Emergencies in valve disease

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Purpose of review

This review will deal with strategies for emergency management of patients with valve disease, a situation that is now rare but remains a very challenging problem: valvular patients are often elderly with a high frequency of comorbidity; furthermore, there is a growing proportion of previously operated patients who present with further problems.

Recent findings

The main treatment is valve replacement, however, the conservative surgical approach is developing, and, more recently, percutaneous interventional techniques have been introduced. Percutaneous mitral commissurotomy is an established treatment for mitral stenosis whereas transcatheter aortic valve implantation, which is presently at the evaluation phase, shows promise.

Summary

The keys to success are establishing a rapid diagnosis based mainly on echocardiography followed by early intervention. Every effort should be made to avoid performing intervention in an emergency setting, as it is always of high risk. Strategies include better patient and physician education in order to decrease the incidence of endocarditis and prosthetic-related complications such as thromboembolism and considering earlier intervention when symptoms or objective signs of ventricular dysfunction are observed in patients with known valve disease.

Keywords

endocarditis, percutaneous valve intervention, valve disease, valve prosthesis

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Introduction

Valvular heart disease (VHD) remains common and often requires intervention. In recent years in Western countries, degenerative aetiology is far more frequent than rheumatic diseases. The incidence of endocarditis remains stable. Valvular patients are now mostly elderly with a high frequency of comorbidity, which should be taken into account for decision-making [1–3]. Finally, there is a growing proportion of previously operated patients who present with further problems.

When presenting in an emergency setting, valve disease may or may not be known, thus, rapid diagnosis, relying mainly on clinical examination as well as echocardiography, which is the main noninvasive examination, is key. Cardiac catheterization has virtually no indications in these patients except the performance of coronary angiography, which is mandatory except in rare circumstances such as if the haemodynamic condition does not allow for it or if there is a large vegetation in front of the left main coronary [3,4••].

The main treatment is valve replacement, but the conservative surgical approach is developing, and, more recently, percutaneous interventional techniques have been introduced.

In current practice, the incidence of emergency valve surgery is rare overall, 2% in the Euro Heart Survey [1], but represents a major clinical challenge because of its consequences in terms of mortality and morbidity [5,6•].

Aortic stenosis

Aortic stenosis is the most frequent native valve disease today [1].

Haemodynamic failure is rare and may occur at the end stages of disease due to continued deterioration of condition or can be precipitated by cardiac complications, such as atrial fibrillation, or acute myocardial infarction; noncardiac complications, such as respiratory infection; or, complications linked to invasive examination [7]. Finally, aortic stenosis may be discovered at the onset

of shock or after cardiac arrest. Clinical examination is particularly difficult in such settings, and the murmur may be faint with only a mild murmur of mitral regurgitation and signs of congestive heart failure.

Transthoracic echocardiography (TTE) can be used to diagnose aortic stenosis and assess the prognosis. Transoesophageal echocardiography (TEE) carries a very high risk in this setting and is not recommended if TTE is adequate.

Inotropic agents and diuretics may transitively improve heart failure, however, intervention should always be considered and not be differed.

In patients in shock or in severe heart failure, data are limited but consistently show that aortic valve replacement (AVR) carries a very high risk, with the perioperative mortality ranging from 25 to 50%, however, the most recent improvements in surgical and postoperative care are now able to provide better results [8,9]. Percutaneous balloon aortic valvuloplasty (PAV) has a very limited role as its efficacy is low and complication rate is quite high, and re-stenosis with clinical deterioration occurs within a couple of months. PAV can be considered as a bridge to surgery in haemodynamically unstable patients who are at high risk for surgery [3,4••]. This recommendation, however, is supported by few data [10–13]. Such bridging PAV could be proposed if the institution has experience in PAV, patients have acceptable, or at least uncertain, life expectancy, and if the contraindication for surgery is temporary. If PAV is successful, aortic valve surgery, with or without by-pass grafting, should be performed early. On the contrary, medical treatment is probably the best option in definitely inoperable patients such as frail octogenarians or those with malignant diseases, very severe respiratory insufficiency, or left ventricular dysfunction resulting from large myocardial scar.

Preliminary reports show that transcatheter aortic valve implantation (TAVI) is feasible and provides significant haemodynamic improvement, resulting in sustained clinical improvement up to 2 years [14,15•,16,17•]. However, today, this technique is under evaluation with pending questions remaining on safety and long-term results. If, after careful evaluation, it holds true to its promise it will be a very useful adjunct in this setting.

Mitral stenosis

Presentation in emergency of these patients is very rare which explains the lack of data.

Mitral stenosis may deteriorate causing patients to present in shock: In developing countries where rheumatic disease is still frequent [18], young patients can be seen initially at an advanced stage of the disease with pulmonary oedema, low cardiac output and shock. In the Western world, patients with refractory heart failure usually are at the end stages of the disease with advanced age, poor general condition and frequent comorbidities [19]. In both situations there is often a precipitating factor such as respiratory infection, anaemia, atrial fibrillation, or more specifically pregnancy in developing countries. Finally, in some cases mitral stenosis may not yet be diagnosed.

Here, again clinical presentation may be dominated by pulmonary oedema. Auscultation may be difficult in this setting and echocardiography is key both to diagnose the disease and assess its severity as well as the applicability of percutaneous mitral commissurotomy (PMC). TEE should be performed to eliminate the presence of left atrial thrombosis.

In these patients, the risk of surgery is extremely high with mortality of valve replacement ranging from 20 to 50%, and PMC is the preferred solution [3,4••,19].

The first step is to exclude contraindications to PMC, which here are fewer than usual. The presence of large or floating thrombus is self-evident if it is localized in the left atrial cavity or in the septum, but PMC can be considered if the thrombus is localized in the left atrial appendage and not protruding. It can also be done in patients with moderate mitral regurgitation. Severe valvular calcification is a relative contraindication. PMC is a viable option in young patients, because good immediate and midterm results can be obtained, despite a higher immediate risk [19–24]. This is of particular interest during pregnancy. In such cases even if the initial result is suboptimal, PMC can be a useful life-saving procedure and will serve as a bridge to lower the risk of secondary surgery. In the elderly population, decision-making is more difficult [25]. An individualized approach should be favoured. The procedure should probably not be performed in elderly patients at the end stage of the disease where all predictors of poor results, both clinical and anatomic, are present.

Aortic regurgitation

Aortic regurgitation is observed in 13% of patients with native VHD [1].

Acute severe aortic regurgitation in a nondilated left ventricle causes a large increase in end diastolic pressure whereas cardiac output increases as there is no compensatory increase in stroke volume accounting for poor haemodynamic tolerance.

The clinical presentation is often pulmonary oedema. Diastolic murmur and peripheral signs are attenuated.

Echocardiography is a key examination and should comprise TEE if haemodynamic status allows for it.

Patients with acute aortic regurgitation during endocarditis have a dismal diagnosis without intervention [26–28]. Nitroprusside and inotropic agents such as dopamine or dobutamine are useful in poorly tolerated acute aortic regurgitation to stabilize the clinical condition before surgery.

When patients present with cardiogenic shock, AVR should be undertaken immediately.

Surgery is also recommended promptly if there are patent signs of left ventricular failure such as tachycardia, S3 or orthopnoea with echographic signs of unfavourable outcome such as early mitral closure. Early intervention is also recommended, in cases of intracardiac destruction such as abscesses or in patients with persistent fever after several days of antibiotics if no other cause is diagnosed. Furthermore, early surgery should be considered in patients with recurrent embolism. Finally, surgery may be considered in the presence of mobile vegetations more than 10 mm within the first week of antibiotic therapy in patients otherwise at low risk for surgery [3,26–33].

The use of homografts is restricted to patients with severe perivalvular damage.

If acute aortic regurgitation is seen in the context of dissection of the descending aorta, a replacement of the ascending aorta should be associated with valve replacement [3,4••].

Severe acute aortic regurgitation could be due to blunt trauma, mostly motor vehicle accidents. After trauma, even if reconstructive repair has been described, most commonly valve replacement is necessary [34].

Massive aortic regurgitation seldom occurs after PAV but will require emergency AVR or, in the future, TAVI, if the clinical condition of the patient allows for it.

Acute mitral regurgitation

Mitral regurgitation is the second most common native valve disease as it is observed in 33% of cases [1].

Acute mitral regurgitation induces an immediate decrease in afterload, left ventricular emptying increases and left atrial pressure rises acutely, which is transmitted back to the pulmonary circulation. Forward stroke volume is reduced in clinical presentation, shock or severe dyspnea with acute pulmonary oedema.

The murmur is shortened and may be inaudible in cases of papillary muscle rupture with low output [35,36]. Here, again, echocardiography is key. TEE is also very useful in this setting and can be performed preoperatively.

Acute mitral regurgitation is poorly tolerated and carries a poor prognosis in the absence of intervention, which is indicated urgently [36].

Reduction of filling pressures can be obtained using vasodilators such as nitroprusside [37]. In the presence of systemic hypotension, intraaortic balloon pump helps to stabilize the patient before surgery [4••]. Inotropic agents should be added in cases of hypotension.

The rupture of papillary muscle, more frequently ahead of the posterior medial muscle, is a rare and dramatic complication of acute myocardial infarction. In such patients, the presence of shock contrasts with a hyperdynamic heart on echocardiography. The rupture of the papillary muscle necessitates urgent surgical treatment, which is most often valve replacement, even if valve repair can be successfully performed in selected circumstances, such as younger patients, if the rupture is partial, and the surrounding tissue is of good quality. Myocardial revascularization is associated in most cases [3,4••,38].

The need for surgery in the context of endocarditis is less frequent than on the aortic side. The feasibility of mitral valve repair depends on tissue quality and the expertise of the surgeon [39]. The indications for urgent surgery are the same as in acute aortic regurgitation. In cases of mitral endocarditis, surgery can also be considered after the first episode of embolism in patients with large mobile vegetation if there is high likelihood of valve repair, surgery carries a low risk, and the patient has low comorbidity. After stroke, the indication and the timing for surgery should be discussed on an individual basis between cardiologists, neurologists, and cardiac surgeons after comprehensive brain imaging. Urgent surgery should considered if there is no intracerebral bleeding and if there are clear cardiac indications such as pulmonary oedema, whereas it is delayed in patients with intracerebral bleeding or large ischaemic damage [3,4••,31–33].

Traumatic mitral valve injury occurs less frequently than tricuspid trauma. It is more commonly associated with dramatic haemodynamic compromise, and the majority of cases are operated on within hours of the injury. Mitral valve replacement is often used, even if repair can be more successful here than in infarction because the rupture of papillary muscle in traumatic injury is often associated with less myocardial necrosis and diffuse injuries in an ischaemic setting [40].

Severe mitral regurgitation after balloon commissurotomy seldom necessitates urgent surgery, except in cases with poor haemodynamic tolerance. Surgery will mostly necessitate valve replacement due to the severity of underlying disease more than to the presence of the valvular tear itself [19].

Patients with valve prosthesis

Patients who have undergone previous valve replacement represent an important proportion of patients with VHD [1].

Occlusive prosthetic thrombosis is characterized by impaired motion of the mobile part of the prosthesis. It is more frequent in patients with mechanical prosthesis and should be suspected promptly in any patients with any type of prosthetic valve who present with a recent increase in shortness of breath or embolic event. Inadequate anticoagulation is the most important risk factor [41,42]. The diagnosis should be immediately confirmed by echocardiography(TTE and TEE) and also fluoroscopy showing an increase in gradient and decreased mobility of the leaflets [3,4••].

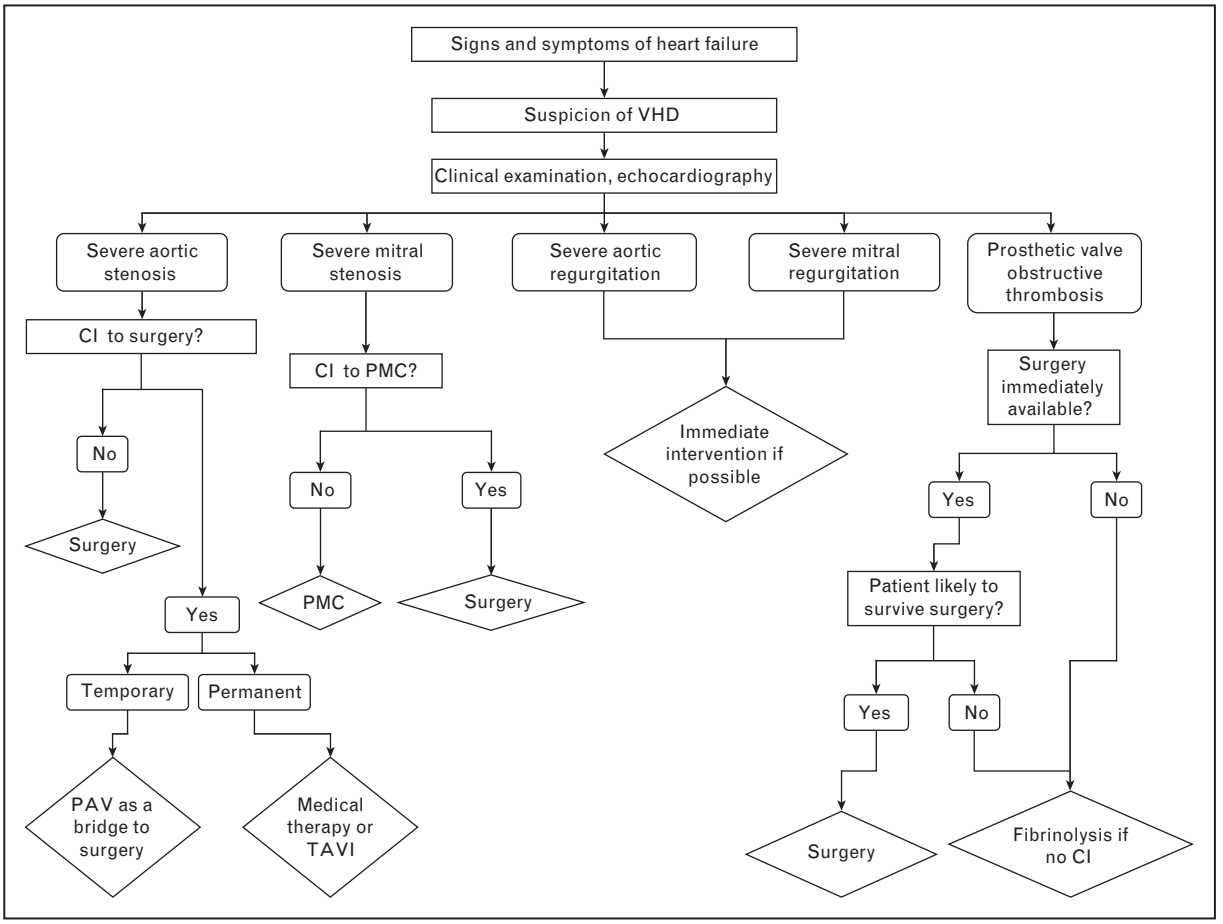
Clinical examination is often difficult in this setting because of frequent pulmonary oedema.

The management of prosthetic thrombosis is of high risk whatever the option taken. Surgery is of high risk as it is most often performed in emergency conditions and is re-intervention. On the contrary, fibrinolysis carries a risk of bleeding, systemic embolism, and recurrent thrombosis.

The risk/benefit analysis of fibrinolysis should be adapted to patient characteristics and local resources.

Emergency valve replacement is the treatment of choice in obstructive thrombosis in critically ill patients without serious comorbidity [3,4••]. If the thrombogenicity of the prosthesis is an important factor, it should be replaced by a less thrombogenetic prosthesis.

Figure 1 Emergency management of valvular heart disease



CI, contraindications; PAV, percutaneous balloon aortic valvuloplasty; PMC, percutaneous mitral commissurotomy; TAVI, transcatheter aortic valve implantation; VHD, valvular heart disease.

Fibrinolysis should be considered in critically ill patients unlikely to survive surgery because of comorbidities or severely impaired cardiac functions, situations in which surgery is not immediately available and patients cannot be transferred, and thrombosis of tricuspid valve because of the higher success rate and lower incidence of embolism [43–46]. Fibrinolysis is less likely to be successful with mitral prosthesis, chronic thrombosis, and in the presence of pannus, which can be difficult to distinguish from thrombus.

If the patient presents with thromboembolism, thorough investigation is essential including cardiac and noncardiac imaging to allow for appropriate management [4••].

Emergency management of prosthetic valve endocarditis may be necessary in 10–15% of patients operated on for active endocarditis (Fig. 1). Prosthetic aortic valve endocarditis accounts for the majority of cases. In the current era, larger and earlier surgical intervention is increasingly advised according to the indications mentioned earlier [3,26].

Aortic homograft is the prosthesis of choice for complex aortic valve endocarditis.

Structural dysfunction of mechanical valves such as disk escape, which occurred with the Björk–Shiley convex or concave prosthesis, is now extremely rare.

Emergency intervention for bioprosthesis failure is rare and carries a very high risk not only due to the cardiac condition but also the noncardiac condition because these patients are often elderly. It is here again mandatory to avoid such situations and to envisage re-intervention when there are clear signs of valve failure, and if the condition of the patient allows for re-intervention [3,4••,47,48]. In the future, TAVI is a promising way forward for research; however, at the present stage, only a few cases have been performed.

Conclusion

Emergency management of patients with valve disease is now rare but remains a very challenging problem. The keys for success are establishing a rapid diagnosis, based mainly on echocardiography, followed by early intervention. Such intervention performed in an emergency setting will always carry a high risk and every effort should be made to avoid such circumstances by using better prevention, which will be based – firstly, on better education of patients and physicians in order to decrease the incidences of endocarditis and prosthetic-related complications such as thromboembolism – secondly, on considering earlier intervention when symptoms or objective signs of ventricular dysfunction are observed in patients with known valve disease.

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Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 613–614).

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