

## THEMATIC REVIEW

### EDUCATIONAL SERIES ON THE SPECIALIST VALVE CLINIC

# Challenges in the diagnosis and management of valve disease: the case for the specialist valve clinic

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## Abstract

Valvular heart disease (VHD) is responsible for a major societal and economic burden. Incidence and prevalence of VHD are high and increase as the population ages, creating the next epidemic. In Western countries, the etiology is mostly degenerative or functional disease and strikes an elderly population with multiple comorbidities. Epidemiological studies have shown that VHD is commonly underdiagnosed, leading to patients presenting late in their disease course, to an excess risk of mortality and morbidity and to a missed opportunity for intervention. Once diagnosed, VHD is often undertreated with patients unduly denied intervention, the only available curative treatment. This gap between current recommendations and clinical practice and the marked under-treatment is at least partially related to poor knowledge of current National and International Societies Guidelines. Development of a valvular heart team involving multidisciplinary valve specialists including clinicians, imaging specialists, interventional cardiologists and surgeons is expected to fill these gaps and to offer an integrated care addressing all issues of patient management from evaluation, risk-assessment, decision-making and performance of state-of-the-art surgical and transcatheter interventions. The valvular heart team will select the right treatment for the right patient, improving cost-effectiveness and ultimately patients' outcomes.

## Key Words

- ▶ valvular heart disease
- ▶ heart team
- ▶ imaging
- ▶ aging

## Introduction

Epidemiological studies have shown that the incidence and prevalence of valvular heart disease (VHD) are high and increase as the population ages. With the changing demographics of the population, a new epidemic of cardiac disease is on the horizon. In contrast to many other cardiac conditions, there is no treatment to prevent or slow the progression of valve disease and the only curative treatment is the performance of a valve intervention,

surgically or through a transcatheter approach, which has dramatically increased this last decade. Optimal management of patients with VHD requires accurate screening for the disease, regular follow-up and timely intervention with individualized therapeutic decision-making. Recent epidemiological data and surveys clearly show that these conditions are not being met and a significant proportion of patients with VHD are

receiving unsatisfactory management and a resultant adverse prognosis with an increased risk of mortality and morbidity. In this article, we highlight the burden of VHD, identify critical challenges and unmet medical needs in VHD, and present how the implementation of a valve clinic with VHD specialists/valvular heart team can circumvent these issues and improve patient outcome.

The following clinical vignettes illustrate many of the challenges encountered during management of the VHD patient. These vignettes highlight critical issues in the management of VHD: (1) late diagnosis and late referral; (2) poor knowledge of current guideline recommendations; (3) incorrect assessment of the risk-benefit balance of interventions; (4) complexity of the evaluation of patients with VHD; (5) uncertainties regarding the appropriate management of certain subsets of VHD patients; and (6) the high burden of comorbidities.

The first patient is a 82-year-old woman referred for the evaluation and management of severe organic mitral regurgitation (MR). Her past medical history is remarkable for moderate chronic kidney disease and rheumatoid arthritis. She was known to have MR as a result of mitral valve prolapse, for several years. Two years ago, she was diagnosed with paroxysmal atrial fibrillation at the time of a transient ischemic attack. She continued to be conservatively managed as surgery was deemed to be at too high risk by her general practitioner. She was eventually admitted to a tertiary care center with congestive heart failure, where she was found to be in atrial fibrillation with moderate left ventricular systolic dysfunction and a high systolic pulmonary artery pressure. This patient should have been referred to a valve clinic at the time of the first occurrence of atrial fibrillation, which is a clear recommendation for intervention. The valve clinic specialists would have provided an appropriate evaluation of risk-benefit balance, discussed the therapeutic options (transcatheter versus surgery) and performed a timely intervention before the occurrence of complications that are known to adversely affect outcomes. The second patient is a 69-year-old man in chronic atrial fibrillation who developed progressive fatigue and shortness of breath. When a cardiologist first assessed him, the diagnosis of severe isolated functional tricuspid regurgitation was made with moderate-to-severe right ventricular enlargement and dysfunction. Conservative management with diuretics was recommended. His functional status continued to worsen despite progressively higher diuretic doses and he was finally admitted in severe right ventricular heart failure with pleural effusions, ascites and severe right ventricular dysfunction. A tricuspid valve repair was performed but

the patient died from multi-organ failure after several weeks in the intensive care unit. Similarly, the risk-benefit balance was not correctly evaluated, and the window for intervention was missed. The third patient is a 76-year-old woman with severe chronic obstructive pulmonary disease and low-gradient aortic stenosis (AS) with a preserved left ventricular (LV) ejection fraction. The valve area was 0.75 cm<sup>2</sup>, but the mean pressure gradient was 22 mmHg. She was NYHA class III. The AS was considered severe based on the valve area and the patient was referred for transcatheter aortic valve replacement. Severity of the disease was uncertain as the patient presented with a low gradient. A repeat echocardiography should have been performed and additional tests such as a CT should have been performed to ascertain AS severity. The last patient is a 57-year-old man with severe secondary MR. He was admitted 18 months earlier as a late presentation anterior myocardial infarction. Despite complete myocardial revascularization and optimal guideline-directed medical therapy, he remained with NYHA class III symptoms with a low LV ejection fraction (30%) and severe secondary MR. Treatment of secondary MR is debated and the patient might benefit from an evaluation in an expert center and the possibility of transcatheter therapy.

## The burden of VHD

The marked decrease in the prevalence of rheumatic disease in Western countries has been largely counterbalanced by the increased prevalence of degenerative VHD with aging of the population. As the population's age pyramid inverts, the proportion of the population ≥65 years is expected to increase from 15% in the 1950s to more than 40% in 2050. VHD increases with age and the prevalence of moderate/severe AS or MR is currently estimated to be as high as 5% in individuals above the age of 75 years (1). Similar to other cardiac epidemics linked to the aging population, namely atrial fibrillation and congestive heart failure, the incidence and prevalence of functional VHD such as secondary MR or functional TR have also markedly increased. A recent study has shown that moderate/severe TR is now as common as MR or AS (2). A National registry using the entire Swedish population demonstrated the same increasing trend for both AS and MR (3). In the OxVALVE study, including 2500 individuals aged ≥65 years screened by transthoracic echocardiography, previously undetected VHD affected one in two individuals and the prevalence of significant (moderate or severe) undiagnosed and/or known VHD was 11% (4). Projecting these findings using population data,

the prevalence of clinically significant VHD is expected to double by 2050 from 1.5 million in 2015 to 3.3 million in 2056 in the UK (+122%).

## An elderly population with frequent comorbidities

Because the main etiology of VHD in Western countries is degenerative or functional disease affecting an elderly population, patients with VHD often present with comorbidities. In the European Heart Survey, now 15 years old, comorbidities were highly prevalent in patients with native VHD (5). The most common comorbidities were diabetes, coronary artery disease, chronic kidney dysfunction and chronic obstructive pulmonary disease. More recently, the IMPULSE registry, a prospective multicenter registry from 23 centers across 9 European countries, evaluated the contemporary (2015–2017) presentation and management of 2171 patients with severe AS (6). Mean age was 78 years and a total of 16% of the population had atrial fibrillation, 7% had previously undergone cardiac surgery and approximately one quarter of patients suffered from severe renal impairment, while 2.0% were on dialysis. Overall, 32% of patients presented with one comorbidity and 20.7% with two or more comorbidities. In addition, 32.0% of patients were considered mildly frail and 5.1% severely frail. It is worth noting that patients referred for surgery are a highly selected population that is not representative of the overall population of patients suffering from VHD. Using an administrative database of all admissions (>100,000) to French hospitals in 2014–2015 with MR as the primary or secondary discharge code were collected (two-third of patients presented with primary MR and one-third with secondary MR), patients who underwent an intervention compared to those who were conservatively managed were 10 years younger (67 vs 77 years) and the Charlson Index accounting for comorbidities was half (1.2 vs 2.4).

## Underdiagnosis and late presentation

VHD are progressive diseases, but may remain silent for decades. In order to perform timely interventions and institute curative treatments, VHD has to be recognized and appropriately followed. Currently, identification of VHD relies mainly on cardiac auscultation and the detection of a murmur. Recent surveys have clearly shown an underuse of auscultation by primary care physicians.

A contemporary survey was recently conducted in a wide range of European practitioners (554 physicians, 115 general practitioners, 215 general cardiologists, and 224 sub-speciality cardiologists or surgeons) to assess their perceived needs in knowledge, skills and confidence, and their actual practice according to case scenarios (7). Only half of general practitioners performed a systematic auscultation in this survey. These findings were corroborated by another survey using 8680 participants aged 60 years or older from nine European countries (8). The two main findings of the survey were that (1) there was a low awareness/concern of VHD in the population, far less than cancer, stroke, Alzheimer's disease or diabetes and (2) cardiac auscultation was performed at less than every second visit in more than half of the population. Auscultation is currently the only widely available method to detect VHD in large populations, but it has limited sensitivity (9). The development of point of care echocardiography and its use in is expected to increase the sensitivity of the diagnosis of VHD. Potential benefit of point of care echo in various setting such as 'murmur clinic' or family practice settings has been reported (10, 11, 12). Nevertheless, in order to improve VHD diagnosis, point-of-care echocardiography has to be used by general practitioners more often than they currently used a stethoscope, which remains uncertain.

Late diagnosis leads to late presentation and increased mortality and morbidity. Despite current recommendations emphasize the importance of the performance of an early surgery, a recent report issued from the STS database showed that among patients referred for isolated mitral valve surgery in the 2011–2016 period, half of the patients presented with a recent history of heart failure or a reduced ejection fraction and one quarter presented with severe pulmonary hypertension (13). This late referral was also observed in the IMPULSE registry, where 40% of patients presented with severe symptoms and 30% with left ventricular dysfunction.

## Marked under-treatment and insufficient knowledge of care providers

When the diagnosis is made, timely intervention and individualized therapeutic decision-making are required to insure the best patient outcomes. However, this aspect of care is critically deficient. In a recent community-based cohort study, moderate/severe MR was associated with an excess mortality and morbidity including heart failure but only one-fifth of the population actually

underwent a mitral valve intervention despite guideline-based class I surgical indications (14). Interestingly, under-treatment was observed despite the fact that all patients had an echocardiogram, reports were provided to their care providers, and patients had easy access to a world-class tertiary center (Mayo Clinic). Similar findings have been reported by others (15). In Europe and in the United States at a nationwide level, less than 10% of patients with MR underwent valve intervention within 1 year following hospital admission. The marked under-treatment of patients with VHD is clearly apparent by the steady increase of transcatheter aortic valve replacements (TAVR) (16). Between 2007 and 2015, the total number of AVRs performed in France increased by 80% from 10,900 to 18,700. The number of surgical AVRs remained stable and the increased volume was mainly due to an increase in TAVR performance. It is unlikely that the increased number of TAVR related to an increase in AS incidence, but more likely that a large number of conservatively managed patients could now be treated with the development of a less invasive alternative to surgery. Nevertheless, in the IMPULSE registry, 20% of patients with severe symptomatic AS are still denied any intervention (17).

How do we explain the under-treatment of patients with VHD? Potential explanations include a poor knowledge of the appropriate management and of current guidelines/recommendations and a misvaluation of the risk/benefit ratio of the intervention (18, 19). The above mentioned physicians' survey highlighted this aspect in general practitioners who were often unable to correctly interpret the echocardiographic findings and poorly aware of validated therapeutic recommendations, as illustrated in the first two vignettes. Consistent with the EuroHeart survey, reasons advocated to not intervene were often inappropriate. Surgery was inappropriately denied in a significant proportion of patients based on their age or the presence of a reduced ejection fraction.

## Complex evaluation and multiplicity of therapeutic options

With the identification of new VHD subsets such as calcific mitral valve disease, low gradient AS or atrial mitral regurgitation (functional MR related mainly to AF and annular dilatation), and the technological progresses of both transcatheter and surgical procedures, evaluation of patients with VHD has become more and more complex. Echocardiography (transthoracic and

transoesophageal echocardiography) plays a pivotal role in the assessment of patients with VHD. The evaluation requires a precise assessment of the etiology, mechanism and severity of the VHD, a careful measure of its consequences on left/right ventricular size and function, left atrial size and pulmonary artery pressure and a clear understanding of the technical feasibility of transcatheter/surgical interventions including anatomic suitability. A quantitative as opposed to qualitative/semi-quantitative assessment is critical for both determining disease severity and its consequences (20, 21). Superiority of quantification over semi-quantitative assessment of regurgitation jets in terms of prognostic value is well validated, although it remains insufficiently performed (22). Advances in imaging, and more specifically 3D echocardiography has allowed improved intra-procedural guidance and the development of novel transcatheter therapies (23). Such evaluation requires extensive and advanced echocardiographic skills underlining the need for valve specialists. In addition, the evaluation of complex VHD often requires the use of multimodality imaging including CT or MRI (24, 25). In patients with low-gradient AS, measurement of the degree of aortic valve calcification using CT provides a complementary flow-independent evaluation of AS severity (26, 27). Use of MRI for myocardial fibrosis has refined the prognosis of both MR and AS (28). Finally, multiple options may be available for one patient while management remains debated in others. For relatively young patients considered at low risk for surgery, both TAVR and SAVR are reasonable options (29, 30). Management of patients with secondary MR remained debated with surgical interventions showing no benefit, while conflicting results have been reported for transcatheter therapies (31, 32, 33, 34).

## Role of the valve specialists and of the heart team

Development of a dedicated valvular heart team/valve clinic has the potential to address the issues highlighted in the previous sections. The valvular heart team is a multidisciplinary group of physicians and allied health care professionals able to offer the most optimal patient-centered care according to current evidence-based medicine within a comprehensive valve clinic. It gathers experts in the field of VHD, including clinicians, echocardiographers and imaging specialists, interventional cardiologists, and cardiac surgeons, as well as other specialists such as anesthesiologists or geriatricians, when needed.



One team member should take the leadership role and work closely with a nurse coordinator in charge of the logistic aspects. The team should be able to offer integrated care, addressing all issues of patients management from evaluation, risk-assessment, decision-making and performance of state-of-the-art surgical and transcatheter interventions. Therefore, the heart valve team should be implemented in heart valve Centers of Excellence capable of offering the full spectrum of interventions and achieve excellent immediate and long-term results.

Valve specialists will provide a standardized high-quality evaluation of patients with VHD. Availability of such centralized evaluation should facilitate and increase patient referrals both internally and externally. Assessment of the risks/benefits balance of intervention will rely on a comprehensive evaluation including frailty and life expectancy assessments by dedicated valve specialists. Therapeutic options will be discussed among the team to select the most appropriate management for a given patient. It will decrease bias related to individual physicians' preference, improve transparency of the process, and share the accountability of decision-making in these complex patients. This model is a paradigm shift from a single-individual decision to a share-confronted team decision. It increases cohesion of the group. In addition, involvement of care providers in all aspects of the care (evaluation, procedural planning and the intervention, and follow-up) reinforce team spirit and improve dedication, motivation and engagement of team members. The aim of the heart valve team and valve specialist is to improve the appropriateness of care, reduce under-treatment, improve awareness of the burden of VHD and increase diagnosis, cost-effectiveness and ultimately patient outcomes. Although intuitively beneficial and suggested in preliminary studies (35), robust data regarding impact of implementation of VHD team remain scarce. If proved beneficial, significant effort on their development will be required as a recent study shows a marked underprovision of specialist heart valve clinics in the United Kingdom (36).

#### Declaration of interest

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