CARDIAC EXAMINATION

I. Introduction

The physical examination of the heart and circulation involves four principle items: physical appearance or general **inspection**, the arterial and jugular venous **pulses,** the movements of the heart or **palpation**, and **auscultation**. Examination of the chest, abdomen and extremities may also reveal abnormalities reflective of cardiac disease.

Examination should take place with the patient comfortable. The upper body should be elevated 30-45 degrees. The examiner must keep both hands and instruments warm.

II. Specific Examination

A. General Inspection

Does the patient look acutely ill, chronically ill, or well?
Is the patient Cyanotic? Edematous? Have Clubbing?
Are there any features characteristic of certain syndromes?

B. The Pulses

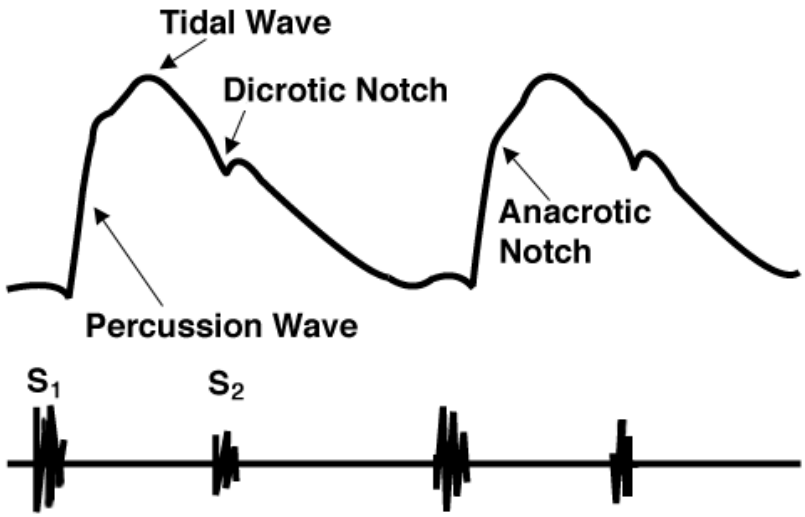
1. The Arterial Pulse

Routine examination in infants involves the brachial and femoral arteries. In the adolescent the carotid artery is added, in adults the radial, popliteal, posterior tibial, and dorsalis pedis pulses are routinely examined. For the purposes of this sequence we will focus on the carotid artery.

The information to be gained from the arterial pulse includes information related to three different points. First concerning the rate and rhythm of the heart's action, second concerning certain events in a cardiac cycle, and third concerning the character of the blood pressure in the artery.

The normal physiology is related to the left ventricular stroke volume and ejection velocity as well as the compliance of the arterial system.

The technique involves use of the first two fingers palpating the lower third of the right neck (to avoid stimulation of the carotid sinus). The **volume** usually relates to the size of the stroke volume. The **contour** usually refers to the perceived actions at the peak or crest of the pulse wave.



2. **The Jugular Venous Pulse**

The jugular veins provide anatomic, physiologic, and electrical information about events in the normal and abnormal right atrium and right ventricle.

The normal physiology involves analysis of waveforms and pressures.

Wave Forms

There are two visible peaks or waves and two visible descents or troughs in the normal jugular venous pulse. The **A wave** is followed by the **X descent**, and the **V wave** is followed by the **Y descent.** The physiologic basis of these waves and descents is as follows:

A Wave:

This wave directly reflects right atrial (RA) contraction, which results in retrograde blood flow into the superior vena cava and jugular veins during RA "systole". The jugular venous A wave follows the P wave of the EKG, precedes the upstroke of the carotid pulse, and is almost synchronous with S_1.

X Descent:

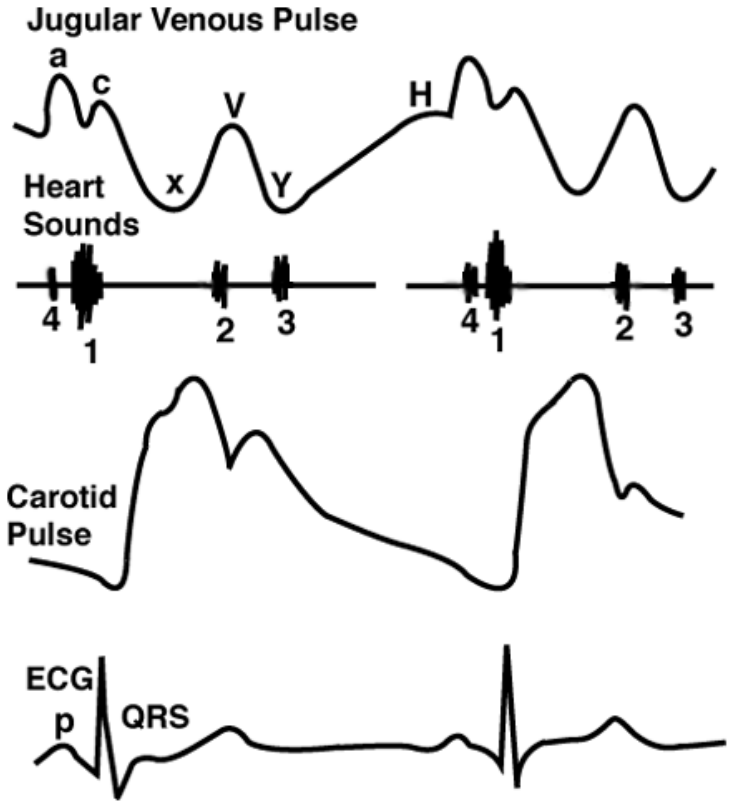
The early portion of the X descent results from the RA relaxation during atrial "diastole". The later and dominant portion (x') reflects the fall in RA pressure during early right ventricular systole, as the tricuspid valve ring is pulled caudally by the contracting right ventricle ("descent of the base "). The RA actually may expand during ventricular systole as right ventricular ejection helps to "suck" blood from the great veins into the RA. The X descent is often the most prominent motion of the normal jugular venous pulse. It begins during systole and ends just before S_2.

V Wave:

The V wave is the second major positive wave, begins in late systole, and ends in early diastole. The V wave results from continued venous inflow into the RA during ventricular systole while the tricuspid valve is closed, but following ("descent of the base"). It is roughly synchronous with the carotid pulse and peaks just after S_2.

Y Descent:

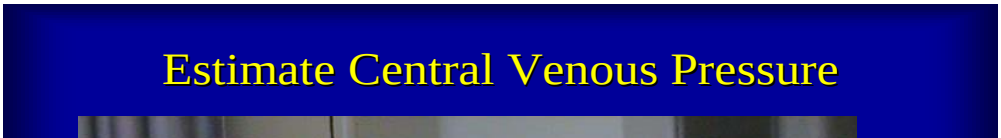
The Y descent is the negative deflection of RA pressure that occurs when the tricuspid valve opens in early diastole. It begins and ends during diastole.



The technique of examination involves proper positioning of the patient at 30-45 degrees. The right jugular vein is usually used because it is more direct in its path to the RA. The right internal jugular vein provides information about waveforms and pressure whereas the external jugular vein provides information mainly about pressures. Ideally the internal jugular vein is used for examination, but in practice either can be used, being aware that compression of the external jugular may take place in the muscular neck and lead to a non-pulsatile distended vein.

Normal Venous Pressure: In most patients elevation of the head to 30-45 degrees is ideal for assessing the venous pressure. During respiration clear-cut pulsations should be visible in order to ascertain that there is a patent, distortion-free venous column. The height of the venous column at the peak of the A and V waves generally is taken as an indication of the venous pressure, although the actual mean jugular venous pressure will be slightly lower.

The **sternal angle (of Louis)**, found at the junction of the manubrium and the sternum at the level of the second rib, is used as the standard reference point for determining venous pressure noninvasively. The right atrium is 5 to 7 cm below this point, **and the relative distance of the right atrium to the sternal landmark changes only a small variable degree in the supine, 45 degree, and 90 degree positions.** The estimated height of the venous column should be related to the sternal angle, eg. “1 cm above to...,” “5 cm above...”, **and estimated by extending a artificial line from the meniscus of the jugular venous column, parallel to the floor, and measuring down to the sternal angle.** The normal venous column should be no more than 2-3 cm above the sternal angle. Adding this to the distance to the mid right atrium below this point (5-7 cm) would give the normal right atrial pressure estimate of 7-10 cm of water. When the mean jugular venous column is 4-5 cm higher than the sternal angle, the venous pressure is abnormally elevated. If the height of the venous column is equal to or slightly higher than the sternal angle in the supine position, the venous pressure is normal. This will be found in most individuals.

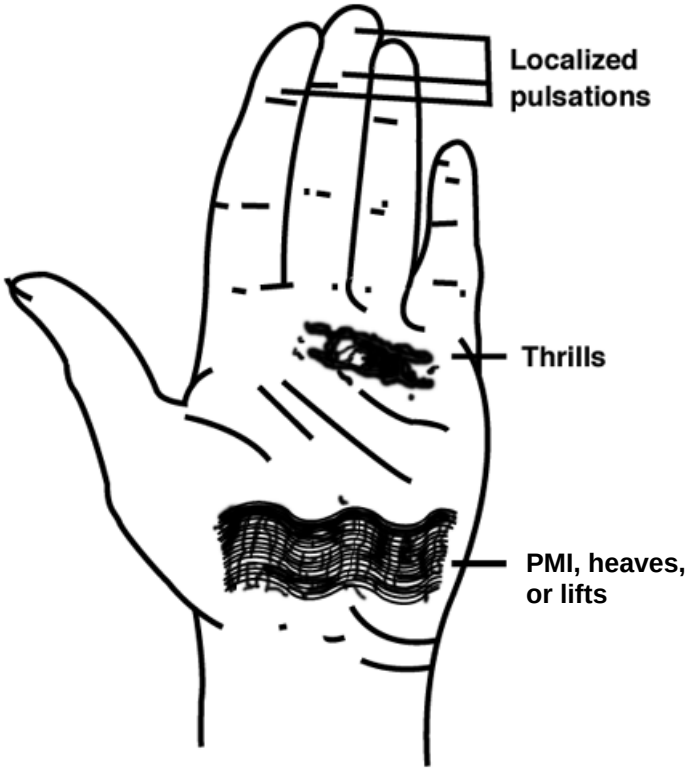


C. **Palpation:**

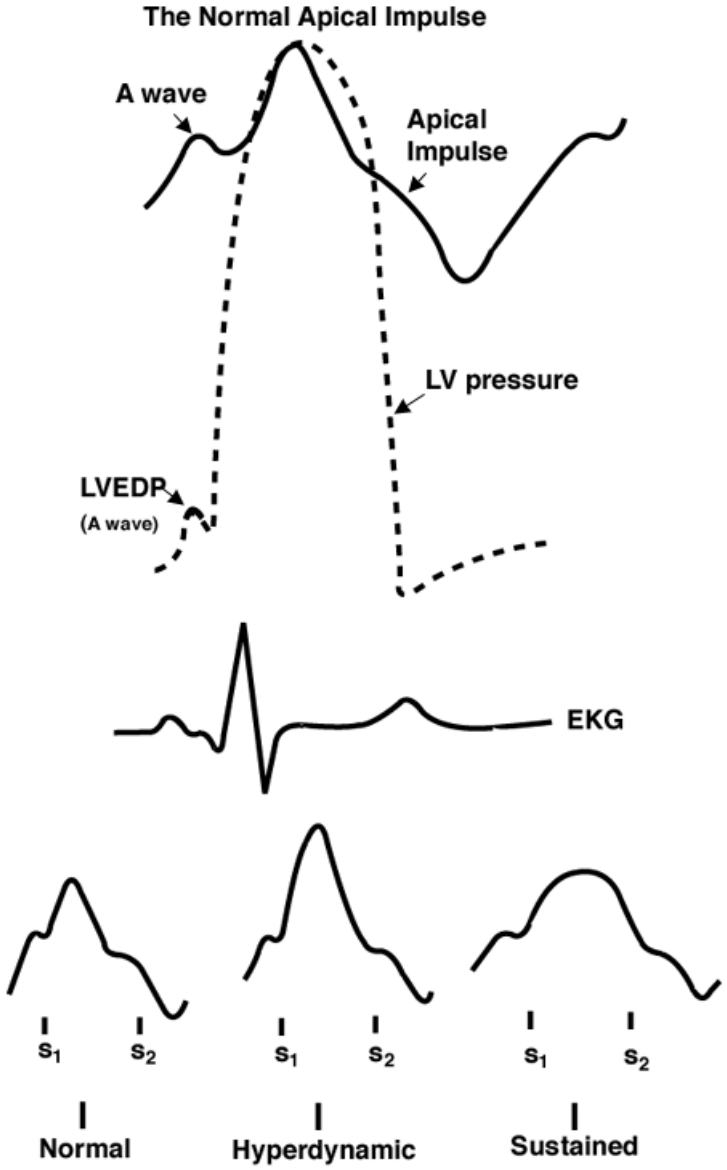
Detection of cardiac activity through the chest wall can be appreciated by inspection or palpation or both. Different parts of the hand may be optimal to detect precordial events.

Normal precordial activity reflects anterior movement of the left ventricle during early systole. As intraventricular pressure rises the left ventricle rotates in a counter clockwise direction on its long axis as the cardiac apex lifts and makes contact with the left anterior chest wall. This is the **apical impulse, which** is the **point of maximal impulse ("PMI")**. In some thin individuals the right ventricular outflow tract can be palpated during systole at the 2nd left intercostal space.

The technique of observing precordial movements requires knowledge of normal and disease states. The patient should be observed in the four areas where one usually auscultates; the right upper sternal border **(2^{nd} RICS**), the left upper sternal border **(2^{nd} LICS)**, the left lower sternal border **(4^{th} LICS**), and the **apex**. These same areas should be palpated with the fingertips or pads, as well as with the palm. Notation should be made of the **amplitude, duration, and location** of precordial movements making specific reference to **thrills, lifts, or heaves.** With cardiomegaly the enlarged apical impulse is often displaced laterally or downward.


Localized
pulsations
Thrills
PMI, heaves,
or lifts

-A gentle nonsustained tap
-Early systolic anterior motion that ends before the last 1/3rd of systole
-Located within 10 cm of the midsternal line in the 4th or 5th LICS
-A palpable area less than 2 to 2.5 cm2 and detectable in only one ICS
-Right ventricular motion normally not palpable
-Diastolic events normally not palpable
-May be completely absent in the elderly

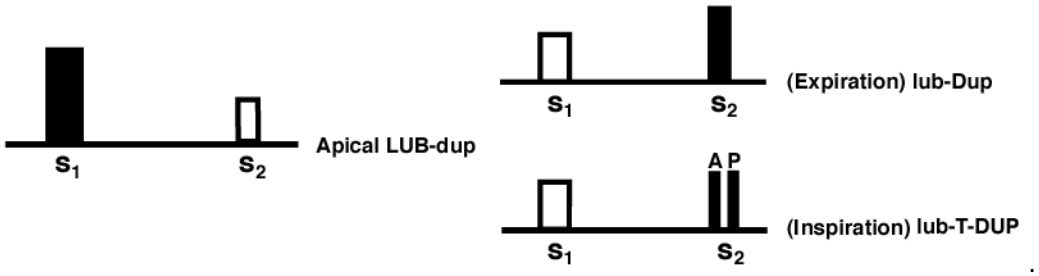


D. **Auscultation:**

Stethoscopic auscultation provides the basis for identifying heart sounds, systolic and diastolic, as well as murmurs.

The technique requires that the patient be examined in a quiet area and in multiple positions, supine and left lateral decubitus, upright and leaning forward, as well as during inspiration and expiration. The examiner should auscultate over the listening areas of the 2nd RICS, 2nd LICS, 4th LICS, and apex. The carotids, and chest areas, both front and back are included at this time.

The **normal heart sounds** include S1, S2, and in the young individual S3. The S1 reflects closure of the mitral and tricuspid valves and is therefore loudest at the apex. The S2 reflects closure of the pulmonic and aortic valves and is loudest therefore at the base of the heart. **Splitting of S2** is physiologic (and normal) when present during inspiration but absent during expiration (fusion). Splitting of S2 may be **fixed** with no appreciable respiratory variation (as occurs with an atrial septal defect), or **paradoxical** (fusing during inspiration) as seen in severe aortic stenosis



Additional heart sounds include the S4; ejection sounds, clicks (systolic), and snaps (diastolic). These are usually seen in pathologic states.

For more details on the S3 and S4, see page 290 in Bates (Table 7-5).

Murmurs are a prolonged series of auditory (occasionally palpable/thrill) vibrations. They may be systolic, diastolic, or continuous (through both systole and diastole).

Proper assessment of murmurs requires several observations:

- Location
- Pitch/Quality (**Ejection, Regurgitant, or Vibratory)**
- Timing
- Intensity/Grade
- Radiation

Grading of murmurs assigns a degree of loudness, with **systolic murmurs graded I through VI,** and **diastolic murmurs I through IV**, the grading system (loudness) of the murmur is the same for both but there are no grade V or VI diastolic murmurs. Their description is written eg. II/VI systolic, or II/IV diastolic etc. **Continuous** murmurs are graded for their systolic component eg. I/VI continuous, or split and each component graded separately and frequently described **as to-fro** murmurs.

Murmur Grading System

I. Soft, but questionably present
II. Soft, but definitely present
III. Loud, but no thrill
IV. Loud with thrill present, but not heard with diaphragm at 45 degrees
V. Loud with thrill, heard with diaphragm tilted at 45 degrees
VI. Loud with thrill, heard with diaphragm 1 cm above the chest

* Diastolic murmurs are only graded up to IV.

The **most common murmurs are innocent**, however the most important murmurs to identify are the **not innocent (pathologic) murmurs.**

The **Not** Innocent Murmurs

A. Diastolic murmurs
B. Loud murmurs, grade IV or above
C. Regurgitant murmurs
D. Murmurs associated with a click
E. Murmurs associated with other signs or symptoms (eg, cyanosis)
F. Abnormal 2nd heart sound (fixed split or single)

* One has to be cognizant of the patient's cardiac output, and in the elderly patient, softer murmurs are more likely to be **not** innocent

When describing the pertinent findings in the examiner's written physical examination, the concise description should attempt to creat a narrative that uses no "diagnostic" terms, but allows the reader to form a picture that would logically lead to the diagnoses listed below, eg. ...a Grade II/VI systolic ejection murmur was heard over the 2nd RICS, no clicks or diastolic murmurs were apparent... In the face of an asymptomatic patient, this would be consistent with the Diagnosis: 1-Innocent Murmur.

For more information on murmurs, see pages 291-294 in Bates.