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LIFE

SPECIAL ISSUE

MEDICAL MIRACLES

FOR THE NEXT MILLENNIUM

Dr. Didier de Canniere, Robotic Heart Surgeon

Fall 1998/$3.99

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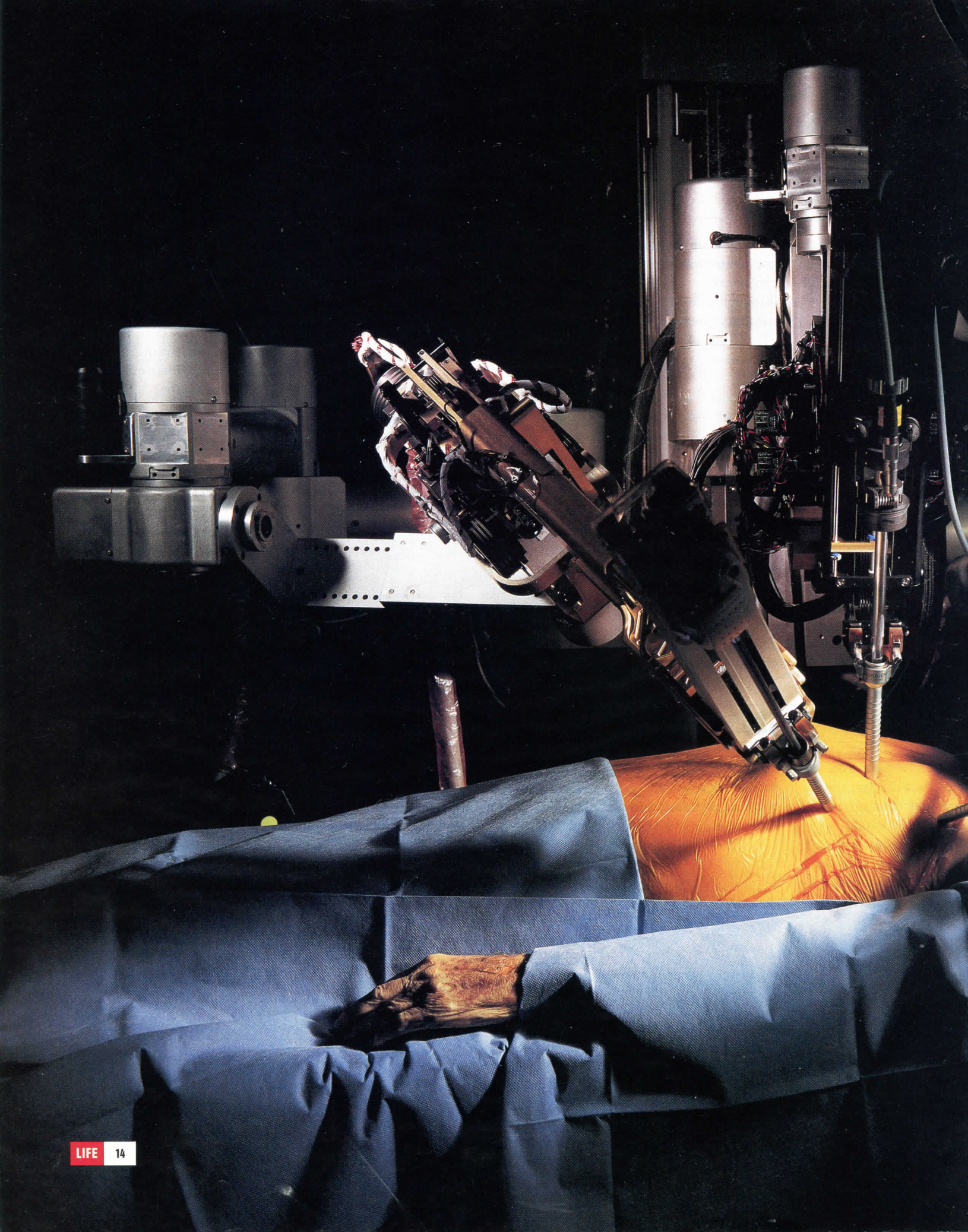


LIFE SPECIAL ISSUE / FALL 1998 / MEDICAL MIRACLES

THE CUTTING EDGE

HEART SURGERY ENTERS THE AGE OF ROBOTICS.

BY TALA SKARI / PHOTOGRAPHY BY MAX AGUILERA-HELLWEG

A SURGICAL ROBOT, nicknamed da Vinci, is put through the paces of a coronary bypass on a cadaver at the Mountain View, Calif., headquarters of Intuitive Surgical, which developed the $500,000 machine.

THE SURGEON SOUNDS MORE LIKE A TEENAG
PLAYING A VIDEO GAME THAN A CARDI
SPECIALIST PERFORMING ONE OF THE FIR
ROBOTIC CORONARY BYPASS OPERATIONS.

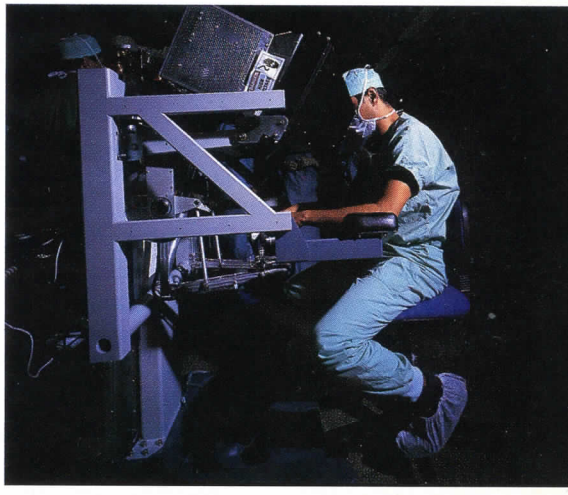
Jean Debergh lies on an operating table in a hospital in Brussels, his rib cage protruding sharply. Poised over the patient like a giant insect is a six-foot-tall robot with three movable arms holding a tiny video camera and quarter-inch surgical tools that are operating deep inside his chest. At a console on the other side of the room, surgeon Didier de Canniere is watching Debergh's heart on a high-resolution monitor, his fingertips on the control handles, as he directs the movement of the tools. For the 27 doctors, nurses and computer technicians crammed into the Saint-Pierre University Hospital operating room, it is a dramatic—and historic—moment.

The surgeon begins to cut.

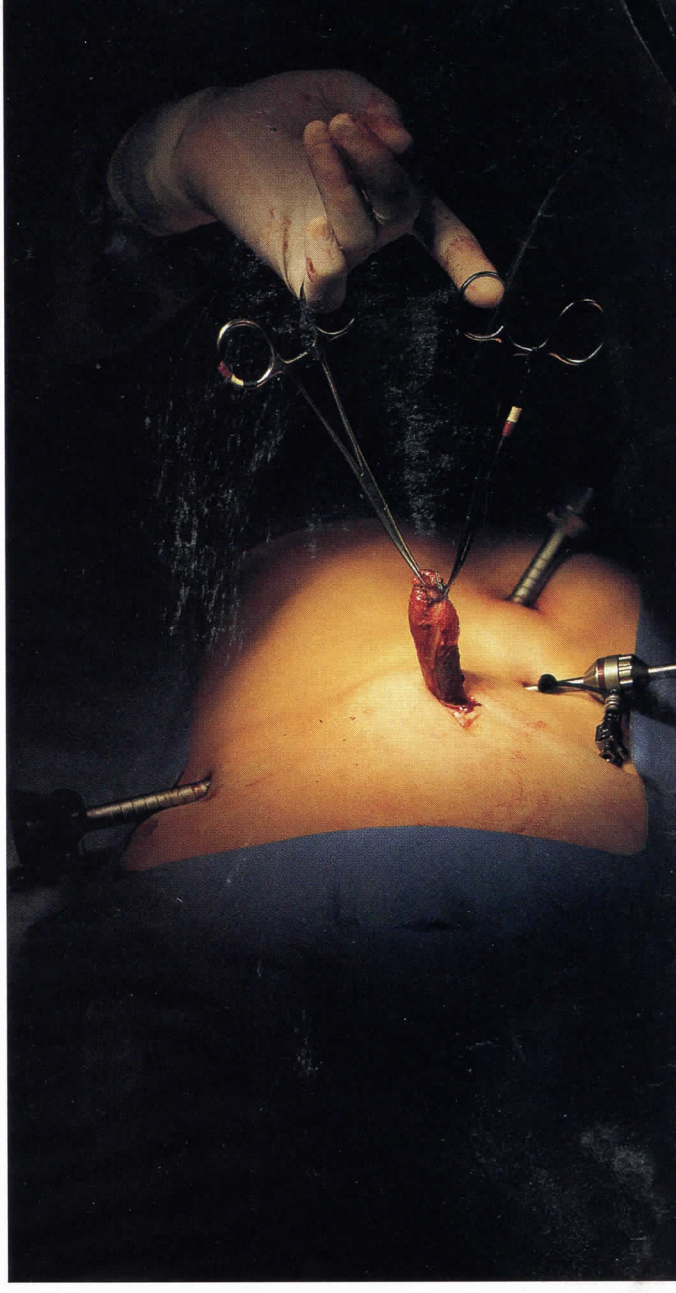
"Master clutch," de Canniere says to a computer engineer, sounding more like a teenager playing Dungeons and Dragons than a 39-year-old cardiac surgeon performing one of the world's first coronary bypass operations using robotic equipment.

This year roughly 360,000 coronary bypass operations will be performed in the United States, the vast majority of them the old-fashioned way, by open-chest surgery. As modern medicine goes, such operations are both spectacular and barbaric: To gain access to the heart, doctors take a saw to the breastbone, then pry open the rib cage with a steel retractor, leaving patients with foot-long scars and the sensation that they've been hit by a truck.

Minimally invasive procedures have brought advances (see page 24). Among oth-



NSIDE THE HEART of cardiac patient Jean Debergh (above), doctors at Saint-Pierre University Hospital in Brussels roboti-ally dissect a mammary artery. The chief surgeon, Didier de Canniere, sits at a viewing console (right), manipulating the con-ols while other doctors and technicians assist at the operating table. Left to right, above: Tool nurse Rachel Izizaw, gastro-ıtestinal surgeon Guy-Bernard Cadière and Intuitive Surgical technician Dave Rosa watch an overhead video monitor as the obotic tools cut and stitch. In a new twist on operating room procedure, the robot wears the sterile clothes—plastic sleeves on s arms—while the surgeon at the console doesn't even bother to scrub.



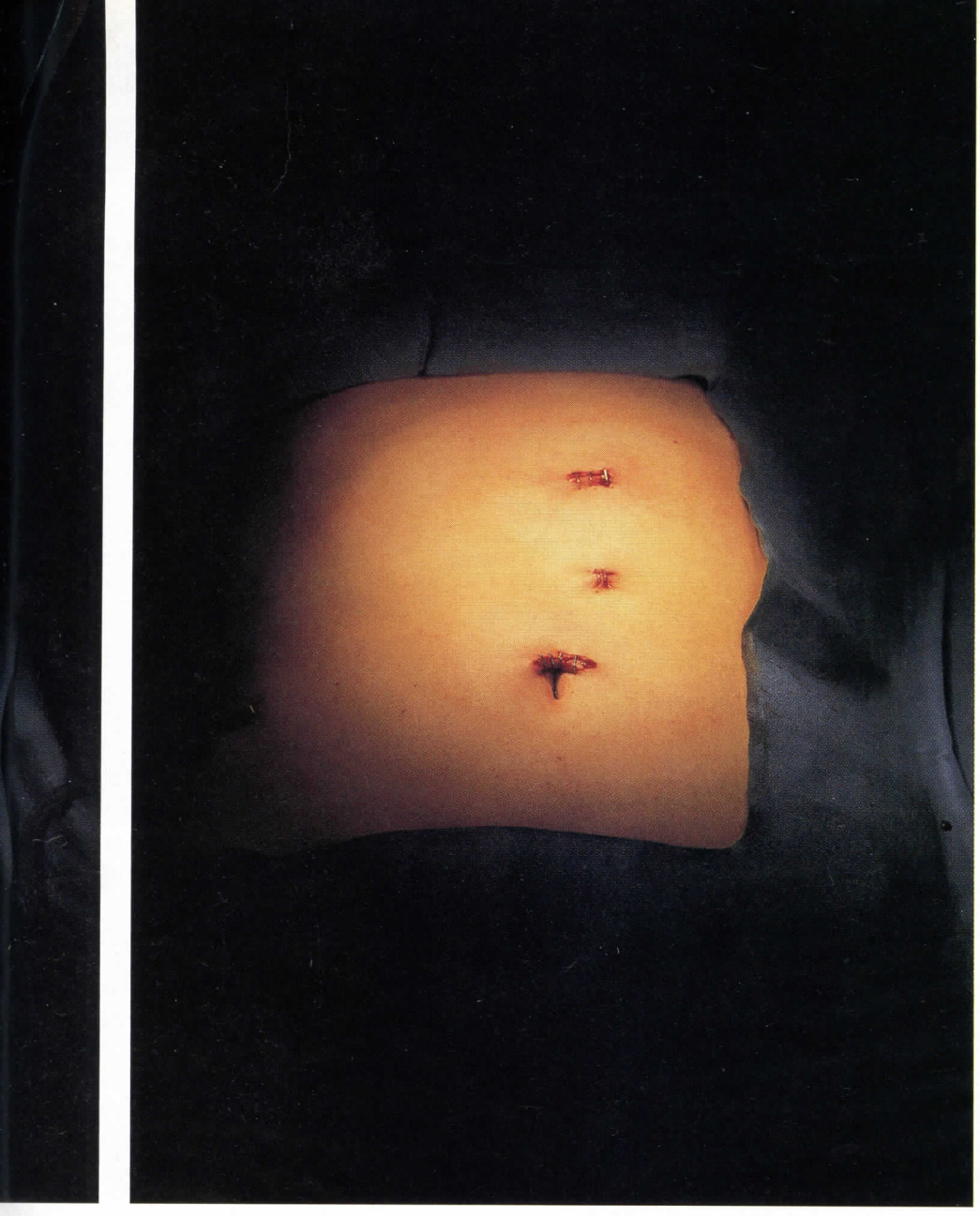
er things, cracking the sternum is no longer required. Instead, doctors operate with long hand-held instruments through small incisions between the ribs, resulting in shorter recovery time and less pain for the patient. Yet fewer than 3 percent of coronary bypasses in the U.S. are performed using minimally invasive techniques. Many surgeons simply don't feel comfortable tying knots and stitching delicate heart tissue from a distance.

Robotic systems, developed by Silicon Valley companies like Intuitive Surgical, address this problem. They allow doctors to "virtually" go inside the body with instruments that mimic and even improve upon the surgeon's skills. By scaling down the doctor's movements, the robot minimizes the danger from hand tremors and increases precision. Its three-dimensional video imaging and flexible tools enhance both vision and mobility. Says Dr. Alex Zapolanski, director of cardiac surgery at the San Francisco Heart Institute, who hopes to be one of the first U.S. surgeons to try out the equipment: "We're on the verge of something major."

For the moment, until the Food and Drug Administration approves the technology in the U.S., these revolutionary new systems are being tested mainly in Europe. In May doctors at Broussais Hospital in Paris performed the first open-chest heart surgery using robotic equipment. In June they completed the first closed-chest coronary bypass with the Intuitive system. A new round of tests took place in Brussels in September. For the doctors involved, these are the Apollo missions of modern surgery. The bonding is intense: In Belgium, Dr. Guy-Bernard Cadière, 42, chief of gastrointestinal surgery at Saint-Pierre, and de Canniere, a cardiac specialist at Erasmus University Hospital, not only are committed to making surgery less invasive and more effective, they're also close friends and windsurfing partners.

When Intuitive sought out Cadière, one of Europe's most skilled laparoscopic surgeons, to help test-drive its system, he proved a quick study and successfully applied the new technology to gallbladder and esophageal reflux operations. Cadière recruited de Canniere, who had extensive experience with minimally invasive coronary bypass surgery. For de Canniere, the goal of new technologies is simple: "Can we make it more efficient, less invasive and cheaper? If the answer is yes, the patient deserves it."

The human guinea pig in Brussels, Jean Debergh, is a 57-year-old architect who suffers from angina, or acute chest pain. Even



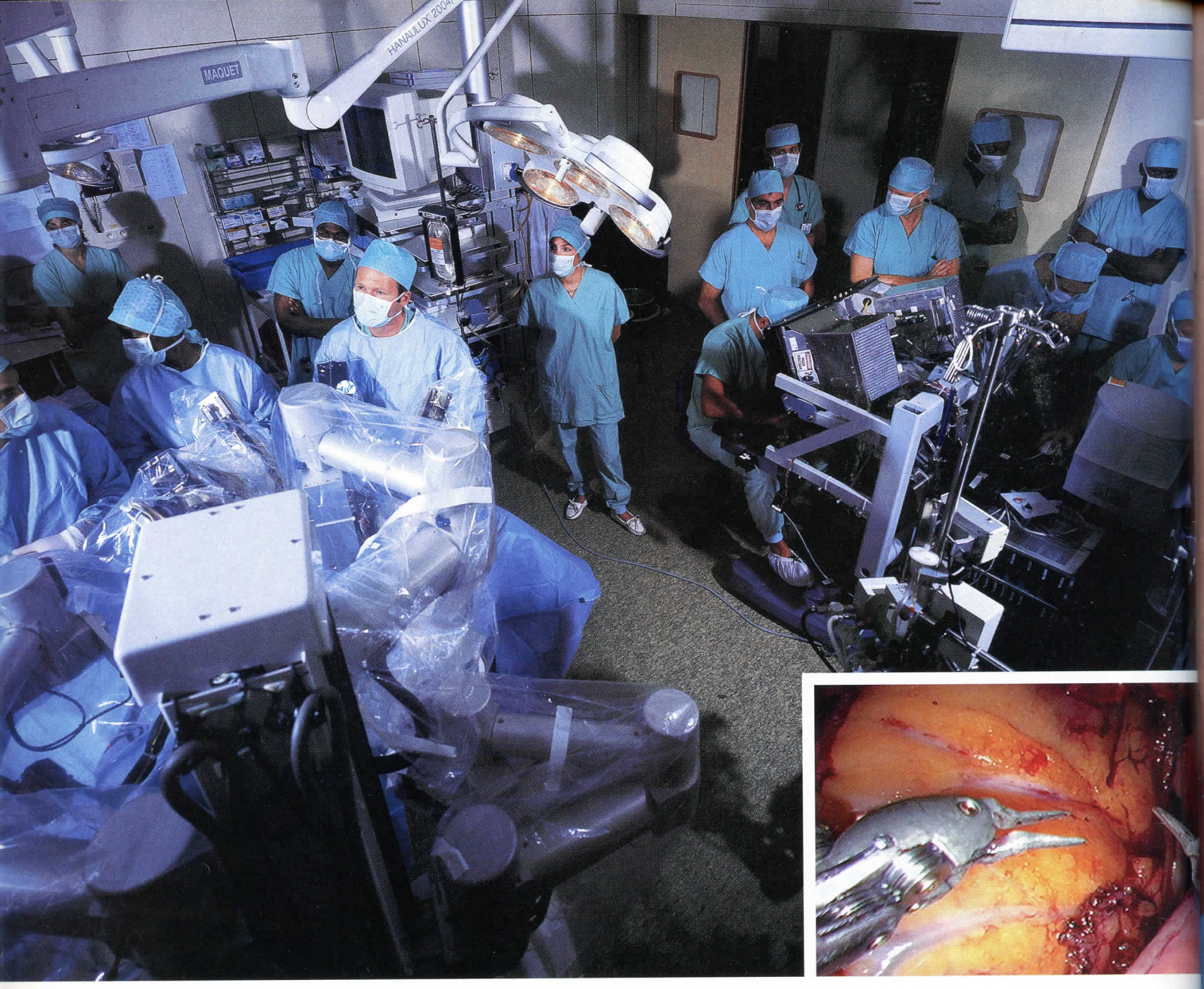
ROBOTIC SYSTEMS ALLOW DOCTORS TO "VIRTUALLY" GO INSIDE THE HUMAN BODY WITH TINY INSTRUMENTS THAT MIMIC AND EVEN IMPROVE UPON A SURGEON'S SKILLS.

the simple act of climbing stairs has become difficult. One of his main coronary arteries is severely obstructed, reducing its blood flow by up to 80 percent. Angioplasty is not an option; Debergh's artery is too badly damaged. So de Canniere recommends a bypass to reroute blood flow. And he suggests using the experimental robotics system. "If we succeed with these tiny instruments," he tells Debergh, "I believe you will recover faster. If it doesn't work, we can at any moment switch to a classic maneuver."

De Canniere has completed more than 200 minimally invasive bypass operations. Over the summer, he tested the Intuitive system on sheep and cadavers. But this is the first time he'll be performing robotic surgery on a live human. The night before the operation he is confident but cautious: "I feel a lot of pressure. I know I can do this operation. I've spent years training for it. But we may fail. What I know is that I won't take risks for the wrong reason."

The next morning, after Debergh is anesthetized, de Canniere takes a seat at the console. Cadière makes three half-inch incisions between the patient's ribs for the tubes that will be attached to the robot. The first step involves locating the mammary artery and cutting it away from the chest wall. The vessel comes into view on the monitors. Gently maneuvering the controls, de Canniere separates the artery with a cauterizing knife, the robot's arms silently moving up, down and sideways, mimicking the surgeon's movements. Inside Debergh's chest, the lilliputian tools, mounted on "wrists," duplicate the

A GALLBLADDER OPERATION, performed by Brussels surgeon Guy-Bernard Cadière with the Intuitive system, is quick and almost scar-free. Three incisions are made in the abdomen of a 61-year-old patient (far left)—one in the umbilicus for a camera and two for the quarter-inch-long instrument tips (far right). The patient's gallbladder is removed 30 minutes later (second from left), leaving behind only small scars.



doctor's gestures with astonishing precision.

Once the mammary artery has been cauterized, de Canniere opens the pericardial sac, and the heart comes into view on the monitor. Debergh is put on a heart-lung machine, which pumps and oxygenates the blood, giving de Canniere a clear operating field. He lowers the mammary artery toward the heart and makes a tiny incision in the left anterior descending artery. This is the defining moment in a coronary bypass—the anastomosis, in which the two vessels are joined. The task is comparable to attaching two pieces of hollow spaghetti with thread as thin as hair. For the first time since the operation began, the room is silent. De Canniere begins stitching. On the video screen, the tools look like tiny porpoises doing a pas de deux as a curved needle passes back and forth.

ON THE VIDEO MONITOR, THE SURGICAL TOOLS LOOK LIKE TINY PORPOISES DOING A PAS DE DEUX AS A CURVED NEEDLE PASSES BACK AND FORTH, TYING KNOTS AND STITCHING AWAY.

But the suturing is tricky. De Canniere suspects that one of his stitches is not tight enough. He asks Cadière to release a bulldog clamp on the mammary artery to test for leakage. The clamp, not part of the robotic system, slips. Blood spurts across the screen. The patient's heart starts fibrillating, making it hard to continue. Stopping the heart again with the chest closed is not feasible.

"That's it," de Canniere says, rising from the console. "This is where we stop."

Within minutes he is scrubbed and standing beside his patient. For the first time since the operation began 12 hours earlier, he is wearing surgical gloves. He enlarges one ►

THE FUTURE OF SURGERY may look something like this gallbladder operation performed in Brussels in September: both high tech and feudal. Cadière is at the surgeon's console (top, at right), talking to a computer engineer who is the interface between the console "master" and the robot "slave." With a pencil-width joystick to direct the camera, the surgeon can zoom in on blood vessels, making them look as fat as garden hoses. To snip away tissue (inset, a video image of a heart during bypass surgery), the doctor makes small movements: When his hand moves one eighth of an inch, the scalpel moves only one 40th of an inch, reducing the effect of hand tremors.

of the incisions and reinforces the stitches. With the job finally done, de Canniere waits quietly as Debergh is taken off the heart-lung machine. The silence is broken by the reassuring ping of an electrocardiograph.

The next morning, de Canniere doesn't hide his disappointment. But he blames human error and bad luck—not the robotic system. "It was a judgment call, and an appropriate one," says Fred Moll, Intuitive's medical director, who followed the operation. "With this system any doctor can always say, 'I'm uncomfortable. We'll switch to the old way.'"

De Canniere wants to continue with the new way. "In any new procedure there's a learning curve," he says. "But I'm 100 percent convinced this will save lives."

The benefits to patients are already evident. After one of the Paris operations, a patient felt so chipper the next day that he later sent the hospital staff 24 bottles of champagne. Another turned down pain relievers.

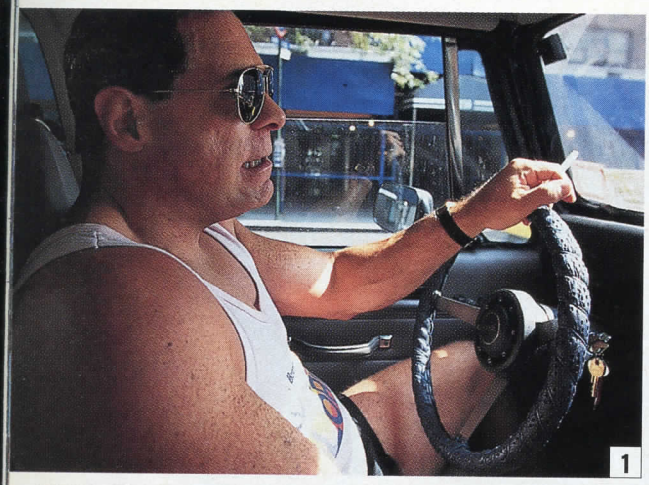
"IT'S IMPORTANT NOT TO FORGET THAT YOU'RE DEALING WITH A HUMAN BEING," DE CANNIERE SAYS. "I NEED TO KEEP IN MIND THE PATIENT'S EYES. THEY'RE SAYING, 'I TRUST YOU.'"

Ten years from now, de Canniere predicts, two out of three heart surgeries will be done robotically. Cardiac specialists might well operate from a command control center. And transcontinental operations—a surgeon in New York operating on a patient in Tokyo—could be routine.

Yet both Brussels surgeons say technology shouldn't get in the way of old-fashioned doctoring. "It's important not to forget that you're dealing with a human being," de Canniere says. "I need to keep in mind the patient's eyes. They're saying, 'I trust you.'"

"FEELING PRETTY GOOD," heart patient Jean Debergh tells de Canniere (left) the morning after the robotic surgery. The doctor explains that a loose suture and a slipped clamp late in the operation caused him to abandon the robotic system for more traditional methods. "It was long, and I have a little gray hair named Jean Debergh," de Canniere says. "We were just two stitches away from finishing." Debergh isn't bothered: "I wanted to do it. I like new technology, and I wanted to recover quickly." He gets his wish. Five days later, Debergh is out of the hospital—in time to attend his son's wedding—and brings his doctor an armload of flowers in appreciation.

Additional reporting by Anne Hollister



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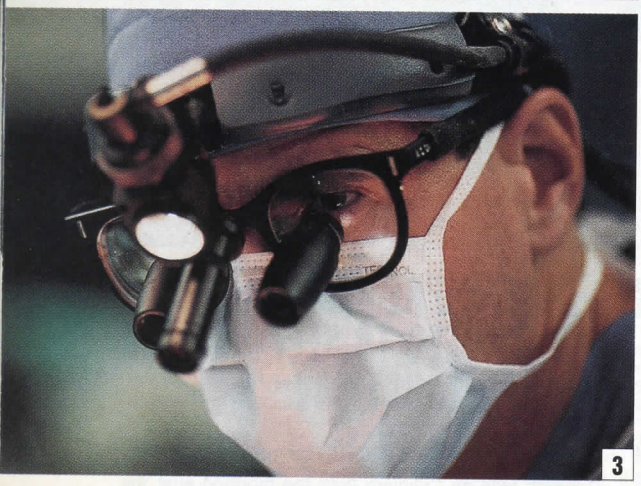

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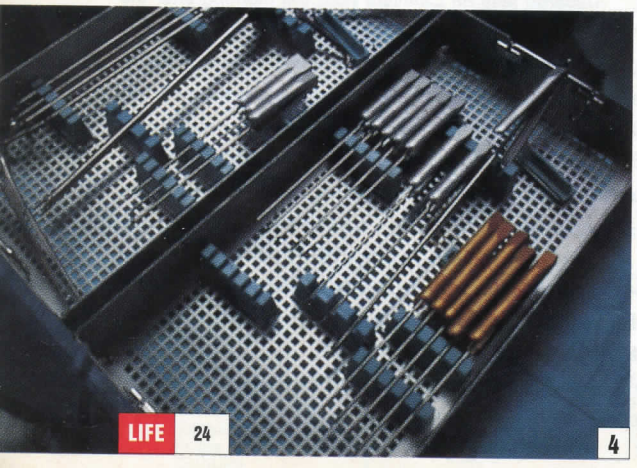

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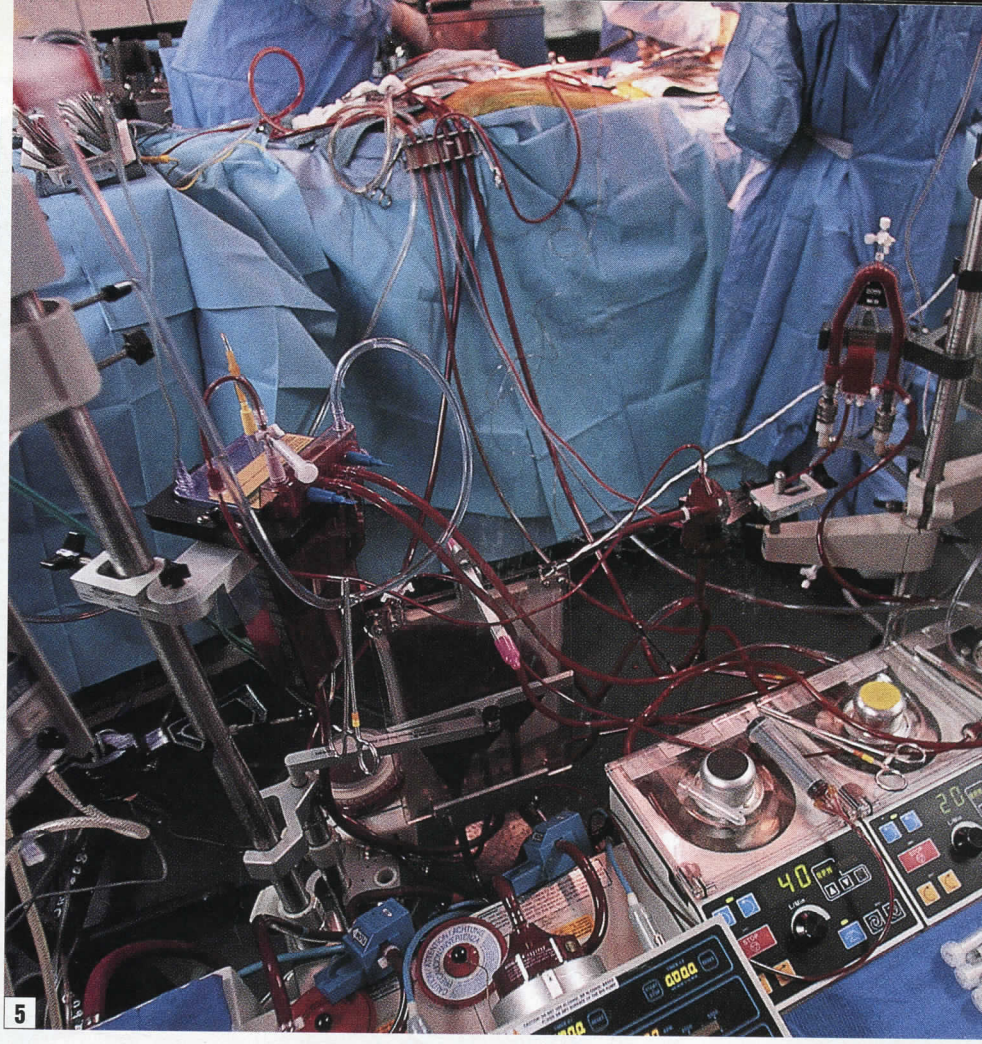

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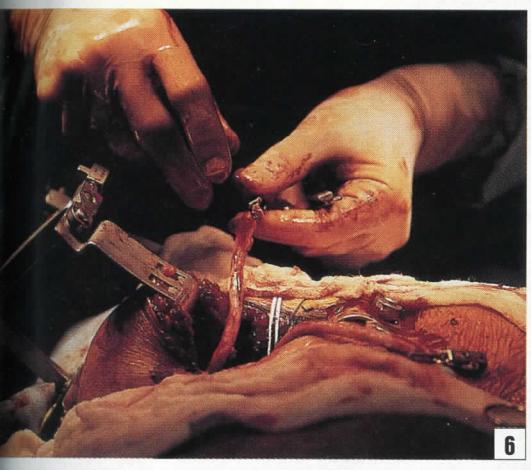
MINIMALLY INVASIVE

A FITNESS TRAINER IS BACK IN THE GYM SEVEN DAYS AFTER HIS CORONARY BYPASS OPERATIO

PHOTOGRAPHY BY PORTER GIFFORD

Michael Cohen's father died on the operating table during open-chest surgery. So when doctors at New York University Medical Center offered the 52-year-old fitness trainer an alternative—triple-bypass surgery the new, minimally invasive way—he jumped at the opportunity. Instead of having a surgeon cut a 15-inch swath from his collarbone to the top of his belly, slash through his sternum with a circular saw as sparks fly, and yank him apart the width of a football to reveal a wildly beating heart, Cohen will have an operation that looks like this: He drives himself (1) to the hospital from his New York City apartment and is under anesthesia a few hours later (2). Dr. Aubrey Galloway (3), one of the pioneers of minimally invasive heart surgery, will use a set of long tools (4) specially designed for the procedure by Heartport Inc., which allow him to perform the delicate surgery through a two-inch slit in Cohen's chest. Instead of puncturing holes in the patient's aorta and heart and attaching him to a heart-lung machine with tubes the size of garden hoses, Galloway snakes cocktail-straw-size catheters through an artery and a vein in Cohen's leg, watching their progress up to the heart on an echocardiogram. The catheters tap at the swinging heart as if knocking on tiny saloon doors; one tube the aortic valve stills; and the machine takes o the now stopped organ (5). Earlier, Galloway at vein grafts taken from Cohen's leg to his ao Now he and a surgical resident perform a ca choreographed ballet as a camera on Galloway' broadcasts the dance to a video monitor (7). They tissue (8), clamp (9) and tie stitches seemingly in (10). If this had been open-chest surgery, Ga would have sewn Cohen up with stainless-ste leaving his sternum looking like the bloody gr vampire—with braces—and Cohen would have out of work for two to three months. Instea surgeon uses dissolvable thread to suture the wound and, six hours after the operation began, Cohen on a gurney to recovery (11). Three day Galloway pronounces him ready for discharg Just one week after surgery the fitness trai back at the gym (13), with little evidence of his except a tiny pink scar tattooed to his chest sheepish smile.—**Cynthia Fox** LIFE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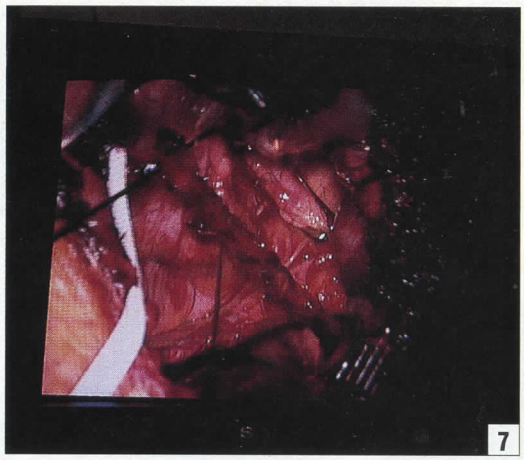
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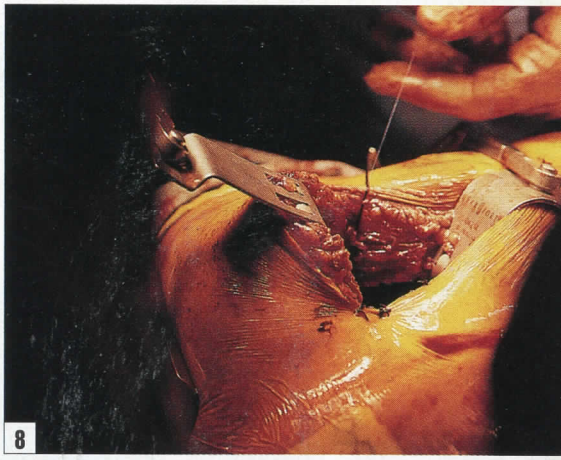
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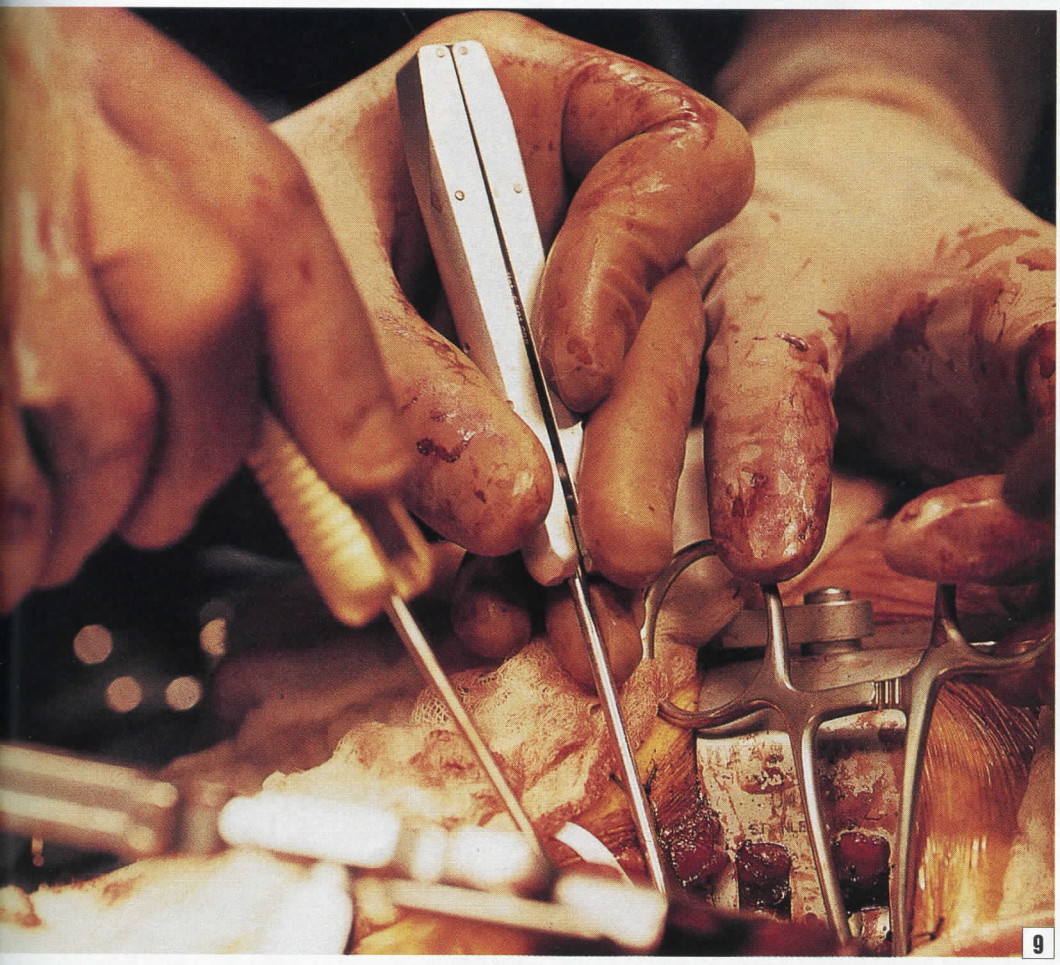
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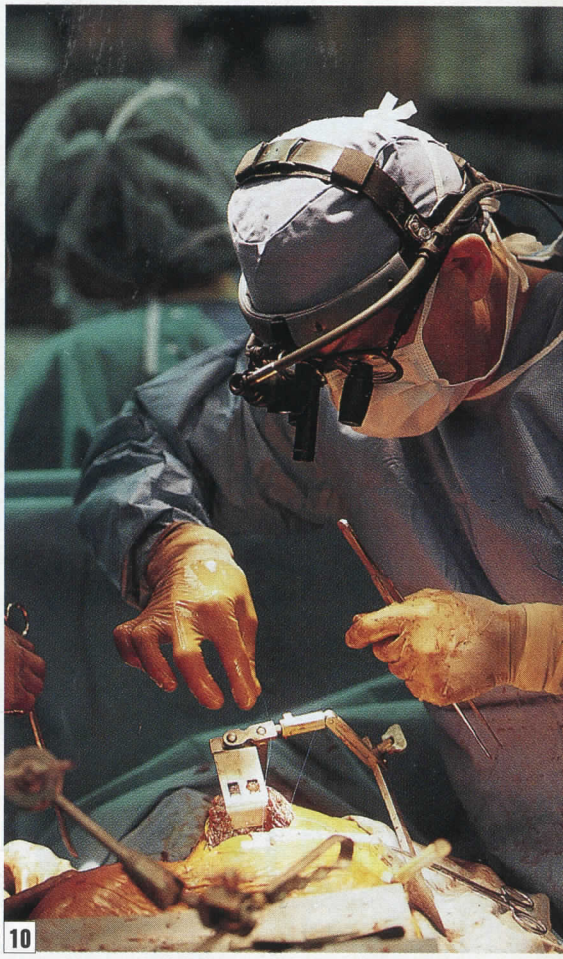
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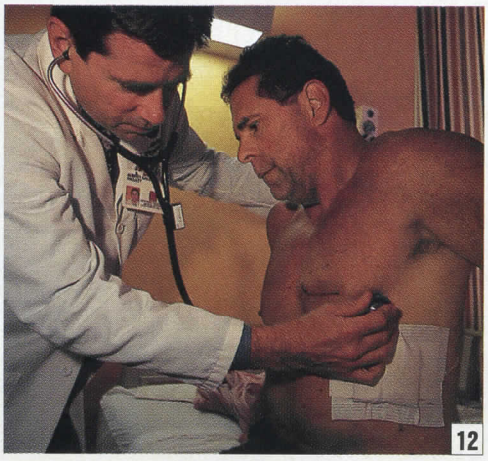
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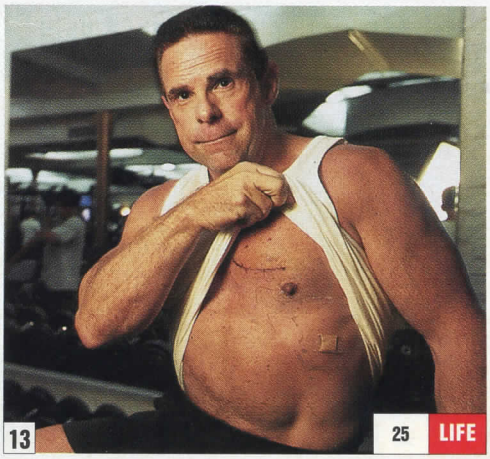
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