HISTORY

70-year-old man.

CHIEF COMPLAINT: Hypertension and a heart murmur noted during a recent routine evaluation.

PRESENT ILLNESS: The patient stated he felt well. He had gained 20 lbs. in the past two years and admitted to dietary excess, including the liberal use of salt. When asked, he also described occasional “skipped beats.”

Question: What diagnosis is suggested by this history?
Answer: His hypertension may be related to weight gain and excess salt intake, although other causes should be excluded. A murmur appearing later in life may relate to degenerative changes of the aortic or mitral valves that occur with aging or mitral dysfunction secondary to ischemic disease. His subjective arrhythmia should be further evaluated, but without associated symptoms is probably benign.

Proceed
PHYSICAL SIGNS

a. GENERAL APPEARANCE - Normal man in no acute distress who appears his stated age.

b. VENOUS PULSE - The CVP is estimated to be 3 cm of H\textsubscript{2}O.

**Question:** How do you interpret the jugular venous pulse?
Answer: The venous pulse is normal in mean pressure and wave form.

c. ARTERIAL PULSE - (BP = 165/80 mm Hg)

Question: How do you interpret the blood pressure and arterial pulse?
**Answer:** There is isolated systolic hypertension defined as a systolic BP $>139$ mm Hg with a diastolic BP $<90$ mm Hg. Isolated systolic hypertension frequently occurs in the elderly associated with impaired aortic distensibility and structural hardening of the arterial walls.

Some elderly people may have high blood pressure as measured by the sphygmomanometer, but may not be hypertensive by direct intra-arterial recordings. This “pseudo” hypertension is related to the failure of the sphygmomanometer cuff to collapse the rigid artery beneath it. This may be diagnosed by palpating an uncollapsed brachial artery and/or radial artery while the blood pressure cuff is inflated (Osler’s sign).

The arterial pulse is normal in upstroke, peak and downstroke.

**Proceed**
d. PRECORDIAL MOVEMENT

**Question:** How do you interpret the patient’s precordial movement?
**Answer:** There is a normal brief apical impulse at the fifth intercostal space in the midclavicular line.

e. **CARDIAC AUSCULTATION**

**Question:** How do you interpret the acoustic events at the upper right sternal edge?
**Answer:** S1 and S2 are normal. There is a medium frequency, short, early peaking, systolic, crescendo-decrescendo murmur. Since the murmur occurs in early systole when the majority of the blood is normally ejected from the ventricles, it likely reflects turbulent flow without significant left ventricular outflow tract obstruction.

**Proceed**
e. CARDIAC AUSCULTATION (continued)

Question: How do you interpret the acoustic events at the upper left sternal edge?
**Answer:** There is normal inspiratory splitting of the second heart sound due to asynchronous aortic and pulmonic closure of .04 seconds.

e. **CARDIAC AUSCULTATION (continued)**

**Question:** How do you interpret the acoustic events at the lower left sternal edge?
**Answer:** At the lower left sternal edge, normal splitting of S1 (arrows), due to asynchronous mitral and tricuspid closure of .03 seconds is present.

e. CARDIAC AUSCULTATION *(continued)*

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**Question:** How do you interpret the acoustic events at the apex?
Answer: S1 and S2 are normal. There is an early, short, systolic crescendo-decrescendo murmur that may be transmitted from the aortic area.

Aortic outflow murmurs characteristically radiate to the apex. The high frequency components of such murmurs typically predominate, giving them a higher pitch and often a musical quality.

In this age group, mild mitral regurgitation may occur due to abnormalities of the mitral apparatus, such as a calcified mitral annulus or papillary muscle dysfunction. It may be difficult to differentiate a transmitted aortic outflow murmur from the murmur of mitral regurgitation.

f. PULMONARY AUSCULTATION

Question: How do you interpret the acoustic events in the pulmonary lung fields?

Proceed
Answer:
In all lung fields, there are normal vesicular breath sounds.

**ELECTROCARDIOGRAM**

![ECG Diagram](ECG-diagram.png)

**Question:** How do you interpret this ECG?
**Answer:** The electrocardiogram shows left superior division block (left anterior hemiblock). Such conduction abnormalities are not uncommon in this age group. There are no other significant abnormalities present, including no evidence of left ventricular hypertrophy.

**CHEST X RAY**

**Question:** How do you interpret the chest X ray?
**Answer:** The heart is normal in size. The lung fields and bony structures are normal for this patient’s age. There is dilatation of the aortic root with some calcification in the aortic knob. These latter findings are commonly seen and may be considered benign in this age group.

**Question:** Based on the history, physical examination, ECG and chest X ray, what is your initial diagnostic impression?
Answer: The history, physical examination, ECG and X ray reveal systolic hypertension and a murmur consistent with trivial aortic sclerosis.

The systolic hypertension is most likely secondary to arteriosclerosis and is common in the aging population. The systolic murmur at the base is probably an ejection murmur. The murmur is confined to early systole, indicating turbulent flow without significant outflow obstruction. The normal apical impulse and the absence of an S4 further support this conclusion, as do the relatively normal ECG and X ray.

The systolic murmur at the apex is most likely transmitted from the base, but mild mitral regurgitation must be considered.

Question: What noninvasive test would you now select to further define the diagnosis?
Answer: An echocardiogram would confirm the etiology of the murmur and its hemodynamic significance, as well as determine left ventricular size and function. The patient’s study follows.

LABORATORY - TWO-DIMENSIONAL ECHOCARDIOGRAM

Question: How do you interpret this study?
**Answer:** The echocardiogram reveals thickened aortic leaflets suggestive of fibrosis and/or mild calcification of the aortic valve (arrows). Left ventricular size and function are normal. A calcified mitral annulus is present (dotted arrow).

A continuous wave Doppler examination was also performed. It showed a normal aortic wave form with a peak flow velocity of 2m/sec. consistent with normal flow across the left ventricular outflow tract and aortic valve, excluding significant aortic stenosis. Mitral regurgitation was not detected.

**Question:** What is the explanation for this patient’s murmur?
**Answer:** The murmur originates from a sclerotic aortic valve. It is due to turbulence associated with rapid early systolic left ventricular ejection. It is maximum at the URSE and is transmitted to the apex.

This type of murmur is commonly heard in older patients whose aortic valve is thickened and fibrotic. It is due to flow across a valvular irregularity, without true obstruction (previously called “innocent murmur of the elderly”). These patients have a worse prognosis than patients without aortic sclerosis. Similar murmurs may occur in high output states.

**Proceed**
Patients with aortic sclerosis usually have fibrous or fibrocalcific thickening at the base of normal trileaflet aortic cusps as they insert into the sinuses of Valsalva. There is initially no fusion of the commissures, good cusp mobility and, therefore, no obstruction. However, if fibrosis progresses and significant calcium is deposited, calcific aortic stenosis may occur.

**Question:** How does this patient’s murmur differ from that of aortic stenosis?
**Answer:** The murmur of mild valvular aortic stenosis may be similar. In moderate to severe aortic stenosis, the murmur is longer, later peaking and most often associated with left ventricular hypertrophy. The latter may be reflected at the bedside by an S4 and a sustained left ventricular impulse.

In aortic sclerosis, the aortic component of S2 is usually normal.

**Proceed**
LABORATORY (continued)

Further laboratory evaluation was normal, excluding high output states and remedial causes of hypertension.

His 24 hour ambulatory monitor revealed occasional APCs and rare isolated unifocal VPCs.

**Question:** How would you treat this patient?
**Answer:** Initial therapy for his systolic hypertension should include weight loss, moderate salt restriction, moderation of alcohol and regular aerobic exercise. Drug therapy should be considered only after the results of this conservative program are evaluated. If drugs are used, small doses of one medication should be given with close follow up. In this patient, dietary treatment alone resulted in a normal blood pressure.

The patient should be advised that his murmur has no hemodynamic significance, but may reflect an accelerated atherosclerotic process and may benefit from cholesterol lowering therapy. Periodic re-examinations are recommended since aortic sclerosis may progress to aortic stenosis.

His arrhythmias are benign and require no therapy.
SUMMARY

There are a number of cardiovascular changes that occur in the elderly as a result of hemodynamic stress and biological aging. The arterial system is less compliant. The myocardium has increased connective tissue deposition. The aging valves gradually become more rigid and thickened as a result of sclerosis and fibrosis. Calcification of the mitral annulus is common.

Systolic hypertension may result from the increased stiffness of the arterial system. Therapy is indicated since systolic hypertension increases the likelihood of cardiovascular morbidity and mortality, especially stroke and congestive heart failure. Initial treatment is dietary, and drug therapy should be instituted gradually.

Proceed
SUMMARY (continued)

The sclerotic aortic valve may result in a murmur. If calcification of the valve leaflets progresses, the spectrum from mild to severe aortic stenosis with commissural fusion may occur.

Proceed
This is a specimen of a tricuspid aortic valve from a patient with aortic sclerosis. Note the cusps are opaque with irregular thickening (solid arrows). The dotted arrows indicate transected catheters that were used to perfuse the coronary tree with a radiopaque medium for post mortem study.

Proceed for Case Review
To Review This Case of Aortic Valve Sclerosis:

The **HISTORY** is that of a recently detected murmur and systolic hypertension.

a. The **GENERAL APPEARANCE** is that of a normal man appearing his stated age.

b. The **JUGULAR VENOUS PULSE** is normal in mean pressure and wave form.

c. The **ARTERIAL PULSES** are normal in upstroke, peak and downstroke. The **BLOOD PRESSURE** reveals systolic hypertension.

d. The **PRECORDIAL MOVEMENT** reveals a normal brief apical impulse.

Proceed
e. **CARDIAC AUSCULTATION** reveals a short, early systolic crescendo-decrescendo murmur at the URSE that is transmitted to the apex.

f. **PULMONARY AUSCULTATION** reveals normal vesicular breath sounds in all lung fields.

The **ELECTROCARDIOGRAM** shows left superior division block (left anterior hemiblock).

The **CHEST X RAYS** reveal a normal-sized heart with slight dilatation of the aortic root and mild calcification in the aortic knob.

**Proceed**
LABORATORY STUDIES include an echocardiogram that shows thickened aortic valves without significant stenosis. A calcified mitral annulus is also present. A continuous monitor reveals rare isolated and benign APCs and VPCs.

TREATMENT for his systolic hypertension was initially lifestyle changes. He was followed closely to determine need for antihypertensive medication. He was reassured regarding his murmur and advised to undergo periodic follow up.