PRE-CLINICAL CLERKSHIP, YEAR 1
Physical Examination

Session Four Heart Sounds
Cheryl A. Walters, M.D.

1. Learning Objectives

To outline on the chest, the maps for auscultating the aortic, pulmonic, Erb's point, tricuspid, and mitral areas.
To practice the techniques of examining the heart sounds (positioning, sequencing, handling of the stethoscope)—inspection, palpation, auscultation.
To describe and appreciate the defining features of S1, S2, systole and diastole.
To develop a flow for the head to toe exam.

2. Student Prep

Read pp. 390-399, 407-429, Chapter 14 The Heart
View the companion portion of the CD **Practice Exercises:**

Inspection: Identify on yourself or partner the aortic (2nd Right intercostal space), pulmonic (2nd Left ICS), tricuspid (4th L ICS), and mitral (5th L ICS) areas and Erb's point (3rd L ICS). Identify the sternal angle or angle of Louis (helpful in measuring JVD).

Auscultation: Read the attached article, "Listening to the Heart: Dying Art?" Listen to the recording of heart sounds on the CD. Practice using the diaphragm of your stethoscope to listen to your own or partner's heart to identify the first (S1) and second (S2) heart sounds, and the systolic and diastolic phases.

Three defining features are helpful in discriminating S1/S2, systole/diastole:

- cadence or relative length of the phases ○ At slow to normal heart rates (less than 100 beats/min), systole is shorter than diastole and the heartbeat is appreciated as a repeating pattern (or cadence) of two grouped sounds followed by a pause: lub/dup (S1/S2), pause, lub/dup, pause….. The short phase between the two grouped sounds S1 and S2 is systole, and the longer pause is diastole.
    - ○ At heart rates 100 or greater the phases become equal, the cadence is similar to a ticking watch, and discrimination is difficult.
- location , location, location ○ At the 2nd L ICS, S2 is much louder than S1. Practice listening over the 2nd L ICS to identify S2 as the louder sound, and then inch slowly along the left sternal border (listen at Erb's point, the tricuspid area and the mitral area at the apex). As you inch along, notice S2 becoming fainter and S1 becoming louder. In a healthy person, at the apex S1 is louder than S2.
- timing of S1 with apical beat or carotid pulse ○ The apical heartbeat (often visible in thin, young patients, and palpable in many patients esp. in the left lateral decubitus position) coincides with S1. The carotid upstroke is just after S1.

Listening to the Heart: Dying Art?

THE NEW YORK TIMES
September 3, 1997

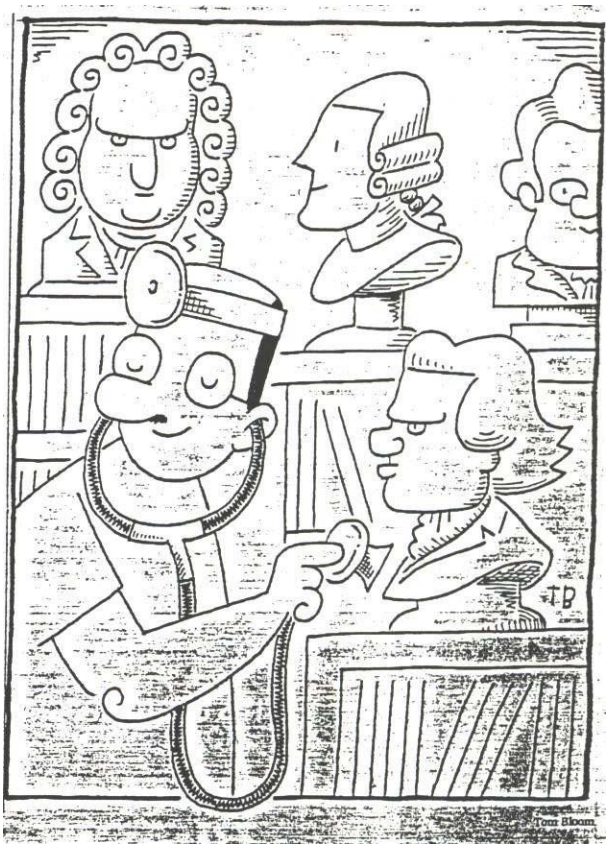
Listening to the Heart: Dying Art?

By DENISE GRADY

IF any one tool could be declared the symbol of the medical profession, it would surely be the stethoscope. But the ability to use that tool may be a dying art, according to a study of 453 recent medical graduates.

The new doctors, residents from 31 training programs in internal medicine or family practice, made the correct diagnosis only 20 percent of the time when asked to identify common heart abnormalities by listening to recordings of patients' heartbeats. Residents who knew how to play a musical instrument scored a few points higher than those who did not, but the overall rate of correct diagnoses was still ''disturbingly low,'' said the researchers, whose study is being published today in The Journal of the American Medical Association.

The scores should have been at least 70 percent to 80 percent correct, said Dr. Salvatore Mangione, an author of the paper. He and Dr. Linda Nieman, both from Allegheny University of the Health Sciences, in Philadelphia, said they conducted their study to test an idea expressed by many medical educators: that doctors are less skilled than they used to be at traditional tasks like examining patients and making diagnoses based on physical findings.



''We think those skills have been waning,'' Dr. Mangione said. ''We don't have fantastic data from before, but there was a study showing that older physicians, who had graduated before 1970, were better than ones who graduated after 1970 at identifying heart murmurs.''

Dr. Mangione said he found the findings troubling. ''This is an important skill,'' he said. ''Everybody agrees that the bulk of our diagnosis, 80 percent of it, is based on the patient's history and the physical exam.'' A doctor who knows what to listen for can find out a great deal with a stethoscope, he said, especially about heart valve disorders.

Doctors who lack that ability may harm patients by failing to recognize important problems, Dr. Mangione said, or they may cause needless anxiety and expense by ordering tests to diagnose heart murmurs that they should have known, just from listening, to be harmless.

Dr. Mangione and Dr. Nieman said that their findings were especially worrisome in today's era of managed care, because generalists -- including family practitioners and internists like those in the study -- are taking care of more and more people. Assigned to act as ''gatekeepers,'' they screen patients and decide which ones need diagnostic tests and treatment from specialists. But, Dr. Mangione said, his and Dr. Nieman's data suggest that generalists may not always be capable of making those decisions.

He also said that a doctor's ability to use a stethoscope has great symbolic value to patients. ''These skills go to the core of what it is to be a doctor, to the art of being a doctor, the laying on of hands,'' Dr. Mangione said. ''Even in this time of technology, the public seems to cherish that. Independent of diagnostic value and cost effectiveness is the value of establishing that connection. It contributes to the patient's comfort and satisfaction, and it may even have therapeutic value.''

Stethoscopes have been around for about 200 years, he said. The first one was developed by a French doctor. ''It was the year after Waterloo,'' he said. ''A very shy, very Catholic physician had to examine a woman who was rather well endowed. The thought of his naked ear on her naked chest was inadmissible. He found that by rolling up a piece of paper and applying it to the lady's chest, he could avoid this predicament. He then made one out of wood, and soon they were selling for 15 francs, with a book of observations. His students called him a cylindromaniac.''

Dr. Mangione and Dr. Nieman said they thought that the residents' poor performance in their study resulted from a lack of training. Fewer than a third of all internal medicine programs offer extensive training in cardiac auscultation, the scientific term for listening to the heart.

And yet even medical textbooks say that identifying heart sounds is the most difficult diagnostic skill that doctors must learn. The sounds are faint and fleeting, and have been sorted by experts into a daunting array of murmurs, clicks, rumbles, gallops, rubs, knocks, snaps and thrills. ''In 0.8 seconds, you have 4 or 5 acoustic events at the threshold of audibility,'' Dr. Mangione said. ''You need to be able to separate them, and pick them up as a pattern.''

In addition, certain sounds occur at characteristic points during the heartbeat, and some can be heard only if the stethoscope is

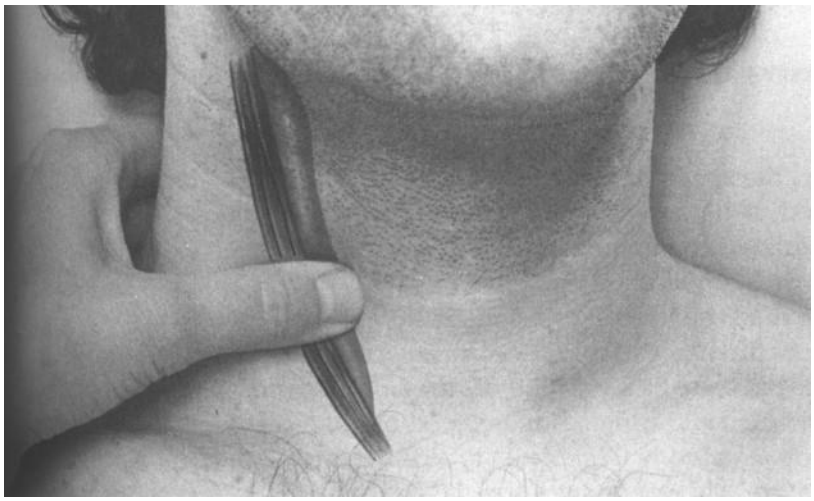
placed at just the right spot on the chest. Picking out the important sounds from all the other whooshes and thumps requires a keen ability to recognize subtle differences in pitch and rhythm. That may be why musicians have an edge in acquiring the skill, the researchers speculate: their ears are already trained to make distinctions.

Dr. Mangione, who teaches auscultation to medical students, plays the guitar by ear, and when he listens to concerts he can hear each instrument separately. He said his own experience had led him to wonder whether musical skill might also be useful when listening to the heart, and that is why subjects in the study were asked whether they played an instrument.

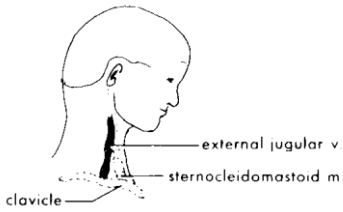
The researchers said that medical training should be improved, and medical students should be given more demonstrations in which they are shown how to use their stethoscopes on patients. In addition, Dr. Mangione said, doctors need to study on their own by listening again and again to audiotapes of heart sounds, because that has been shown to make them more proficient with a stethoscope. Cardiologists who frequently study that way were 80 percent to 90 percent accurate on his tests. He and Dr. Nieman recommended that doctors seeking board certification in family practice or internal medicine also be required to pass a test in cardiac auscultation, something that is not done now. ''These are valuable diagnostic skills, and they will be lost unless we do something about it,'' Dr. Mangione said.

3. Clinical Anatomical Landmarks

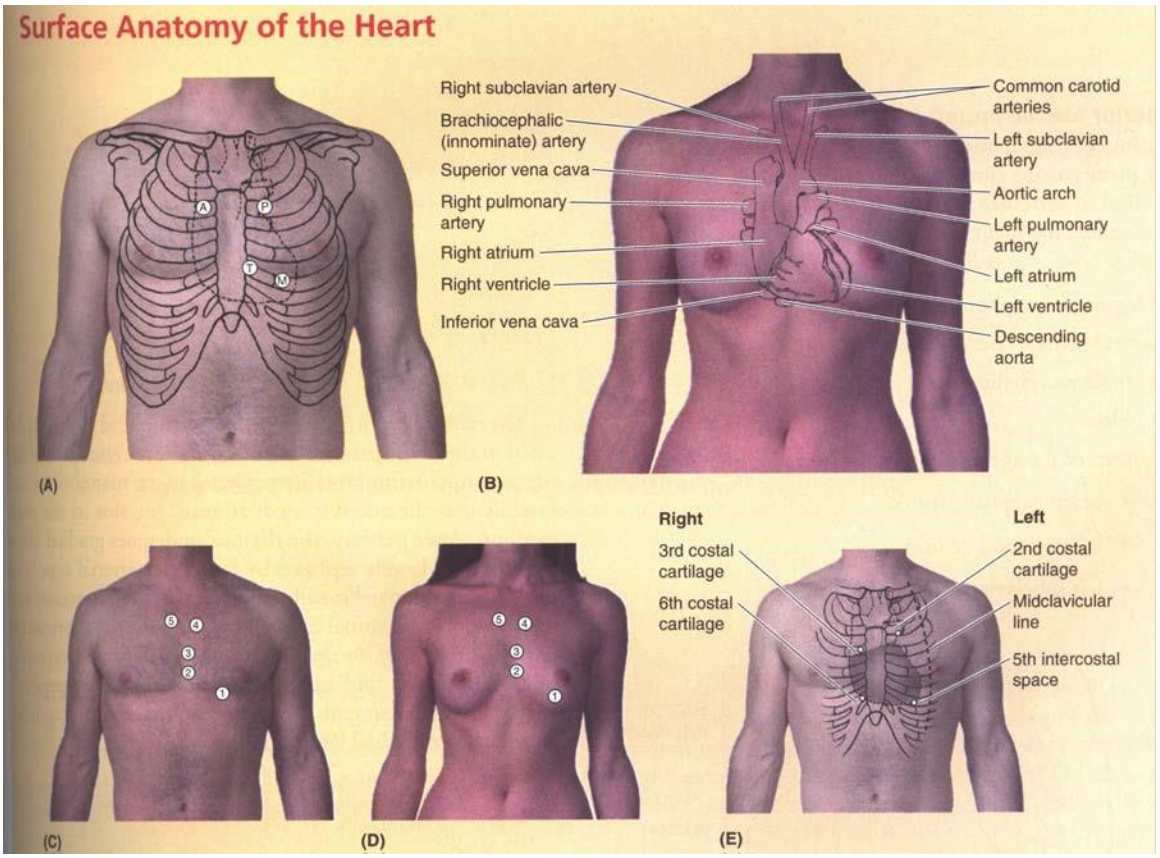
Angle of Louis
Carotid artery
Internal jugular venous pulsation (JVP)
External jugular vein
Auscultation map
Aortic valve area
Pulmonic valve area Erb’s
point
Tricuspid valve area
Mitral valve area
Base (aortic area and pulmonic area)
Apex (mitral area and point of maximal impulse – PMI)



The carotid artery is just medial to the sternocleidomastoid muscle.



The internal jugular pulsation is beneath the sternocleidomastoid muscle and is sometimes visible by shining a light on the overlying tissue at an angle. The vein itself is not visible.
The external jugular vein is visible lateral to the sternocleidomastoid muscle.



Auscultatory Areas of the Chest

A Aortic area	1 Mitral area (5LICS)
P Pulmonic area	2 Tricuspid area (4LICS)
T Tricuspid area	3 Erb's Point (3LICS)
M Mitral area	4 Pulmonic area (2LICS)
	5 Aortic area (2RICS)

4. List of Maneuvers to be Demo/Practiced

Inspection with patient supine at 30 to 45 degrees: Identify the following landmarks on your partner:

Angle of Louis
Carotid artery
JVP
Aortic area
Pulmonic area Erb's point
Tricuspid area
Mitral area
Base of heart Apex of heart

Observe neck veins - measure the height of jugular venous distention (JVD) at a right angle to the reference point of the angle of Louis. The height of the right internal jugular pulsation is the most accurate estimate of JVD. If the pulsation is difficult to appreciate, the height of the grossly visible right external jugular vein offers a rough estimate. At 30 degrees, the upper limit of normal is 6 cm above the angle of Louis; at 45 degrees, the upper limit of normal is 4 to 5 cm. Observe precordium.

Palpation with patient supine:

Aortic area
Pulmonic area Erb's point
Tricuspid area
Mitral area
PMI

Auscultation with patient supine, using diaphragm of stethoscope:

Aortic area
Pulmonic area Erb's point
Tricuspid area Mitral area

Identify the cadence – lub,dup, pause;
Compare the relative loudness of S1,S2 as you inch along the valvular areas from the base to the apex.

Note S2 is loudest at the pulmonic area; S1 becomes louder than S2 at the apex.

Auscultation with patient supine, using bell of stethoscope:

Tricuspid area

Patient supine—ask patient to roll to left lateral decubitus position: Palpate to relocate apex, PMI.

Auscultation with patient in left lateral decubitus, using bell of stethoscope:

Mitral area

Auscultation with patient sitting, using the diaphragm of stethoscope:
All areas

Auscultation with patient sitting, leaning forward,using the diaphragm of the stethoscope:

Base (aortic area, pulmonic area)

5. Procedural Tips

Handling the stethoscope: Demonstrate with explanation the approach to handling the stethoscope and observe and guide students through the following steps. The stethoscope has two heads—the bell and diaphragm. Do not listen through clothing. Place the bell or diaphragm of the stethoscope directly on the patient's skin. The smaller head, the bell, is better for appreciating low-pitched sounds like diastolic rumbling murmurs at the apex or gallops at the apex. The bell should be placed lightly on the skin. If it is pressed too tightly, the skin acts as a diaphragm effect. The diaphragm is the larger, flat head and is better for appreciating high pitched sounds. It is placed firmly on the skin.

6. Perceptual Tips

Inspection: Illustrate how to differentiate jugular and carotid pulsations. Emphasize the defining features outlined below.

	Internal Jugular Pulse	**Carotid Pulse**
Palpation	Not palpable	Palpable
Wave forms	Multiform: three components	Single
Quality	Soft,undulating	Vigorous
Pressure	Wave forms obliterated	No effect
Inspiration	Decreased height of waves	No effect
Sitting up	Decreased height of waves	No effect
Valsalva maneuver	Increased height of waves	No effect

Auscultation: Illustrate how to identify S1, S2, and the systolic and diastolic phases. Emphasize the defining features - cadence, inching, and timing. Ask students to begin describing what they are hearing.

- cadence or relative length of the phases ○ At slow to normal heart rates (less than 100 beats/min), systole is shorter than diastole and the heartbeat is appreciated as a repeating pattern (or cadence) of two grouped sounds followed by a pause: lub/dup (S1/S2), pause, lub/dup, pause….. The short phase between the two grouped sounds S1 and S2 is systole, and the longer pause is diastole.
    - ○ At heart rates 100 or greater the phases become equal, the cadence is similar to a ticking watch, and discrimination is difficult.
- location , location, location ○ At the 2nd L ICS, S2 is much louder than S1. Practice listening over the 2nd L ICS to identify S2 as the louder sound, and then inch slowly along the left sternal border (listen at Erb's point, the tricuspid area and the mitral area at the apex). As you inch along, notice S2 becoming fainter and S1 becoming louder. In a healthy person, at the apex S1 is louder than S2.
- timing of S1 with apical beat or carotid pulse ○ The apical heartbeat (often visible in thin, young patients, and palpable in many patients esp. in the left lateral decubitus position) coincides with S1. The carotid upstroke is just after S1.

7. Description of Key Features

Jugular venous pressure: ___ cm at ___°

Jugular venous pulsations

Carotid arteries - palpate (grade 0 - 4+)

0 Absent
1+ Diminished
2+ Normal
3+ Increased
4+ Bounding (reflecting a wide pulse pressure or difference between the systolic and diastolic blood pressure)

Carotid arteries – auscultate for presence or absence of bruits

PMI (location, diameter)

Palpable thrill (murmur) or heave (lift)

Palpable P2

S1

S2

Extra sounds:

S3 gallop
S4 gallop
Snap
Click
Murmur
Tumor plop
Pericardial knock
Pericardial rub

For Extra sounds, record the following dimensions –
Timing in the cardiac cycle (systolic, diastolic, continuous, or to-and-fro) Shape (quality and duration, e.g., crescendo-decrescendo or diamond shaped or ejection murmur, holosystolic, etc.)
Location (where best heard)
Radiation (other places heard – radiation to carotids, axilla, or back)
Pitch (high, low or rumbling)
Timbre (coarse or musical)
Intensity (loudness, grade I-VI)

I Lowest intensity, difficult to hear consistently
II Low intensity, consistently heard
III Medium intensity, without a palpable thrill
IV Medium intensity, with a palpable thrill
V Loudest intensity that is heard when the stethoscope is placed on the chest, with a palpable thrill
VI Loudest intensity that is heard when the stethoscope is removed from the chest, with a palpable thrill

Relationship to respiration Relationship to body position