Board of Insurance Medicine Teaching Case

MITRAL VALVE PROLAPSE -
RECENT ADVANCES IN RISK ASSESSMENT
(From the 8th Triennial
Board of Insurance Medicine Course)

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Presentation of Case

A 30-YEAR old divorced female lawyer is applying for a $500,000 Whole Life policy. The beneficiary is her daughter. She is a nonsmoker. She has experienced palpitations and atypical chest pain intermittently for 7 years, now controlled with propranolol. She has been told that she has mitral valve prolapse. Parents and siblings are alive and well.

The Attending Physician's Statement (APS) confirms the history above. It also indicates that she has a normal build and a regular pulse. Blood Pressure is 120/80. A midsystolic click and 2/6 late systolic murmur are audible at the apex. 1991 chest x-ray is reported as normal. 1991 ECG reveals sinus rhythm with minor ST-T wave changes in leads 2, 3 and AVF. A 1990 echocardiogram report discloses normal left atrial and left ventricular dimensions with no evidence of LVH. Midsystolic prolapse of the posterior leaflet of the mitral valve is present with Doppler evidence of trivial mitral regurgitation.

Mitral Valve Prolapse - Recent Advances

Mitral valve prolapse (MVP) is now recognized as one of the most prevalent cardiac abnormalities. Currently its prevalence in the general adult population is estimated to be up to 4%. Therefore, 7 million affected subjects may be found in the United States alone. Although it is recognized that complications of MVP are uncommon, even a rare event in such a large population can affect a substantial number of people. It is not surprising, therefore, that the medical director will frequently be faced with assessing the mortality risk of applicants with MVP.

MVP was first recognized by its auscultatory features and by angiographic and echocardiographic evidence of abnormal mitral valve motion. Studies appeared soon thereafter that reported a high prevalence of non-anginal chest pain, dyspnea, and anxiety-related symptoms in patients with MVP (the MVP syndrome). Although MVP has been associated with these clinical features in early studies of highly selected populations, subsequent controlled studies have not supported this association. Thus, carefully controlled studies show the spectrum of clinical features associated with MVP to be narrower than previously thought. Even features felt truly associated with MVP such as thoracic bony abnormalities and palpitations, are not sufficiently specific to be useful in the diagnosis or assessing the prognosis of MVP.

Because of its ability to visualize the anatomy and function of the mitral valve, echocardiography has proved to be the most useful objective method for the detection and characterization of MVP. However, the early astonishing finding that nearly 15-20% of some populations have shown echocardiographic MVP, led to suspicion that this technique may have poor specificity. This concern has been addressed by recent echocardiographic studies that have clarified both the dynamic geometry of the mitral valve and the relative merit of the different criteria for diagnosis of MVP.
Since the early 1970’s, the mainstay of echocardiographic diagnosis of MVP has been the demonstration on M-mode recordings of posterior systolic motion of continuous mitral leaflet interfaces behind the line connecting the valve’s closure and opening points, by at least 2 mm. in late systole or 3 mm. for holosystolic prolapse. The diagnosis of MVP by these criteria has been shown to be acceptably reproducible (sensitivity 65-90%, specificity 99% against the gold standard of pathologic examination). Since MVP is principally a displacement or bulging of the mitral leaflet into the left atrium, it would be expected that the spatial orientation inherent in two-dimensional (2D) echocardiography might be helpful in establishing this diagnosis. Most echocardiographers have adopted the stricter criteria of superior systolic billowing of one or both leaflets across the plane of the mitral annulus evident on at least 2 views (particularly the parasternal long axis view) before making the diagnosis. These slightly stricter criteria for diagnosis have resulted in a slight decrease in sensitivity but have identified a more realistic prevalence for MVP in the general population and a positive diagnosis in nearly all patients who have MVP that is associated with severe mitral regurgitation and other complications. Redundant, or thickened, mitral valve leaflets detected echocardiographically have been suggested to be highly sensitive for predicting subsequent complications including sudden death. However, the sensitivity for stratifying risk of sudden death has been questioned by its low prevalence among resuscitated survivors of out-of-hospital cardiac arrest in whom mitral valve prolapse is the only detectable abnormality.

A number of early papers on MVP included reports of sudden death as a complication. Subsequent reviews have pointed out that these reports were from populations that were often highly selected by virtue of referral to cardiologists and therefore these groups may be at higher risk than the general prolapse population.

A number of potential risk factors have been proposed for the identification of subjects with MVP who are at risk for sudden death. These include:

1. male gender
2. older age
3. history of syncope, pre-syncope, or palpitation
4. inferolateral ST-T changes in the electrocardiogram
5. prolonged QT interval
6. complex or repetitive ventricular arrhythmias
7. redundant or thickened mitral leaflets
8. mitral regurgitation.

Recent evidence suggests that only hemodynamically significant mitral regurgitation, a complication affecting a small proportion (2-4%) of the general prolapse population, marked increases (50-100 times) the risk of sudden death in MVP. On physical examination, hemodynamically important mitral regurgitation is suggested by a pansystolic apical murmur, commonly accompanied by third heart sound and leftward displacement of a dynamic left ventricular impulse. The diagnosis can be confirmed by the demonstration of significant (moderate or severe) mitral regurgitation by pulsed and color flow Doppler echocardiography in conjunction with MVP and left heart chamber enlargement.

Because sudden death is most often an arrhythmic event, it has long been suspected that complex ventricular arrhythmias might play a role in mortality. However, although complex ventricular arrhythmias certainly occur among subjects with MVP, the excess prevalence of arrhythmia initially reported has not been confirmed in more recent controlled studies that have excluded selection bias. Evidence is now available that complex arrhythmias are substantially more common in the small segment of MVP with associated hemodynamically significant mitral regurgitation. Of further interest, has been the demonstration that the frequency and complexity of ventricular arrhythmias in MVP patients with mitral regurgitation is nearly identical to those in patients with comparably severe mitral regurgitation that was unassociated with MVP. These findings suggest that the complex arrhythmias found among prolapse patients with mitral regurgitation are more directly related to the hemodynamic load imposed by the valvular insufficiency than to the presence of MVP itself.

With this background we can now estimate the mortality risk of MVP. The annual risk of sudden death among the entire United States population is approximately 2.2 per 1000 (0.22% per year), an overall mortality that is predominantly due to coronary artery disease in the United States. The annual risk of sudden death among 45 to 54 year-old subjects with no clinical evidence of coronary artery disease in the Framingham study has been reported at 0.7 per 1000 (0.07% per year). Based on recent epidemiologic and forensic necropsy studies, Kligfield and associates have estimated the risk of sudden death among MVP subjects who do not have significant mitral regurgitation to be 0.19 per 1000 (approximately 0.02% per year).

Thus the estimated risk of sudden death potentially attributable to uncomplicated MVP appears to be far less than the risk attributable to known or unsuspected...
coronary artery disease in the general adult population, and even less than the annual sudden death risk reported in otherwise apparently normal middle-aged adults. This low estimate of sudden death risk among patients with uncomplicated MVP is certainly compatible with the general impression in clinical practice that MVP is inherently a rather benign finding.

It appears that the risk of sudden death in patients with MVP is significantly higher when hemodynamically important mitral regurgitation develops as a complication. Based on a 2-4% prevalence of significant mitral regurgitation among subjects with MVP the annual risk of sudden death in this subset is estimated at 1-2% per year (50-100 times greater than uncomplicated MVP). This striking concentration of risk of sudden death suggests that more than half the mortality associated with MVP may occur in a subset comprising less than 5% of the total prolapse population.

To summarize, recent evidence suggests that sudden death does occur, but quite uncommonly with MVP who do not have significant mitral regurgitation. In contrast, the risk of sudden death appears to be highly concentrated, by perhaps 50-100 fold, in patients with MVP complicated by severe mitral regurgitation. These patients also can be shown to have a high prevalence of complex ventricular arrhythmias. Although sudden death is ultimately an arrhythmic event, complex arrhythmias have not been shown to predict mortality in unselected populations of subjects with MVP. Other associated findings of potential predictive value for sudden death in MVP, such as QT interval prolongation, inferior ECG changes, thickened mitral leaflets, are only inconsistently present in subjects with MVP who have died suddenly.

Case Discussion

This applicant has clinical and echocardiographic evidence of MVP. From the preceding discussion the presence of symptoms does not have significant predictive value for increased mortality. Her clinical findings do not suggest hemodynamically significant mitral regurgitation nor does the echocardiogram. Pulsed Doppler echocardiography is the echocardiographic procedure of choice for detection of mitral regurgitation. Widespread use of this method has resulted in a sudden epidemic of valvular regurgitation, raising concerns that Doppler may be too sensitive. The current technique for quantifying the degree of mitral regurgitation is semiquantitative at best and is by mapping the presence of the systolic turbulent flow within the left atrium. One places the sample volume at increasing distances from the mitral orifice and thus one can estimate the size of the detectable regurgitant jet with the degree of regurgitation essentially related to the width of the jet and how far it can be detected from the valve orifice. Echocardiographers commonly use the terms physiologic, trivial, or minimal to indicate the presence of mitral regurgitation which is not felt to be clinically significant.

The technology is still evolving, and therefore, the sensitivity and quantification aspects have not been completely worked out. In this case where the term trivial is used and there is no evidence of chamber enlargement, I would interpret the comment on the echocardiographic report as indicating clinically insignificant mitral regurgitation. Normal build and aortic root dimensions would rule out most cases of Marfan’s Syndrome.

At the 8th Triennial Board of Insurance Medicine course, an informal poll of participants was taken regarding this case, and estimations of expected mortality ranged from 100% of select and ultimate to as high as 150%. Those making the higher estimation appeared to be influenced by the constellation of symptoms, abnormal ECG and the presence of thickened leaflets and mitral insufficiency on the echocardiogram.

Suggested References
