Medical Management (β Blocker ± Disopyramide) of Left Ventricular Outflow Gradient Secondary to Systolic Anterior Motion of the Mitral Valve After Repair

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Systolic anterior motion of the mitral valve (SAM) occurs intraoperatively after mitral valve repair (MVRr) in up to 14% of cases and typically resolves in the operating room with conservative measures. Less commonly SAM may also occur in the early or late postoperative period. The clinical course and optimal management of such cases is poorly defined, but reoperation is common. We describe our experience using disopyramide to successfully treat postoperative SAM refractory to beta blockade. Seven patients were retrospectively identified with mitral valve prolapse who underwent MVRr from 2003 to 2015 and were found during follow-up to have severe SAM with a left ventricular outflow tract (LVOT) gradient not observed intraoperatively. All 7 patients were successfully managed medically. In 5 cases, SAM persisted even after maximization of beta blockade, and the addition of disopyramide led to significant improvement or resolution of SAM, the LVOT gradient, and mitral regurgitation. The postoperative LVOT gradient initially exceeded 30 mm Hg in 6 of 7 patients. In 2 patients, the LVOT gradient exceeded 100 mm Hg, and both were managed medically with disopyramide with complete resolution of SAM. In conclusion, SAM after MVRr typically follows a benign clinical course and can be managed medically in most cases. When an initial treatment strategy of beta blockade is insufficient, the addition of disopyramide can effectively alleviate and terminate this condition and should be considered before reoperation. **(Am J Cardiol 2016;118:1053−1056)**

Systolic anterior motion of the mitral valve (SAM) is a well-described phenomenon associated with mitral regurgitation (MR) and usually a left ventricular outflow tract (LVOT) peak systolic gradient. This gradient, SAM, and MR are dynamic and highly sensitive to the size and inotropic state of the left ventricle. SAM and LVOT gradients may occur in a variety of conditions and physiologic states (Figure 1), including after mitral valve repair (MVRr). The incidence of SAM after MVRr with an annuloplasty ring has been reported to be as high as 14% in the immediate postrepair period in the operating room,[1] with more recent series reporting rates of 6% to 8%.[2,3] In most cases, up to 85% in some series,[2] medical management in the operating room with volume loading and beta blockade reduces or eliminates the SAM, MR, and LVOT gradient. Much less commonly, SAM after MVRr may recur or newly occur in the early or late postoperative setting as ventricular contractility and loading conditions evolve. The clinical course and optimal management of such cases is less clear. Medical management has been reported to be successful in small numbers of patients with β blockers, but repeat intervention is common.[4,5] This report describes a single-center experience using disopyramide to successfully treat postoperative SAM refractory to β blockers alone.

Methods

Seven patients were retrospectively identified with a history of mitral valve prolapse, defined as type II by the Carpentier classification,[6] who underwent MVRr between 2003 and March 2015 at Cedars-Sinai Medical Center (Los Angeles, California) and were found at any time during the postoperative period to have severe SAM not observed intraoperatively. In 5 cases, partial or complete posterior leaflet resection was performed with placement of an incomplete mitral annuloplasty ring—4 with an ATS band (ATS Medical, Inc., Minneapolis, Minnesota) and one with a CG Future band (Medtronic, Inc, Minneapolis, Minnesota). In one patient, posterior leaflet resection was not performed, and a Carpentier-Edwards Physio ring (Edwards Lifesciences Corp, Irvine, California) was placed. Surgical details were not available in one patient. Severe SAM was identified by 2-dimensional echocardiography and defined as any portion of the mitral valve that protruded into the LVOT during systole and was associated with either an LVOT gradient of at least 30 mm Hg or greater than mild MR. Patients were followed until February 2016 by chart review for available information pertaining to symptom

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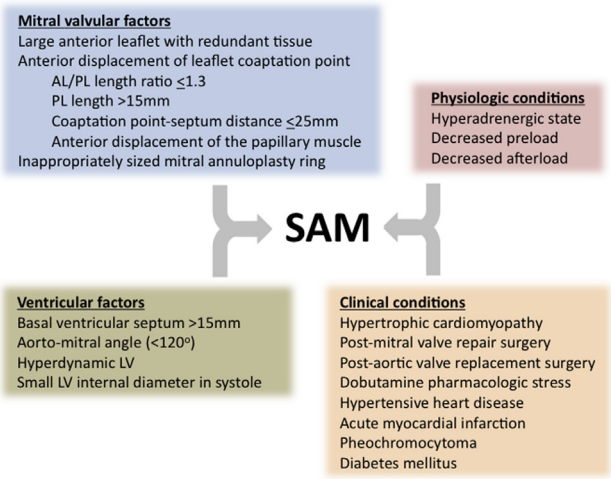

Figure 1. Anatomic, physiologic, and clinical risk factors for development of SAM. AL = anterior leaflet of the mitral valve; LV = left ventricle; PL = posterior leaflet of the mitral valve.

status, clinical outcome, medication management, and follow-up echocardiograms. No patients underwent an invasive assessment of the LVOT gradient.

Results

As demonstrated in Table 1, 7 patients were identified with severe SAM with the presence of an LVOT gradient that was not observed intraoperatively, but first noted postoperatively. SAM was noted within the first 3 days postoperatively in 3 of 7 patients, by the end of 10 days postoperatively in 2 other patients, and beyond 20 months postoperatively in 2 patients. The LVOT gradient exceeded 30 mm Hg in all patients at rest or with the Valsalva maneuver and exceeded 50 mm Hg in 5 patients. Two patients had LVOT gradients exceeding 100 mm Hg at rest, and a third developed a gradient >100 mm Hg (184 mm Hg) after initial therapy.

Six patients were initially managed conservatively with metoprolol. In one of these patients, initiation of metoprolol (sustained release, 25 mg daily) resulted in resolution of the LVOT gradient and SAM by 23rd postoperative day. Resolution of SAM persisted for the duration of follow-up at 2 years. In 5 patients, SAM and the LVOT gradient persisted despite initiation and/or uptitration of metoprolol to 50 to 100 mg, administered in once or twice daily doses to a target heart rate of 50 to 60 beats/min. In each of these cases, oral disopyramide was subsequently added and uptitrated to the maximal tolerated dose, totaling 300 to 750 mg administered in divided doses 2 or 3 times daily. In all these patients, there was a reduction in MR severity, symptoms, and/or the LVOT gradient. There was complete resolution of both the gradient and MR after 14 to 17 days in 3 of these 5 patients (Figure 2). In one patient, severe SAM was first noted 21 months postoperatively, and it resolved within 6 weeks after initiating metoprolol and discontinuing an angiotensin-converting enzyme (ACE) inhibitor. However, it recurred after the ACE inhibitor was reintroduced and ultimately resolved 6 weeks later after discontinuation of the ACE inhibitor and addition of disopyramide. Another patient was noted to have a persistent LVOT gradient >100 mm Hg despite treatment for over 8 years postoperatively with diltiazem (180 mg twice daily). After its discontinuation, SAM and the LVOT gradient resolved.

Discussion

In this series of 7 cases of new onset severe SAM late after MVRr, all were managed successfully with medical therapy consisting of beta blockade with or without disopyramide. Previous reports have also shown successful medical management of this condition. For example, in a recent series of 11 patients with SAM newly noted in the early postoperative period after MVRr, all were successfully managed medically with β blockers and avoidance of afterload-reducing agents, without need for repeat invasive intervention.[2] Our series highlights the utility of including disopyramide in the medical management of SAM after MVRr. In 5 cases in which SAM persisted even after initiation of beta blockade, adding disopyramide led to improvement or resolution of SAM, significant MR, and the LVOT gradient.

SAM after MVRr usually results from relative or absolute anterior displacement of the mitral valve apparatus into the LVOT, creating drag forces that pull the anterior leaflet of the mitral valve toward the septum during systole.[7] Anatomic risk factors include an elongated posterior leaflet or narrow aortomitral plane angle and common surgical risk factors include insertion of a small annuloplasty ring or inadequate posterior leaflet height reduction.[7] However, an oversized annuloplasty ring has also been reported to cause SAM due to displacement of the anterior leaflet into the LVOT.[5] Accordingly, the use of an incomplete annuloplasty ring, or band, has been associated with lower rates of SAM compared with a complete ring.[7] In this series, most cases underwent posterior leaflet resection and placement of an annuloplasty band, and a single common surgical risk factor for the development of SAM was not observed.

Disopyramide is a class Ia antiarrhythmic with potent negative inotropic properties, which was first demonstrated to be efficacious in patients with hypertrophic cardiomyopathy with LVOT gradients.[8] More recent studies have found that the use of disopyramide in patients with hypertrophic cardiomyopathy and an LVOT gradient may prevent need for septal reduction therapy in up to 2/3 of patients, by reducing the LVOT gradient and improving symptoms.[9] The mechanisms of SAM in hypertrophic cardiomyopathy are similar to those after MVRr and are exacerbated by the hypercontractile state frequently seen in the postoperative period. Although recently proposed treatment algorithms for SAM in the setting of hypertrophic cardiomyopathy have included disopyramide,[10] similar proposals for SAM after MVRr have not included its use.[2,7] To our knowledge, this is the first reported series of successful use of disopyramide for SAM after MVRr.

Several other important findings emerge from this study. First, even markedly elevated LVOT gradients after MVRr may still be successfully managed medically. A previous report described an LVOT gradient due to SAM after MVRr as high as 90 mm Hg,[2] in a case that was ultimately managed