and AS is not exceptional. If dominance exists in currently managing, in the Western countries, the occurrence of degenerative disease is currently increasing. It is important not to underestimate the diagnostic and therapeutic challenges raised by this entity. The increased morbidity and mortality of multivalvular surgery has to be balanced with the risk of a second operation down the line if one valve for implantation is denied surgery. These complex situations require the multidisciplinary approach of a heart team involving surgeons, cardiologists, and imaging specialists.

CONFLICT OF INTEREST:

None.