**Vital Signs**

03.01.2002

**Ultrasound uncovers a lethal choke hold on the heart**

by Tony Dajer

"The patient needs the unit. She's sick, and she's definitely not surgical!" said Diane, the surgical resident, as she finished up her consultation note. Kendrick, one of my internal medicine residents, stood by, looking distressed. I had just come into the emergency department for my evening shift.

"What's going on?" I asked, and Kendrick gave a quick rundown of the case.

"Mrs. Hom. Sixty-five-year-old Chinese woman. Sick for two or three weeks. Cough, runny nose, very fatigued. Got antibiotics and allergy pills from her doctor a week ago. Today she was so weak, she couldn't get out of bed. Almost passed out when her daughter stood her up. No fever, but a very fast heart rate. And abdominal pain."

"Abdomen is benign," Diane said. "Not a surgical problem."

Mrs. Hom's chart said her white blood cell count was very high, which is typical of a serious infection. Her kidneys were failing and her blood was turning acidotic, a sign that the waste products of metabolism weren't being cleared. But her blood pressure was holding steady at 105/60.

"Looks septic," I said. Sepsis is usually caused by bacteria that produce organ-damaging toxins. The condition is fairly common, and frequently it can be a cause of death.

"I think so, too," Kendrick said. "But I don't see any sign of infection either in her lungs or in her urine. And she has no fever. In any case, I have already started her on antibiotics."

"Could it be the gallbladder?" I asked. "That's a possible source of infections that lead to sepsis."

"Right," Kendrick said, "but how do we check? It's 9 p.m. All of the sonographers work only till five."

I stepped into a side room and grabbed the ER's ultrasound machine.

"Easy."

Ultrasound works like radar: It captures sound waves as they bounce off an object, creating an image that is displayed on a monitor. Depending on how the sound reflects, structures within the body appear as black, white, or shades of gray. Excellent sound transmitters, such as blood and water, show up black. Liver is a mottled gray; bone and gallstones, white as chalk.

Physicians have long used ultrasound to examine large organs like the uterus and heart, as well as gallstones, aortic aneurysms, kidney stones, and prostate lesions. And in the early 1990s, improvements in the technology helped trauma surgeons get an even better image of blood pooling in the abdomen, the chest, or the sac around the heart. When you have only five minutes to figure out why a trauma victim's blood pressure is plunging, that kind of information can save lives. And new portable designs have made it easy for emergency room doctors to operate the equipment themselves.

We wheeled the ultrasound machine over to Mrs. Hom's bedside. Thin and pale, she grimaced and shifted about in discomfort on the bed.

I gently pressed on her abdomen. *"Tong, tong-ah?"* I asked in rudimentary Cantonese. Pain?

She shook her head.

I pulled up her gown, squirted some ultrasound gel just below her right rib cage, then pressed the curved plastic probe to her skin. The liver—gray and triangular—materialized on the screen. I fanned back and forth more carefully. A smooth black oval swam into view: the gallbladder. Its wall was thin, no sign of inflammation, no stones breaking up the inky interior. Everything appeared to be normal.

Then a big black stripe flew across the screen.

I swept back and there the stripe was again, above the liver, black and huge. Dropping the probe flat, pressing harder below the breastbone, I scanned the chest. It was almost solid black. But deep within that dark pool, fluttering like a small, trapped bird, was the heart. Around the dark fluid was a bright white line, the pericardium.

Form-fitted in a double layer around the heart, the pericardium is a tough fibrous sac. One layer, called the visceral pericardium, adheres to the heart; the other layer, the parietal pericardium, encloses it. Although not crucial to cardiac function, the pericardium is thought to provide a low-friction space for beating. But infections or other disorders can mar its smooth, gliding surfaces. The resulting inflammation is called pericarditis. Its symptoms are chest pain, shortness of breath, fever, and weakness. If caused by a virus, the infection usually responds to anti-inflammatory drugs like ibuprofen. More serious bacterial infections, such as tuberculosis, must be treated promptly with antibiotics. Far more worrisome is the accumulation of fluid in the pericardium, which can be the result of infection, cancer, renal failure, or autoimmune disorders. It can also occur for no discernible reason.

If the fluid builds up slowly, the pericardium can expand to accommodate up to two quarts of fluid before it starts pressing on the heart. But if the buildup is sudden, say, from a stab wound to the heart, the pericardium doesn't relax, and a mere pint of fluid can very quickly choke off all venous flow into the right side of the heart. This state of affairs, called cardiac tamponade, sometimes kills the patient within minutes.

"Kendrick, she's in cardiac tamponade! Look at this." I pointed to the huge black pool around the heart.

I immediately recalled several significant clues. When I listened to Mrs. Hom's chest, the heart sounded muffled. Her electrocardiogram showed small spikes that alternated in shape—a classic sign of cardiac tamponade called electrical alternans. Her chest X ray showed a large heart. Her neck veins were visibly bulging—a sure sign that blood wasn't able to enter the heart.

"Call cardiology."

Diane wandered over.

"Looks like it may be surgical after all," I said.

She nodded, her eyes glued to the ultrasound screen.

The hallmark of cardiac tamponade is fluid accumulation that puts pressure on the heart, causing collapse of the right, or venous, side of the heart during diastole, the filling phase of a heartbeat. But many patients display diastolic collapse and do not suffer cardiac tamponade. In Mrs. Hom's case, we hadn't had time for formal measurements. The final judgment boils down to a clinical one: Is the patient dying or not?

Dr. Zhen, the cardiologist, confirmed our diagnosis. "I've never seen a pericardium so enlarged," he added. "It's making her heart the size of a walnut. And she looks terrible."

Mrs. Hom twisted and grimaced on the stretcher. Ideally, we would slip in a breathing tube. But intubation requires sedation, and many sedating drugs can have unpredictable effects on such an unstable patient. She needed immediate surgery to release the fluid pressing on her heart.

We got her to the operating room in record time. Dr. Ramirez, the cardiovascular surgeon, numbed a small patch of skin beneath her breastbone and angled a large needle toward her left shoulder blade. A gush of bloody fluid filled the syringe. He drew off six ounces' worth. Mrs. Hom's blood pressure and heart rate improved dramatically. Now she could be intubated. After the breathing tube went into her windpipe, she was put under deep anesthesia. Dr. Ramirez made a small incision between the ribs, just below her left breast, then inserted an instrument to spread the ribs apart. Mrs. Hom's hugely enlarged pericardium, purple and quivering, came into view. Dr. Ramirez inserted a catheter and drew out almost a liter of bloody fluid. Then he cut out a large square, a pericardial window, to prevent fluid from ever building up again. Diane felt around the opened pericardium. She said the surface was gritty.

"A tumor or an infection like tuberculosis can stud the surface like that," said Dr. Ramirez.

Two days later I stopped by to see Mrs. Hom. I expected to find her weak and drawn. Instead, she was energetic and smiling. When I checked with the lab, tests on the fluid and biopsies from the pericardium had all come back negative. Mrs. Hom's condition fell into that frustrating category of unsolved mysteries labeled "idiopathic." Luckily, it was an idiopathic condition we could easily detect, thanks to on-the-spot ultrasound.

**“Vital Signs” Article:**

Describe the woman’s symptoms.

Describe the woman’s condition.

Explain how the condition was discovered.

Explain how the conditions was treated.

What about the cause of the condition? What does “idiopathic” mean?