

# TIME HEALTH

TOPIC

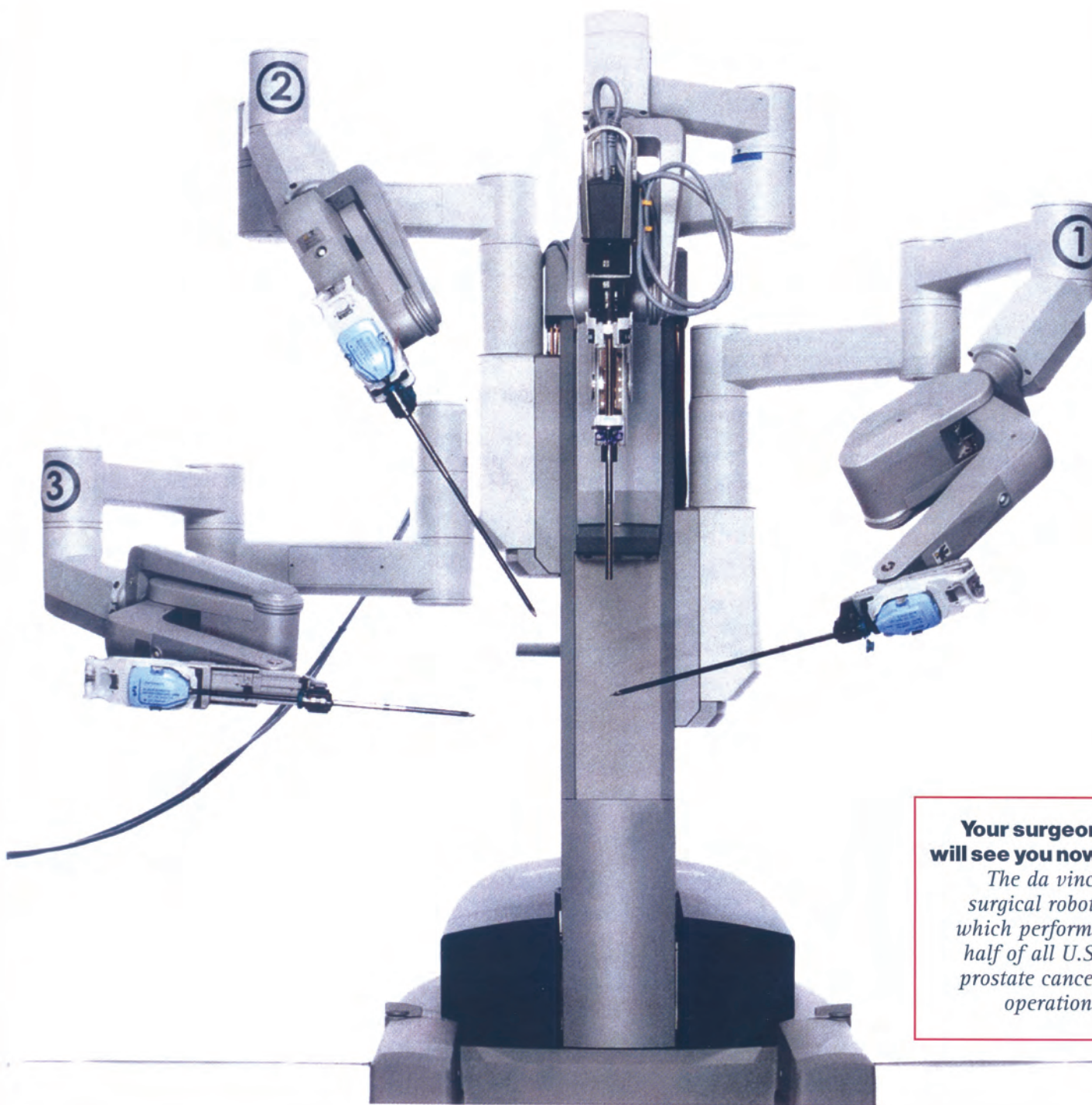
## Surgery and the Rise of the Robots

### Light Touch

Technology means surgery with less pain, more gain

CHECKUP

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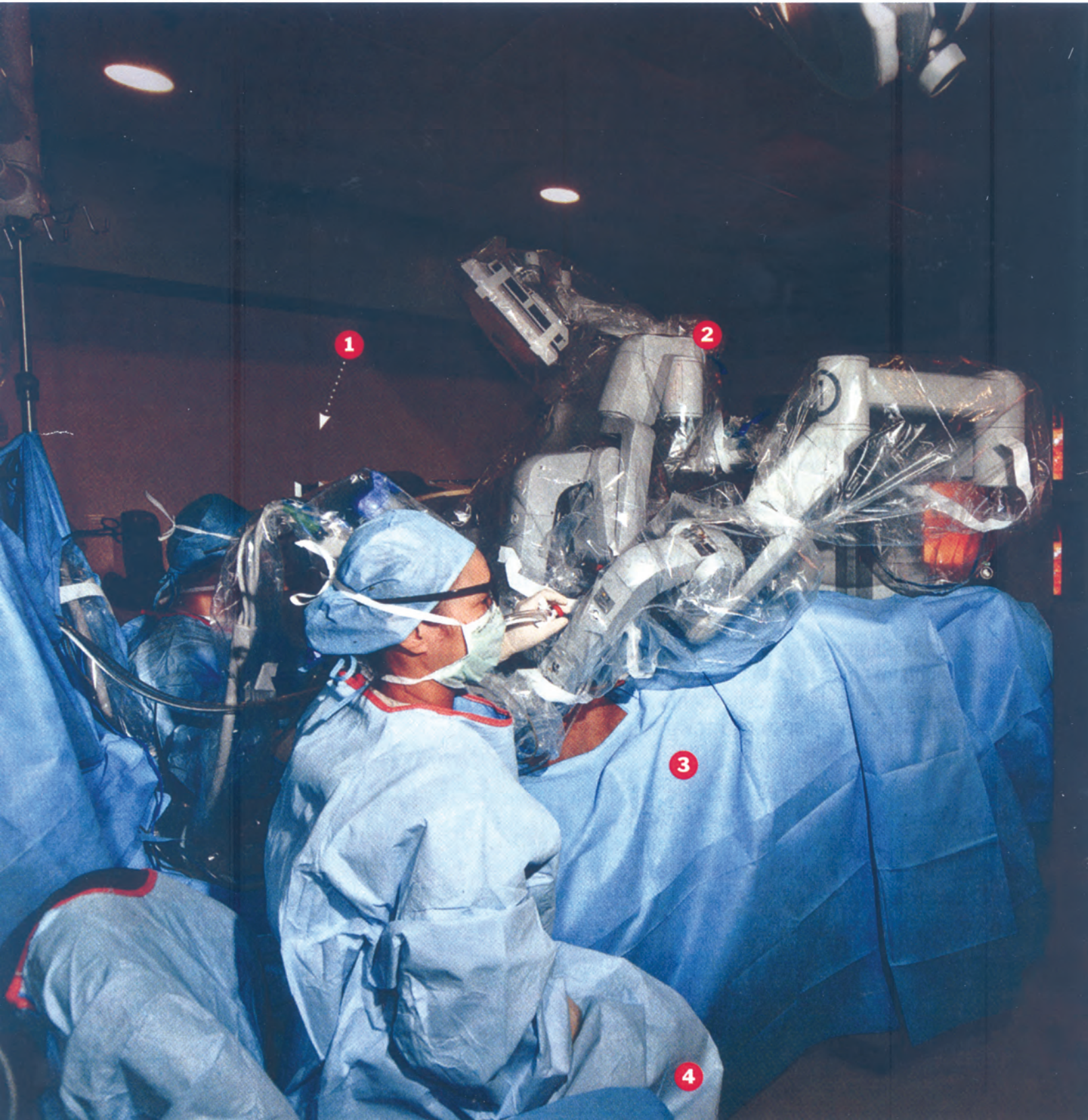


**Your surgeon will see you now**

*The da vinci surgical robot, which performs half of all U.S. prostate cancer operations*

# Meet Dr. Robot. Your next surgeon may not be human. Why that should make you happy – and a little wary

BY DAVID VON DREHLE



If your idea of surgery comes mainly from TV-doctor dramas, you'll find this operating suite at the Henry Ford Hospital in Detroit a bit disorienting. There's a major surgery in progress — that's what they tell you, anyway — but you can't see a patient. For that matter, you can't see the surgeon. There must be a scalpel wielder here somewhere, but all you can see is people sitting at machines in near darkness. The largest of the machines is a weird behemoth in the center of the room, spiderlike, shrouded in plastic sleeves and protective drapery. Next to it, incongruously, are several lounge chairs facing a wall of enormous flat-screen monitors. The place is half alien spaceship, half man cave. Plus, people are wearing 3-D glasses.

In the tones of his native India, Dr. Mani Menon, medical pioneer, explains that the patient is lying in the center of the shrouded behemoth — which, it turns out, is a surgical robot. Beneath those drapes, the robot has its skinny arms buried deep in the patient's abdomen, busily lifting and cutting and cauterizing with its tiny instrument-hands, guided by a man at the far side of the room — his face peering into a console, his hands operating a pair of souped-up joysticks, his stocking feet pressing pedals more in the manner of an organist than a doctor. Every move of the robot is visible, in real time, on the flat screens: pictures from the belly of the sleeping patient, brilliantly lit, magnificently magnified and startlingly vivid in high def.

"The robot is just a tool," says Menon, director of the Vattikuti Urology Institute at Henry Ford. But that's like saying a Gulfstream jet is just a way to get from here to there. "Just a tool" suggests a No. 7 hemostat clamp, perhaps, or a pair of mosquito forceps. A million-dollar robot executing every movement of a delicate kidney surgery: that's not a tool; it's a revolution. And it is one that is shaking the surgical world. For an increasing variety of surgeries, robot-assisted techniques are now — or soon will be — standard operating procedure.

Menon is a founding father of the revolution. In 2000 he was the first surgeon to remove a cancerous prostate gland using a robot. His path to such an improbable feat went like this: as a protégé of the renowned surgeon Dr. Patrick Walsh of Johns Hopkins University, Menon had mastered Walsh's great breakthrough, an approach to prostate surgery that spared delicate nerves and offered patients the hope of a cancer cure that did not render them impotent and

incontinent. Walsh's technique, for all its elegance, starts with a 4-to-6-in. (10 to 15 cm) incision carved with a handheld scalpel; it soon finds the surgeon's fingers inside the patient's pelvis. Menon wondered whether advances in laparoscopy could be applied to this delicate and complex surgery. Laparoscopy involves a set of surgical implements, a light source and a camera, each small

enough to be inserted through relatively tiny incisions and manipulated by the surgeon from outside the patient's body like knitting needles. Because smaller incisions typically mean shorter hospital stays, less pain and quicker recoveries, laparoscopy had become, by the 1990s, the standard approach in many common abdominal procedures.

But as Menon was exploring laparoscopy, along came the robot. The instrument grew out of a U.S. Army sponsored project in the 1980s to develop a remote-controlled laparoscopic robot for battlefield surgery. That project is still a futurist's fantasy. But a couple of companies saw the commercial applications, and in 1999 the first surgical robots were introduced as the next phase in minimally invasive surgery.

Their inventors touted the power of robots to eliminate even the ghostliest of hand tremors. The machines could be calibrated to translate relatively large motions at the controller's console into tiny, ultrafine actions by the instruments. Best of all, perhaps, the robotic camera offered an unsurpassed view of previously claustrophobic surgical fields, magnified tenfold. Before the robot, a

### Robotic surgeons on the job

# 1,000

Hospitals and clinics in the U.S. using the da vinci robot

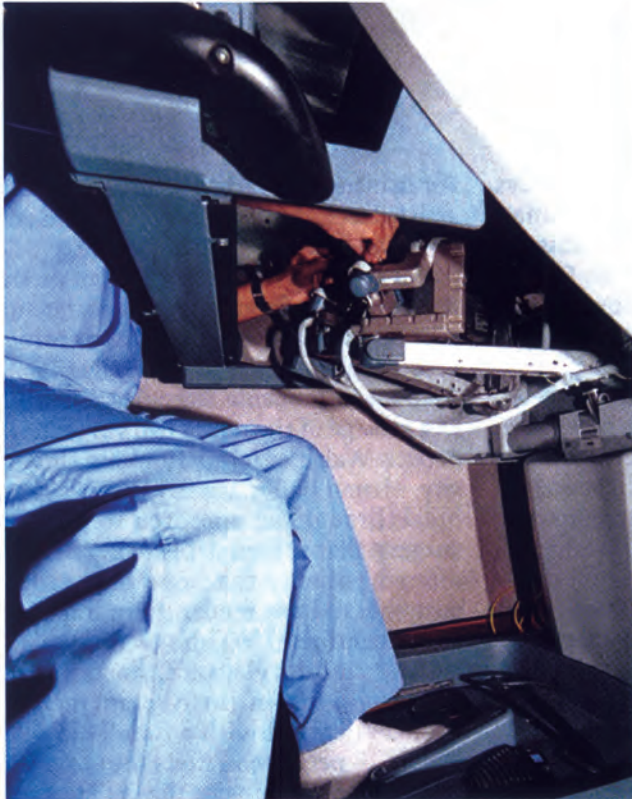
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Facilities with da vinci worldwide

Source: Intuitive Surgical, Inc.

## ROBOTIC SURGERY

In near darkness, the surgeon (1) sits at a control panel, guiding the robot (2), a behemoth shrouded in plastic sleeves and protective drapery, which almost completely conceals the patient (3). Nearby, an assistant (4) helps the doctor with sutures, suction and more. Hi-def monitors (5) provide a real-time close up view of the surgical site



**Man and machine** Dr. Mani Menon, right, operates a da Vinci robot during surgery, left, at the Vattikuti Urology Institute. The robot is equipped with a suite of interchangeable surgical tools, center

prostate surgeon like Menon had to learn parts of the craft by feel, because fingers in the pelvic cavity obstruct the line of sight. One highly experienced surgeon, on first seeing a robot's-eye vista of his longtime field of battle, marveled, "So that's what it looks like!"

Menon quickly became a believer. "For a surgeon, if you see better and there's less blood, you do a better job," he says. He found minimally invasive surgery was much easier with the help of a robot, and with a little practice it became easier than the Walsh-style open surgery too. In 2000, Menon established the nation's first center for robotic prostatectomy at Henry Ford and soon reported cure rates equal to those achieved with the Walsh method. Drawn by the promise of less intrusive surgery and easier healing, hundreds and then thousands of men came to Detroit, while surgeons across the country hustled to master Menon's breakthrough.

Within seven years, Menon's approach was the most common treatment for what is the second most frequently diagnosed nonskin

cancer in America. The leading manufacturer of surgical robots, California-based Intuitive Surgical Inc., reports that roughly half of all prostate cancer surgeries in the U.S. in 2008 employed the company's da Vinci robotic system, which is now in use at more than 1,000 hospitals and clinics across the country and another 400 institutions around the world. Since then, the robot has continued to gain market share over both the open procedure pioneered by Walsh and the laparoscopic version of that operation.

Indeed, the robot revolution is moving so quickly that data goes stale even before it can be released. Menon offers a taste of that speed when he says that his hospital alone employs "nine going on 11" da Vinci machines.

Beyond the prostate, robot-assisted laparoscopy is being applied in all regions of the abdomen, from gall bladders to hysterectomies, from hernia repairs to liver resections. The abdomen is a lovely place to be a robot because surgeons can inflate the region like a balloon using carbon dioxide and then light the space like a film studio.

But even in tighter spaces, cardiac surgeons, thoracic surgeons, orthopedic surgeons — even neurosurgeons — are joysticking their way through operations on hearts, throats, joints and spines.

Other robotic advances offer tantalizing glimpses of a mechanized medical future. By marrying high-tech imaging machinery to robotic tools, surgeons may journey into even more-remote, less accessible regions of the body with perfect surgical precision. (Imaging machines are already used to guide radiation beams with pinpoint accuracy, reducing damage to healthy tissue while permitting more intense therapies.) Perhaps one day there will be no need for a human surgeon. Researchers in artificial intelligence are working to design computers able to learn surgical techniques and then apply those patterns to steer robots through common operations. Add wireless technology, and maybe remote robots in underdeveloped parts of the world will perform surgery far from the humans or the supercomputers controlling them. Remote surgery has challenges: What happens if there's a power failure or the machine



**'For a surgeon, if you see better and there's less blood, you do a better job.'**

— DR. MANI MENON, DIRECTOR  
OF TEH VATTIKUTI UROLOGY  
INSTITUTE AT HENRY FORD  
HOSPITAL

academic group practice in the country, behind Mayo and the Cleveland Clinic.

The Ford family no longer owns or operates the hospital, though it is one of its largest benefactors. Its endowments and those of other grantors are well spent. Ford employs some 1,200 doctors, trains 500 medical students and delivers high-quality care to patients of every economic profile. Because the group offers a complete range of services, from checkups to hospice, Ford is able to coordinate treatment and keep costs below national averages. The system was an early adopter of computerized medical records; doctors are on salary rather than earning fees based on how many procedures they perform, so the staff have both the tools and the incentives to work efficiently. "This is absolutely the best model for health care," boasts system president and CEO Nancy Schlichting. "Having a fully integrated medical group, 1,200 doctors completely aligned — teaching, researching, delivering clinical care — is the greatest asset we have."

Part of being a thriving institution is recruiting first-rate staff and encouraging their innovations — just as Ford did with Menon. "Saying yes to very creative people is a good thing to do," Schlichting declares. That hunt for creativity sometimes takes her to unexpected places. Ford's surgeon in chief Scott Dulchavsky developed a remote ultrasound device tested aboard the International Space Station. Several years ago, Schlichting hired an executive to open a new Ford System hospital in suburban West Bloomfield, Mich. She wanted a beacon of wellness, not a sickness center, so instead of choosing a veteran hospital administrator, she picked an executive from the Ritz-Carlton hotel chain.

Excellence and innovation, the jewels of America's battered health care crown, flow from this freedom to be creative. The rub comes when you try to subject that creativity to a rigorous cost-benefit analysis. Which brings us back to the robot.

Ten years into the revolution, robotic surgery is undeniably popular, but whether it is worth its price tag is a matter of hot debate. A da Vinci system costs more than \$1 million, and roughly \$1,500 worth of parts must be replaced after every procedure. The robot also entails significant additional training for surgeons. Authorities on prostate cancer, for example, generally agree that a typical surgeon will need to perform as many as 50 prostatectomies with the robot before achieving real proficiency.

But such questions aren't slowing the revolution. Robotics are gaining ground on traditional techniques for most abdominal surgeries. The urologists who started with prostate surgery have expanded to kidney and bladder procedures. The gynecologists who in the 1980s and 1990s were early adopters of laparoscopy are now, in more and more cases, using robots to assist with hysterectomies, fibroid surgery, treatments for infertility and more. Innovation begets innovation.

Cardiac surgeons are using the machines to repair mitral valves and perform bypass surgery without having to reach for a rib spreader. Robots make it possible to extract a cancerous thyroid gland through the patient's armpit, leaving the throat unscarred. For certain other diseases, like tumors of the larynx, tonsil and tongue, surgeons at the University of Pennsylvania have developed robotic procedures that enter the throat through the patient's mouth. This has made brutally invasive surgeries — involving large incisions, pulled teeth and broken jaws — far less punishing, if hardly pain-free.

The success of the da Vinci robot — and the steep rise in the manufacturer's bottom line — is spurring other companies to design robots for even smaller applications. A Florida company, Mako Surgical, recently introduced a robotic arm to assist in surgery on arthritic knees. And yet as the technology

malfunctions? But several years ago, doctors in New York guided a robot in France through a simple gall bladder procedure.

**Machines and Money**

Something else is also going on inside this same Detroit operating suite. You can't see it, but it's every bit as real as the technology on display — and arguably more important. For here we have a collision between the engine of medical innovation and the runaway train of health care spending. Ponder the robotics revolution, and you begin to see how complex the effort to reform the U.S. health care industry is going to be.

The first thing to notice is that this hospital and these doctors are an example of what is right about American health care — not what is wrong. The Henry Ford Health System, which owns Henry Ford Hospital, is a well-run example of a large medical group practice. When the automobile magnate opened the hospital to serve the burgeoning Motor City in 1915, he sought advice from Mayo Clinic founder Dr. William Mayo, and today, Ford is the third largest nonuniversity

goes racing ahead into nearly every part of the body, the medical community has not been able to decide whether even Menon's decade-old surgery is worth the extra dollars. The answer to that question seems to change depending on whom you ask.

"My skills are in innovation and scholarship, not marketing," Menon says candidly, and so he characteristically begins his answer by acknowledging that robots, thus far, have not improved his ability to cure prostate cancer. "It doesn't matter what tools you use to cut, the cure rate will be the same."

But the robots do have real benefits. "Any time you can do the same surgery in a minimally invasive way, you should," says Menon, "and the robot facilitates that. It's clearly better in terms of blood loss. It's not unusual in an open procedure for the patient to lose a liter of blood. Our patients lose more blood to preoperative testing than they do during surgery." Furthermore, the vast majority of the robot's patients are discharged from the hospital within 24 hours, and only 5% to 10% of them experience complications, compared with up to 30% of open-surgery patients. Robotic-surgery patients begin to regain urinary control and, perhaps, sexual potency more quickly than open-surgery patients, says Menon. But after the first month or so following surgery, patients with longer scars begin to catch up, and the recovery paths of robotic and conventional patients tend to converge.

Some doctors, more skilled at spin, make more lavish claims for the robotic procedure, based on self-reported data. A man who believes everything he reads on the Internet might conclude that robots have rendered prostate cancer a mere nuisance, easily cured, with scant side effects. Many robotic surgeons have begun to worry about a backlash from this aggressive overselling. A recent survey found that prostate-cancer patients who chose robotic-assisted surgery were more likely to report disappointment

with their treatment than patients who opted for open surgery – which was odd, because their results were not worse. The obvious conclusion: their expectations had been raised beyond the robot's ability to deliver, especially in one respect. "Regaining normal sexual function is still the issue," says Menon.

#### The Inevitable Backlash

For Menon's teacher, the eminent Dr. Walsh, the glamour of robotic surgery is a distraction from what should be the crucial issue: the skill and experience of the surgeon. No tool, Walsh says, can match his hard-won ability to feel his way around the delicate veil of nerves that control erections, judging by touch whether cancerous adhesions have begun to spread from the prostate gland.

Whatever a robot might offer in terms of clear sight and fine-tuned movements can't make up for the loss of touch, Walsh maintains. And he argues that improvements in the open technique by leading surgeons have shortened recovery time – a point echoed by another highly experienced open surgeon, Herbert Lepor of New York University. "In essence, we transformed open ... prostatectomy into a minimally invasive surgical procedure," Lepor wrote recently.

The harshest critics of the surgical robot go well beyond that critique. They don't just dispute its advantages; they believe that the robotic revolution has actually hurt thousands of prostate-cancer patients – and may lead to unnecessary procedures of other kinds as well. How so? When a hospital invests that much money to buy a surgical robot and train surgeons to use it, it creates pressure to sell surgery over other therapies. At the same time, the minimally invasive robot is less frightening than an operation involving a big cut or split bones. So patients may be more likely to choose robotic surgery.

In their provocative book, *Invasion of the Prostate Snatchers*, cancer patient Ralph Blum and oncologist Mark Scholz decry the rising number of prostatectomies performed in the U.S. – many of which, according to

emerging data, do nothing to extend the lives of patients. Prostate cancer, in most cases, is a slow-growing disease affecting older men. "The vast majority of men with prostate cancer would have lived just as long without any operation at all," but "their rational thinking has been short-circuited by the word cancer," the authors write. "Scared, frantic and vulnerable – relying on a doctor's insight – they are ripe to being sold on surgery as their best option."

That cynical view of doctors makes Menon wince: "I was Pat Walsh's resident when he performed the first radical retropubic prostatectomy" – the technique that Menon later adapted to the robot. "At the time, 40% of patients had metastatic disease," meaning that their cancer had spread beyond the prostate and their chance of a cure was remote. Anyone who has seen a man in the last stages of prostate cancer knows what a slow, painful death looks like. "It's very disturbing to watch men dying so miserably," says Menon. Today, the death rate from prostate cancer is at an all-time low, though experts don't agree on precisely why. If prostate cancer is being overtreated, the willingness of patients to choose surgery is, at least, understandable. Prostate-cancer patients know that surgery gives them a good shot at a cure, and a cure is what they seek. That, more than greedy surgeons, is the reason so many robots are whirring through so many surgeries.

The scientific way to settle these questions about cost vs. benefits would be to conduct a random trial in a large group of patients, assigning some to one treatment and others to another. At one point, Menon considered doing that, but quickly ran up against the American way: patients refused to go along. They wanted to choose their treatments for themselves.

Swiftly and overwhelmingly, they have chosen the robot. And so we find ourselves a decade down the road from the day Menon opened the doors on the Vattikuti Institute.

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**From Detroit to orbit** *Henry Ford Hospital's Scott Dulchavsky has developed a remote ultrasound device that's been tested aboard the space station*

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**Maybe the robotic revolution is the medical equivalent of a Rolex watch. Maybe we can't afford a Rolex**

More than \$1 billion worth of robots are operating on tens of thousands of patients all over the country, with generally good results and minimal complications. Maybe the whole thing is a medical version of a Rolex watch: impressive and reliable, and yet an unnecessary extravagance. Maybe we can't afford a Rolex.

So many variables go into the treatment of disease – the patient's fitness, the doctor's skill, the virulence of the malady – that it may be impossible to isolate the precise value of each tool or technique. Certainly by the time enough data is collected to make a persuasive case, the robotic revolution will be so far along that it would be an infernal task to reverse it. This horse is long gone from its barn.

And that is the complicated reality of medical innovation. As Nancy Schlichting says, it's a good thing to say yes to creativity – even when we might not know the price tag. Today's costly venture may be the seed for tomorrow's cost- or life-saving breakthrough. "We're just seeing the tip of the iceberg for robotics," Menon declares. "One company has been making one product, but as more companies enter the market, costs will go down."

Menon understands that creativity cannot wait for absolute certainty. But he is completely sure of this much: "In the future, most surgery will be done in minimally invasive ways, assisted by computers. Will it necessarily look like this? Who knows?" he says with a shrug. "But medicine has to progress." ●



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