Learning to perform a quick cardiac assessment isn't as difficult as you might think. This month's photo guide shows you how to assess normal heart sounds. Next month, in Part 2, you'll see how to detect abnormal sounds—murmurs, clicks, and rubs.
Michelle Lebow, a moderately obese 63-year-old, has just been admitted with a diagnosis of early congestive heart failure (CHF). The admitting nurse noted that Ms. Lebow's heart rate was 118 and that her heart occasionally skips a beat. Her respirations are regular, with a respiratory rate of 28. Her temperature is 98.2°F (36.8°C), and her skin is slightly cool.

Now that Ms. Lebow has arrived on the medical/surgical unit, she needs a brief—but more thorough—assessment of her cardiac status. This will include inspection, palpation, and most important, auscultation of heart sounds. To help you meet the challenge of doing quick cardiac assessments on patients like Ms. Lebow, let's look at the key anatomic landmarks and review the examination techniques you'll use.

**Heart's position in the thorax**

The cone-shaped heart sits within the thorax, about two-thirds of it to the left of the midline (see Photograph 1). The atria tilt slightly toward the back of the thorax. This broad upper part of the "cone" is called the base of the heart.

The ventricles extend to the left of the sternum, with the right ventricle taking up most of the heart's anterior surface. The left ventricle comes closest to the chest wall at a point located just behind the junction of the fifth intercostal space and the midclavicular line. In some patients, you can see the thrust of the contracting left ventricle at this site, known as the point of maximal impulse (PMI). This part of the heart is called the apex, and the pulse you can detect here is called the apical pulse.

**Four listening posts**

Two sets of valves—the atrioventricular and the semilunar valves—connect the four chambers of the heart. The atrioventricular valves are the mitral valve (between the left atrium and left ventricle) and the tricuspid valve (between the right atrium and right ventricle). The semilunar valves are the aortic and pulmonic valves. The aortic valve connects the left ventricle to the aorta; the pulmonic valve connects the right ventricle to the pulmonary artery.
Each time these valves close during the normal cardiac cycle, they produce vibrations, called heart sounds. You can hear these sounds on auscultation, but you won’t hear them directly over the four valves. That’s because the vibrations are transmitted away from the valves in the direction of blood flow.

To hear heart sounds best, auscultate at these four cardiac “listening posts” (see Photograph 2):
- **mitral valve**: fifth intercostal space on the midclavicular line (5ICS/MCL)
- **tricuspid valve**: fourth or fifth intercostal space at the left sternal border (4ICS/LSB or 5ICS/LSB)
- **aortic valve**: second intercostal space at the right sternal border (2ICS/RSB)
- **pulmonic valve**: second or third intercostal space at the left sternal border (2ICS/LSB or 3ICS/LSB).

**Understanding heart sounds**
The cardiac cycle consists of two phases—diastole (or relaxation) and systole (or contraction). After ejecting blood into the aorta and the pulmonary artery, the ventricles relax and the mitral and tricuspid valves open. This lets blood flow from the atria into the ventricles. As ventricular systole begins, pressure builds in the ventricles, forcing the two atrioventricular valves shut. These closures produce the first heart sound (S₁)—commonly referred to as the *lub* of the *lub-dub* sound made by the first two heart sounds. Because the mitral valve closure is louder than that of the tricuspid, S₁ can be heard best at the mitral valve area (see Photograph 3).

Pressure continues building in the ventricles. When it exceeds the pressure in the aorta and the pulmonary artery, the semilunar valves open and blood is ejected from the ventricles. After ejection, ventricular diastole begins. As the ventricles relax, ventricular pressure falls below the pressure in the aorta and the pulmonary artery. Then the aortic and pulmonic valves snap shut, causing the second heart sound (S₂)—the *dub* of the *lub-dub*. The closure of the aortic valve is louder than that of the pulmonic, so S₂ is heard best at the aortic valve area (see Photograph 4).
When you listen to heart sounds, you may actually hear a splitting of both S\textsubscript{1} and S\textsubscript{2}. That's because events in the left side of the heart occur just before those in the right side. So the mitral valve closes before the tricuspid valve, causing a physiologic splitting of S\textsubscript{1}, and the aortic valve closes before the pulmonic valve, producing a similar splitting of S\textsubscript{2}.

During diastole, you may also hear two other heart sounds, S\textsubscript{3} and S\textsubscript{4}, considered normal variants in children and young adults. A low-pitched sound, S\textsubscript{3}, results from early rapid ventricular filling. You'll hear this sound right after S\textsubscript{2} in early diastole. Then, just before S\textsubscript{4}, you may hear S\textsubscript{4}, which is caused by increased resistance to ventricular filling after atrial contraction.

Now let's recap the events in the cardiac cycle that produce heart sounds:
- S\textsubscript{1} (systole)—closure of mitral and tricuspid valves
- S\textsubscript{2} (diastole)—closure of aortic and pulmonic valves
- S\textsubscript{3} (diastole)—passive ventricular filling
- S\textsubscript{4} (diastole)—atrial contraction.

**Inspection and palpation**

Before starting your assessment of a patient like Ms. Lebow, make sure the room is quiet and well lit. Have the patient lie supine with her chest exposed. Stand to her right (unless you’re left-handed) and briefly inspect the chest for general size and symmetry.

Now, locate the heart's four listening posts, corresponding to the atrioventricular and semilunar valves, as described above. Use the sternal angle to help you find these areas (see Photograph 5). First, palpate the sternal notch, located at the top of the sternum. Then, slide your fingers down to the sternal angle, the elevated ridge two to three fingerbreadths below. When you move your fingers directly to the left of this landmark, you'll feel the second rib. From here, you can count up or down to find other ribs and intercostal spaces and thus locate the four listening posts.

Here’s a tip you might find helpful: Practice finding these areas on both an adult and a child. During your practice sessions, use a water-soluble marker to write M, T, A, P (for mitral, tricuspid, aortic, and pulmonic) over the appropriate areas (see Photograph 6). This
will help you visualize these key sites when you’re assessing a patient.

You can use any sequence you want when assessing these areas. But once you choose a particular sequence, use it consistently during inspection, palpation, and auscultation. Many examiners like to start at the mitral valve listening post (the apex of the heart) and work clockwise. So that’s what we’ll do here.

Start by observing the mitral valve area for the size of the PMI. Normally, it will be 1 to 2 cm, about the size of a quarter. If your patient’s heart is enlarged, her PMI may be bigger or it may be displaced to the left. You’d probably see the PMI displaced down and to the left in Ms. Lebow. This is a common finding in patients with left ventricular hypertrophy secondary to CHF.

After you assess the PMI, check for lifts (or heaves), retractions, and pulsations in all four valve areas. Remember to follow the same clockwise sequence as before—mitral valve area first, then the tricuspid, aortic, and pulmonic valve areas.

Now, palpate the four valve areas—again starting at the mitral valve area and proceeding clockwise. At each area, palpate first with the palm of your hand, then with your finger pads. Vibrations or thrills, which you can feel best with your palm, may indicate turbulent blood flow. You’ll feel pulsations more easily with your finger pads. This finding may indicate increased volume or pressure.

**Auscultating heart sounds**

Before auscultating your patient’s heart sounds, warm the diaphragm of the stethoscope with your hands. Then place the diaphragm on the mitral valve area and listen to the patient’s heart rate and rhythm. Now, focus on S₁ and S₂. You’ll have to concentrate to hear heart sounds in a patient like Ms. Le-

bow, because breath sounds may be noisy in a patient with CHF.

At the mitral valve area, S₁ will be louder than S₂. So expect to hear the *lub* sound more distinctly than the *dub* sound. After you hear S₁ and S₂ at this area, move on to the other three sites. You’ll be able to hear the distinctive *dub* sound more easily than the *lub* at the aortic and pulmonic valve areas.

If you have difficulty distinguishing S₁ from S₂, try palpating the carotid pulse as you auscultate. The *lub* sound of S₁ will occur at almost the same time as the beat of the carotid pulse.

Once you’ve auscultated S₁ and S₂ at all four valve areas, listen for the splitting of S₁ and S₂. Again, start at the mitral valve area, and move on to the tricuspid, aortic, and pulmonic areas. Hearing these splittings of S₁ and S₂ will take more concentration than just hearing S₁ and S₂. A normal split S₂ can be best heard at the tricuspid valve area. The familiar *lub* will sound like a broken syllable. A split S₂, in which the *dub* sounds broken, is best heard at the pulmonic valve area during inspiration. Typically, a split S₂ will be easier to hear than a split S₁. That’s because the sound of the tricuspid valve closing is very faint.

**Additional heart sounds**

What about S₃ and S₄? Unlike the first two heart sounds, S₃ and S₄ are low pitched. To hear them best, have the patient lie supine or on his left side. Then auscultate at the mitral valve area with the bell of your stethoscope. You’ll hear S₃ in early diastole, right after you hear the *lub-dub*. It may sound like lub-dub-dee. In an adult, this abnormal sound indicates left ventricular failure.

So you’d probably hear S₃ in a CHF patient like Ms. Lebow. S₃ comes late in diastole or presystole, just before the *lub-dub*. You’ll hear it as dee-lub-dub. Frequently, S₃ occurs in patients with hypertension or coronary artery disease.

An auscultatory finding of an S₃ or an S₄ is known as a gallop rhythm—so called because it sounds like a horse galloping. S₁ is considered a ventricular gallop; S₃, an atrial gallop.

**Describing your findings**

As important as your auscultation skills are, they’ll mean little if you don’t accurately describe what you hear. So note the rate, rhythm, and intensity of normal heart sounds. If you detect S₃ or S₄ in an adult, document its location and pitch and the patient’s position. Also, record whether the sound increases on inspiration. If you’re not certain that you’ve detected S₃ or S₄, ask a more experienced nurse to confirm your findings before recording them.

For Ms. Lebow, your nurses’ notes would probably include the following information: PMI 2 cm, displaced down and to the left. No lifts, pulsations, or thrills. Heart rate 118, with occasional skipped beats. S₃ heard over mitral valve area with patient in left lateral position; S₃ low pitched and increases on inspiration.

Learning to perform quick, accurate cardiac assessments really isn’t all that difficult. It just takes careful practice so you can get used to the feel and the sounds of the heart. Then, when you’re assigned to a patient like Ms. Lebow, your practice will pay off.

When you’re practicing, use a water-soluble marker to write M, T, A, P (for mitral, tricuspid, aortic, and pulmonic) over the appropriate listening posts.
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