

"Paging Dr. Robot!"



New surgical robot lends a hand (or 2 or 3 or 4)

It's surgery, except the surgeon never lays a hand on the patient.

It's surgery, except the surgeon is two metres away from the operating table.

It's surgery, except the surgeon seems to be playing a video game.

It's surgery, except the surgeon wears no gloves, mask or gown.

Yet, it's the most exciting and revolutionary form of surgery ever performed at the Jewish General Hospital—or anywhere else in Quebec, for that matter. It also marks a significant integration of surgery with robotics—an upgrade that gives doctors the unprecedented ability to carry out delicate, minimally invasive procedures with exceptional precision. As a result, patients who have undergone robot-assisted surgery experience less blood loss, lower risk of complications, shorter hospital stays and quicker recuperation times.

Hovering obediently over the patient is a four-armed electronic marvel known the da Vinci Surgical System, the star performer in two to three JGH operations per week. Earlier versions of the da Vinci robot, manufactured by Intuitive Surgical Inc. of California, have been used in the United States and Europe for several years. However, the model that the JGH introduced last December is the most advanced of its kind, purchased by private donation for \$4.5 million. As of spring 2008, the only other Canadian cities boasting this level of robotic sophistication were Vancouver, Edmonton and Toronto.

Da Vinci gives doctors a big boost in performing the next genera-

tion of minimally invasive surgery, also known as laparoscopic surgery. In the basic form of this surgery, long, thin, flexible tubes are inserted into small incisions in the patient's body. One tube carries a tiny light and camera, while the others are equipped with small surgical instruments. As the surgeon watches a television monitor, he or she manipulates the instruments and performs an operation without having to open a large cavity in the patient's body.

The da Vinci system takes this concept to a new level in two important ways. First, it frees the surgeon from actually having to handle the instruments. Instead, da Vinci's robotic arms—each bearing its own instrument—are passed through the incisions and into the patient's body. The surgeon, sitting a couple of metres away at a special console, uses hand controls and foot pedals to manipulate the robotic arms with a degree of precision that can be difficult to achieve in regular laparoscopic surgery.

The second key advantage is the optical system. In routine laparoscopic procedures, the surgeon watches the surgery on a flat-panel video monitor. By contrast, when the surgeon looks into the viewfinder of the da Vinci console, he or she gets a crystal-clear, 3D image of the surgery, because the system's mini-camera has two lenses.



Dr. Guy Breault, (left) a urology resident, assists in robotic surgery. To keep the area hygienic, plastic sheets encase all of the machinery except for the sterile instruments in the patient's abdomen.

Dr. Breault (above) watches the operation, which is performed by a surgeon (not shown) who manipulates the controls on a nearby console.

A high-definition, flat-panel monitor does perch near the patient, but it's there to show other members of the surgical team what the surgeon is doing.

"There's no question that this system is a significant advance for certain types of surgery," says Dr. Lawrence Rosenberg, Chief of Surgery at the JGH. "To be sure that a tumour has been removed completely, the surgeon has to cut away a small margin of normal tissue. The enhanced optics of the da Vinci system improve the surgeon's ability to take out as little healthy tissue as necessary, but just enough for the surgery to be effective.

"The robotic instruments also move and swivel with a wide range of motion. That's why tying a knot is easy for the robot, but quite difficult in regular laparoscopic surgery. Another advantage is that the arms can lock into place for as long as desired. This gives the surgeon an opportunity to stop and rest, or to have a colleague take over. Once the surgery resumes, it picks up exactly where it left off."

In some conventional operations, the surgeon's hands or instruments may lack the agility to move through tight spaces or around difficult corners. However, da Vinci's design eliminates this problem by giving its robotic arms greater flexibility than that of the human wrist. As a result, the JGH can now offer minimally invasive surgery to patients who might otherwise have been denied this surgery for various reasons, such as obesity.

Robot-assisted surgery is so easily tolerated that recuperation is remarkably quick. Staff in the Department of

The human touch behind the robotic arms

Impressed though he may be by the high-tech wonders of the da Vinci robot, John Stella insists it was the human touch of the Jewish General Hospital that made all the difference to his successful surgery.

Mr. Stella, 52, received confirmation last October from his urologist, the JGH's Dr. Samuel Aronson, that he had cancer of the prostate. Given his family history, the surgical removal of his prostate offered better odds than radiation therapy in ridding his body of the disease.

"I was referred to Dr. Maurice Anidjar, who ended up performing the surgery at the Jewish in January," Mr. Stella says. "He's the one who first suggested using the robot, and he took the time to explain what it was and why it would be so useful. The most important thing was that he made sure I understood that the robot was there to assist him and not the other way around."

Mr. Stella, a corporate communications director for a Montreal company, realizes how crucial the da Vinci system was in enabling Dr. Anidjar to avoid damaging his sphincter muscle or nerves. As a result, he spent just a little over two days in the hospital and was back at work within three weeks.

"If not for Dr. Anidjar," Mr. Stella says, "I probably would have thought twice about agreeing to surgery with the robot, but he really put me at ease. After the operation, he called me twice a day while I was in the hospital, and later he even called me at home. The personal touch was everywhere, from the nurses on the third floor to the people at Hope & Cope. They were unbelievable."



At a JGH news conference in February, patient John Stella (centre) described his robot-assisted surgery. Joining him were his surgeon, Dr. Maurice Anidjar (left), and the Chief of Urology, Dr. Jacques Corcos.

Continued ... please turn the page.

Obstetrics and Gynecology still speak with amazement about the surgery of a 76-year-old woman earlier this year. She went home just one day after her operation, instead of having to spend the customary five to seven days in the hospital. Within hours of coming home, she was cooking dinner for her husband. The day after that, she was well enough to travel by metro to her folk-dancing class.

During a typical robot-assisted procedure, the mood and level of concentration in the operating room are about the same as during regular surgery. The major difference is that the primary surgeon sits off to one side at the da Vinci console. Since the surgeon is not in the sterile area close to the patient, there is no need to wear a surgical gown, mask or gloves. Some surgeons even find it more comfortable to press the console's foot pedals in their stocking feet—a preference that staff jokingly refer to as “pyjama surgery”.

Despite this novelty, a robot-assisted operation remains a team effort. At the patient's side, a fully gloved, masked and gowned assistant surgeon monitors the procedure, changes instruments on da Vinci's arms, and helps in removing diseased tissues through the flexible tubes. Also present are an anesthetist, circulating nurse, scrub nurse and technicians.

Unlike the primary surgeon, the da Vinci robot does come into direct contact with the patient in the sterile area. Therefore, it

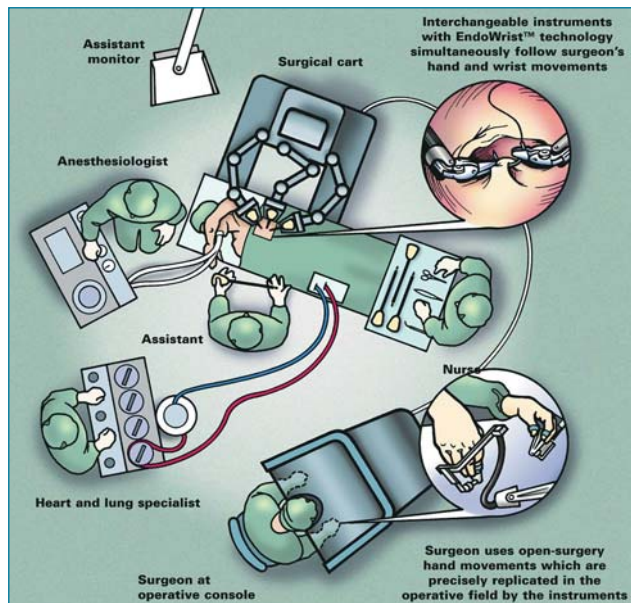
must be covered in clean plastic sheets before the operation begins—a task that takes nurses 20 to 30 minutes. To accommodate the robot, the JGH operating room also had to be enlarged by incorporating some space from an adjoining storage area. However, the room is still used for other surgical procedures; the da Vinci equipment is simply folded up and wheeled out of the way.

When da Vinci went into service in December, four JGH doctors—Dr. Jacques Corcos, Chief of Urology; Dr. Maurice Anidjar of the Department of Urology; and Dr. Walter Gotlieb and Dr. Susie Lau of the Department of Obstetrics and Gynecology—had received training in robot-assisted surgery at a special facility at Ohio State University in Columbus. Since then, the ranks have been increased by the addition of Dr. Jacob Garzon and Dr. Shannon Fraser from the Division of General Surgery, with training scheduled for two more doctors from Obstetrics-Gynecology. Interest has also been expressed by the Divisions of Cardiac Surgery and Neurosurgery.

That doesn't mean da Vinci will be used in every instance from now on. Dr. Rosenberg notes that conventional surgery still makes more sense for relatively simple procedures such as removal of the appendix, while standard laparoscopic surgery is fine for operating on the gall bladder. “Surgeons around the world are comparing notes, and we know that several procedures, such as removal of the prostate, are ideal for the



Members of staff demonstrate the components of the da Vinci Surgical System. During an operation, the patient lies on the surgical table (left), and robotic arms, each equipped with a tiny surgical tool, extend into the patient's body. The operation is performed by a surgeon at a special console (right) connected to the robot. Surgery is monitored by electronic equipment on a separate cart (centre). During an operation, the robot and its arms—but not the surgeon's console—are covered in sterile plastic sheeting.



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In this bird's-eye view, the surgeon (bottom) manipulates the controls on his console to move the robotic arms (top, centre) whose instruments are inside the patient's body.

Where the robot works best

Not all fields of medicine can claim immediate benefits from robot-assisted surgery. Here are some of the ways in which the da Vinci Surgical System is now used or may soon be used at the JGH:

Urology – removal of the prostate and kidneys, removal tumours from the kidneys, repairs to the ureter

Obstetrics and gynecology – removal of the uterus, removal of tumours from the ovaries, repairs to the Fallopian tubes

General surgery – repair of a hiatus hernia in the esophagus, removal of the gall bladder, resection of the bowel, repair of the esophagus to improve swallowing

Cardiac surgery – repair or replacement of the heart's mitral valve, repair of the tricuspid valve, closure of congenital holes, removal of benign tumours on the right side of the heart

Neurosurgery and orthopedics – To be determined.



robot. But we don't yet have enough collective experience to know how well it works in all cases."

The future of robot-assisted surgery is also of interest to Dr. Corcos, who was the driving force behind acquisition of the da Vinci system. What he envisions is a JGH-based research and training centre, developed in co-operation with Quebec's six universities. The aim, he says, is not just to certify surgeons in the use of existing devices like da Vinci, but to enable bio-medical, engineering and other experts to collaborate in the creation of new robotic technology.

As for the near future, Dr. Corcos and Dr. Rosenberg predict the JGH will need a second da Vinci system before the end of 2009. It would accommodate the additional operations that will be performed as more doctors become certified in robot-assisted surgery. The second system would also serve as an invaluable aid to teaching and research.

"We're proving once again that the approach of the Jewish General Hospital is to deal with the concerns of the present by keeping one eye on the future," says Dr. Rosenberg. "Our goal is to make the JGH a focal point for the best medical technology and the most up-to-date facilities, in order to be not just Montreal's hospital, but Quebec's hospital."

Adding it all up

Purchase price of the JGH's da Vinci Surgical System: **\$4.5 million**

JGH surgeons accredited for robot-assisted surgery (as of spring 2008): **6**

Robotic surgeries per week: **2 to 3**

Time to prepare robot for surgery: **20 to 30 minutes**

Length of incisions where instruments are inserted: **About 2 centimetres**

Surgeon's console

(controls the robotic arms)

Hand controls: **2**

Foot pedals to control the camera: **2**

Foot pedals for cauterizing tissue: **2**

Foot pedals for other purposes: **1**

Height: **1.25 metres**

Width: **1 metre**

Weight: **270 kilograms**

Patient cart (holds the robotic arms)

Arms for surgical instruments: **3**

Arms for camera and light: **1**

Camera lenses: **2** (for stereoscopic vision)

Height: **2 metres**

Width: **1 metre**

Weight: **540 kilograms**

Vision cart (displays the operation to the surgical team)

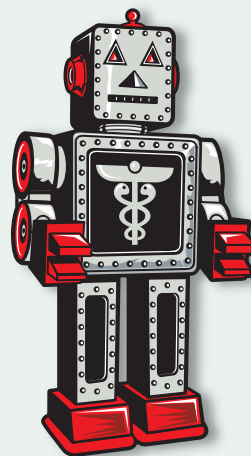
Weight: **180 kilograms**

Size of high-definition, video monitor: **19"**



The robotic arms of the da Vinci system are uniquely designed to mimic the movement of the human wrist.

"Is my doctor a machine?"



Can the da Vinci robot perform surgery by itself?

No. Basically, it's just another type of medical instrument, albeit a very large and complicated one.

So it's not R2D2 with a scalpel?

Not at all. Without a surgeon at the controls, it can't make a move.

Then why call it a "robot"?

Because it's like an extension of the surgeon's arms. It takes the surgeon into areas within the patient's body that he or she might not otherwise reach easily. Also, the robot's arms are so sensitive that they can precisely duplicate and, in some cases, improve upon the movements of a surgeon's own hands.

How does the "da Vinci" name fit in?

It refers to the great Italian scientist and artist, Leonardo da Vinci (1452-1519). Not only did he design a rudimentary humanoid automaton, but he was famed for the precision of his anatomical drawings.

So my doctor isn't about to be replaced by a robot?

Not anytime soon—probably not even in this century. After all, even the starship Enterprise has a flesh-and-blood doctor.

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