

Graves Induced Reversible LVOT Obstruction

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Highlights

We report the case of a 59 year old male with a structurally normal heart who developed symptomatic LVOT obstruction in the setting of Graves disease. His symptoms and LVOT gradient completely resolved once his thyroid function normalized with appropriate treatment. To our knowledge this is the first case report of hyperthyroidism induced reversible LVOT obstruction.

Keywords: Hyperthyroidism, Graves disease, LVOT obstruction, dyspnea, cardiomyopathy

Citation: Smyrlis A, Yaranov D, Khan S et al. Graves induced reversible LVOT obstruction. International Cardiovascular Forum Journal 2016;8:103-105. DOI: 10.17987/icfj.v8i0.166

A 59-year-old male with a past medical history of obesity (BMI=31), controlled hypertension (HTN) and hyperlipidemia (HLD), presented for evaluation of new exertional dyspnea of three weeks duration. He reported difficulty climbing one flight of stairs in his house; six months ago he was able to exercise without limitations. He also complained of palpitations which he described as intermittent, regular and fast "heart pounding" both at rest and with activity. He denied chest pain, dyspnea at rest, orthopnea, paroxysmal nocturnal dyspnea, edema and syncope. Review of systems was also significant for 29 lbs of unintentional weight loss in the past six months confirmed by office weight record (199 to 176 lbs), generalized fatigue, mild hand tremor and insomnia. On physical exam his vital signs were within normal limits. He was noted to have mild exophthalmos as well as a new harsh 3/6 systolic murmur best heard at the 2nd right intercostal space. The murmur was intensified by having the patient stand up. His exam was otherwise unremarkable.

His HTN and HLD have been managed by a cardiologist for the past decade during which time he has had three echocardiograms, the most recent one six months prior to presentation for evaluation of atypical chest pain and palpitations. Baseline echocardiogram demonstrated upper limits of normal LV wall thickness and mild diastolic dysfunction and no significant valve disease. There was laminar flow across the LVOT. A 12-lead electrocardiogram (ECG) revealed normal sinus rhythm at 96 beats per minute. Exercise stress echocardiogram six months prior for evaluation of atypical chest pain was diagnostic and negative for ischemia. He exercised for 9 minutes and 31 seconds on the standard Bruce protocol.

In view of these findings hyperthyroidism was suspected and a thyroid panel and echocardiogram given the new murmur were

obtained. Thyroid function testing was consistent with overt hyperthyroidism: TSH <0.01; FT3 14.4 (normal range 2.3-4.2); FT4 3.6 (normal range 0.7-1.5). Thyroid ultrasound was negative for nodules and TSI and TBII antibodies were positive confirming the diagnosis of Graves disease.

Echocardiogram demonstrated hyperdynamic left ventricular (LV) function with an EF >75%, normal septal and posterior wall thickness of 1.1 cm, systolic anterior motion of the anterior mitral valve leaflet (SAM) and flow acceleration across the LVOT with peak velocity of 2.5 m/s and a resting LVOT gradient of 25 mmHg. Figures 1, 2.

He was referred to an endocrinologist and was started on methimazole 10 mg tid, metoprolol XL 50 mg daily, which was subsequently uptitrated to 75 mg daily. Within ten weeks his symptoms completely resolved and his systolic murmur was no longer present. Follow up echocardiogram 3 months later revealed normal LV function with stable mild LVH and resolution of SAM and LVOT gradient. Figures 3, 4.

Discussion

Dynamic left ventricular outflow tract (LVOT) obstruction is most commonly seen in hypertrophic cardiomyopathy (HCM). Typically in HOCM, the hypertrophic basal septum and SAM result in a dynamic outflow obstruction. Dynamic LVOT obstruction has been described in other conditions such as, hypertensive hypertrophy, stress cardiomyopathy and after acute extensive anterior wall myocardial infarction with compensatory hypercontractility of the basal segments [1]. It has also been observed in septic patients with structurally normal hearts who treated with adrenergic agonists as well as in patients with Pheochromocytoma [2]. The common pathophysiologic mechanism in these cases is

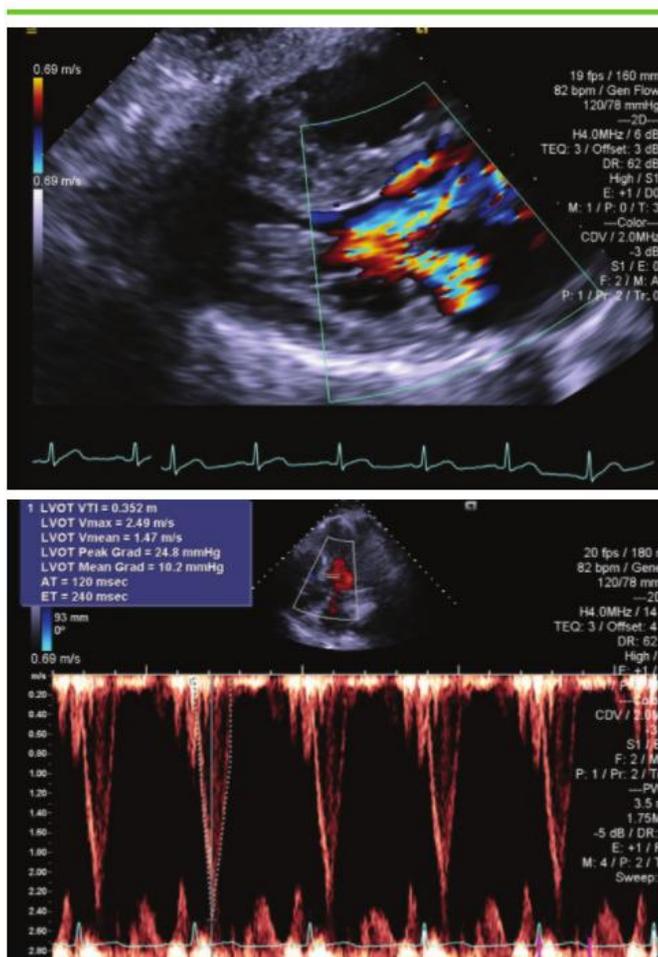


Figure 1 and 2. Transthoracic echocardiogram demonstrates flow acceleration in the LVOT, systolic anterior motion of the anterior mitral leaflet with left ventricular outflow tract obstruction and new mild mitral regurgitation (Fig1). The peak pressure gradient measured with pulse wave Doppler in the LVOT was 24.9 mm Hg. (Fig2)

presumed to be increased contractility of the base of the heart in the setting of catecholamine excess with or without hypovolemia. Hyperthyroidism is a common disorder with an estimated prevalence of 1.3-3.9% in patients over the age of 60 years [3]. Hyperthyroid patients commonly present with cardiovascular symptoms including palpitations secondary to sinus tachycardia or atrial fibrillation or exertional dyspnea.

Thyroid hormone regulates myocardial contractility, baseline heart rate, total blood volume as well as peripheral vascular resistance by acting on a multitude of intracellular and membrane receptors in the myocardium and peripheral vessels [4]. Excess in thyroid hormone activates the renin-angiotensin-aldosterone system and increases plasma volume and thus preload while at the same time promotes relaxation of vascular smooth muscle cells and increased endothelial nitric oxide (NO) production, which reduces systemic vascular resistance (SVR) or afterload. Thyroid hormone has also been shown to directly increase myocardial contractility. Overt hyperthyroidism results in a high cardiac output state and can lead to high output heart failure [5].

Furthermore isolated systolic hypertension has been reported in

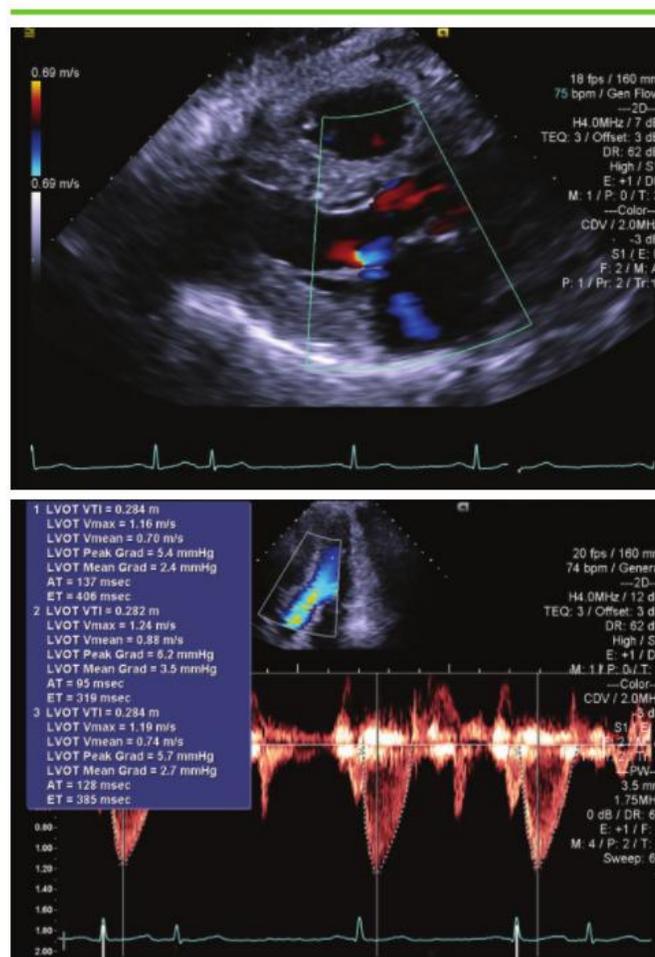


Figure 3 and 4. Figures 3,4. SAM and LVOT gradient are no longer present. Mitral regurgitation is reduced to trivial.

up to 30% of patients with hyperthyroidism. It is usually attributed to the combined effect of increased cardiac output and decreased arterial compliance. LVH is associated with long standing, untreated hyperthyroidism. In the short term, hyperthyroidism may be associated with improved diastolic function, however, in the long term, chronic thyrotoxicosis may induce LVH and diastolic dysfunction [6-8].

Exercise intolerance and dyspnea on exertion in overt hyperthyroidism is presumed to be secondary to a relative loss of cardiac reserve as the hyperthyroid heart functions at the upper limits of heart rate and myocardial contractility as well as under a near maximally reduced SVR [9].

Multiple endocrinopathies such as pheochromocytoma, hyperthyroidism and hyperparathyroidism have direct, well described effects on the cardiovascular system and can present with cardiovascular symptoms. In these cases it is very important to recognize the endocrinopathy as the culprit since on many occasions restoration of normal endocrine function results in reversal of the abnormal cardiovascular hemodynamics. Hyperthyroidism typically is associated with atrial fibrillation, high output heart failure and pulmonary hypertension however it has never been linked to LVOT obstruction. The close temporal relationship between the development of clinical overt hyperthyroidism and new symptomatic LVOT obstruction which completely

resolved with the treatment of the endocrinopathy strongly supports the diagnosis of Graves induced reversible LVOT obstruction. To our knowledge this is the first case report of this pathophysiologic entity.

Declarations of Interest

The authors state that they have no conflicts of interest related to this publication

Acknowledgements

The authors state that they abide by the statement of ethical publishing of the International Cardiovascular Forum Journal [11].

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