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REVIEW ARTICLE

Physical examination in valvular aortic stenosis

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Abstract :

Aortic valve (AV) stenosis is one of the most common valvular diseases and is the third most common cardiovascular disease in developed countries. It occurs in ≈2.8% of patients ≥75 years of age. Physical examination still plays a key role in the bedside diagnosis of aortic stenosis (AS) even in modern era. It remains a valuable and cost-effective tool that often enables a rapid, integrative, accurate and patient-orientated diagnosis of aortic valve disease.

Keywords:

Aortic stenosis, murmur, heart sound

Abbreviation:

AV - Aortic valve, AS-Aortic stenosis, S_1-First heart sound, S_2-Second heart sound, ASD- Atrial septal defect, MR-Mitral regurgitation.

Introduction:

Aortic valve stenosis is the most common cause of left ventricular outflow obstruction in children and adults. As aortic valve disease, especially aortic stenosis, has an increasing prevalence worldwide, a good screening tool for the selection of patients being referred for further evaluation and/or intervention is always needed. Physical examination has remained the main stage of bedside diagnosis of cardiovascular disease for centuries. AS is typically asymptomatic for a prolong period despite the obstruction and increased pressure load on the left ventricle. In most patients with AS and normal LV systolic function symptoms uncommonly occur until stenosis is severe. The most common presenting symptom of AS are

- Dyspnea on exertion or decreased exertion to tolerance
- Exertional dizziness (presyncope) or syncope
- Exertional angina

Physical examination in modern era

Unfortunately, expertise and proficiency in auscultation has been declining in the current era and new technology and development has been trying to replace. In the recent part, there are advanced bed side diagnosis equipment such as electronic stethoscope, handheld ultra sound or echocardiographic devices, which have been used increasingly. Some benefits of handheld ultrasound versus physical examination for diagnosis of different cardiac disease shown in several studies.[1,2,3]

A systemic review by Stanger et al showed that the sensitivity and specificity of insonation in identifying AS ranged from 62% to 94% and 85% to 98% respectively and that these ranges were similar to auscultation.4 Auscultation is of low sensitivity (56.6 - 73%) in detecting aortic valve lesions compared to echocardiography but has a high specificity (92 - 98%).[5,6]

Sensitivity of detecting aortic valve lesions were low in subjects with aortic regurgitation (AR), mild valve lesions, and in patients with significant lesions and concomitant left ventricle systolic dysfunction.5 Regarding the diagnosis of AR, studies have found a sensitivity of 0% to 38% for mild AR and 60% - 80% for moderate or greater AR.[7]

Clinical Anatomy

The normal aortic valve has three leaflets, the right, left and noncoronary leaflet. The right coronary artery arises from the right cusp, and the left coronary artery arises from the left cusp. The normal aortic valve has an area of 3–4 cm 2.

Definition

=Aortic stenosis is a pathologic narrowing of the aortic valve.

Physical examination of valvular aortic stenosis

Examination of carotid pulse, palpation and auscultation of precordium are very valuable and provide clue to the presence of aortic stenosis and severity of lesion (Table1).

Carotid pulse:

In normal subjects, it is characterized by a relatively rapid upstroke and a smooth, more gradual down stroke, interrupted only briefly in the pulse peak. In patients within significant

AS, the carotid pulse is weak (pulsus parvus), rises slowly and has a delayed systolic peak (pulsus tardus). It is best appreciated in the carotid artery where the pulse is reduced in amplitude and delayed in occurrence. These can be absence in elderly patients with non-complaint vasculature.[8]

Palpation of precordium:

The precordial apical thrust is accentuated and initially normal in location and a bifid apical impulse is sometimes felt in left lateral decubitus position in isolated as. The first impact comes from the left atrial contraction (presystolic gallop) and the second impulse from the LV contraction. A systolic thrill may be felt at the right intercostal space (aortic area) or at the sternal notch, especially during full expiration with the patient leaning forward. A low - intensity and/or displaced systolic apical impulse could be a sign of low - flow AS or may be caused by other associated cardiac condition.

Cardiac Auscultation:

Findings suggest both the diagnosis and seventy of AS.

Heart sounds:

First heart sound (S_1) is normal. Second heart sound (S_2) is soft and single. In severe AS associated with LV dysfunction. S_2 may become paradoxically split. An aortic ejection clinic is more commonly heard with a congenital bicuspid valve, and heard after S_1 early in AS. A vigorous left atrial contraction against a stiff, noncompliant ventricle can produce an S_4.

Murmur:

It is an ejection systolic murmur with onset a short interval after the S_1 and ends before S_2. Aortic ejection clicks precedes the murmur if valve is still flexible. It is commonly best heard in 2nd right intercostal space (aortic area), but if could be also audible along the left sternal border in the 3rd and 4th intercostal spaces. As it is usually harsh and medium pitched, it is audible with either bell or diaphragm of the stethoscope.

It is characteristic diamond shape in the phonocardiogram. In majority, the murmur is loudest in the aortic area but it can be better heard at the apex in 15% of cases.[9] The murmur is transmitted well and equally to the carotid arteries and both clavicles. The absence of the transmission of the murmur over the right clavicle effectively rules out AS.[10]

Gallavardin Phenomenon:

The murmur may also radiate to the apex of heart where it has different quality (musical due to high frequency vibration) and may be louder. This is called as Gallavardin phenomenon. It has lead the misperception that the patient also has mitral regurgitation.

Table1: Typical physical examination findings of AS

Physical examination	Finding
Carotid pulse	Low volume and slow rising
Cardia apex	Thrusting and normal location
S_1	Normal
S_2	Soft, single
Murmur	Systolic ejection murmur, Best heard in aortic area, radiates to carotids and clavicles

Differential Diagnosis

The AS murmur should be differentiated from other conditions that can cause a basal systolic murmur.

Functional murmur:

These are generally faint, medium - pitched and very short. S_2 is usually normal.

Hypertrophic obstructive cardiomyopathy:

It is an ejection systolic murmur heard along the left sternal border and the apex. It is amplified by exercise, squatting Valsalva maneuver or administration of vasodilator or positive inotropic agents.

Supra-valvular aortic stenosis :

It produces most of the signs of valvular stenosis and systolic click is absent. S_2 is accentuated and carotid murmurs are very loud.

Hypertension or aortic sclerosis:

It could have a similar harsh, medium - pitched murmur but with a normal or even loud S_2.

Pulmonary stenosis:

It has similar configuration, intensity and pitch to AS but it is heard loudest at the pulmonary area and S_2 is widely split.

ASD:

It produces murmur similar to pulmonary stenosis but S_2 is wide and with a fixed split.

It AS murmur radiates to apex, following clinical hints (Table2) help to differentiate from mitral regurgitation(MR).

Table:2 Clinical features help to differentiate AS from MR if AS murmur radiates to apex

Clinical features help to differentiate AS from MR if AS murmur radiates to apex
Apical impulse - Normal in location
First heart sound - Normal
It is not holosystolic
It is not transmitted to axilla

Clinical signs of severe aortic stenosis

Several physical signs help in the diagnosis of severe AS but no combination of physical signs has both a high sensitivity and specificity, particularly in a asymptomatic patient.

a. Sensitivity of the Murmur:

The intensity of the murmur reflects the velocity of blood flow across the valve. A very loud murmur (grade iv or greater) has a high specificity for severe AS. Despite of high specificity, the intensity of murmur has a low sensitivity in diagnosing severe AS as it depends on the haemodynamic status. Murmur intensity decreases in low left- ventricular ejection fraction or low stroke volume where as it is frequently augmented in hyperdynamic states.[11]

b. Absent or diminished S_2

Aortic cusps are immobile in severe aortic stenosis. So aortic component of the second heart sound in faint or even not

audible. Only 9% had an absent S_2 in a series of 397 patients with AS at their first hemodynamic evaluation.[12]

c. A Mid or Late - Peaking of Murmur:

In severe AS, it takes longer for blood to be ejected through valve. So severe AS would has a late peaking murmur, which in mild AS, the murmur peaks at early in systole.

d. Paradoxical Splitting of the S_2

The paradoxical splitting of S_2 occurs when the transaortic pressure gradient is very high and the aortic valve closes after the pulmonary valve. It is more obvious during expiration. The degree of prolongation of left ventricular ejection time above that predicted stroke volume is closely correlated with aortic valve area. In patients with failing ventricles, the ejection time was less prolonged and the duration of ejection was unrelated to the valve area.[13]

e. Presence of Presystolic Gallop (fourth heart sound) or Atrial Gallop

Due to forceful atrial contraction into a hypertrophied, non - compliant left ventricle, a prominant S_4 can be audible and palpable.[9] Presence of an S_4 in a young patient with AS indicates a significant AV lesion but in elderly or hypertensive person this not necessary true because it can be related to the very common diastolic dysfunction.

f. Parvus et Tardus carotid pulse

Occlusion of more than 75% of the aortic orifice produces a plateau pulse and diminished pulse pressure that can be objectified by carotid or peripheral pulse palpation. Pulsus tardus is the better discriminator, detecting severe AS with a sensitivity of 31% to 90% and a specificity of 68% to 93% because of its two components.[14]

Conclusion

If we are aware of the limitations and strengths of physical examination, it could be succeed in keeping the expertise and proficiency in cardiac auscultation. Then clinical examination remains a valuable and cost-effective tool that often enables a rapid, integrative, accurate and patient-orientated diagnosis of aortic valve disease. Physical examination still plays a crucial role in the screening, diagnosis and evaluation of the severity of aortic valve stenosis, even in modern era.

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