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Health Sciences

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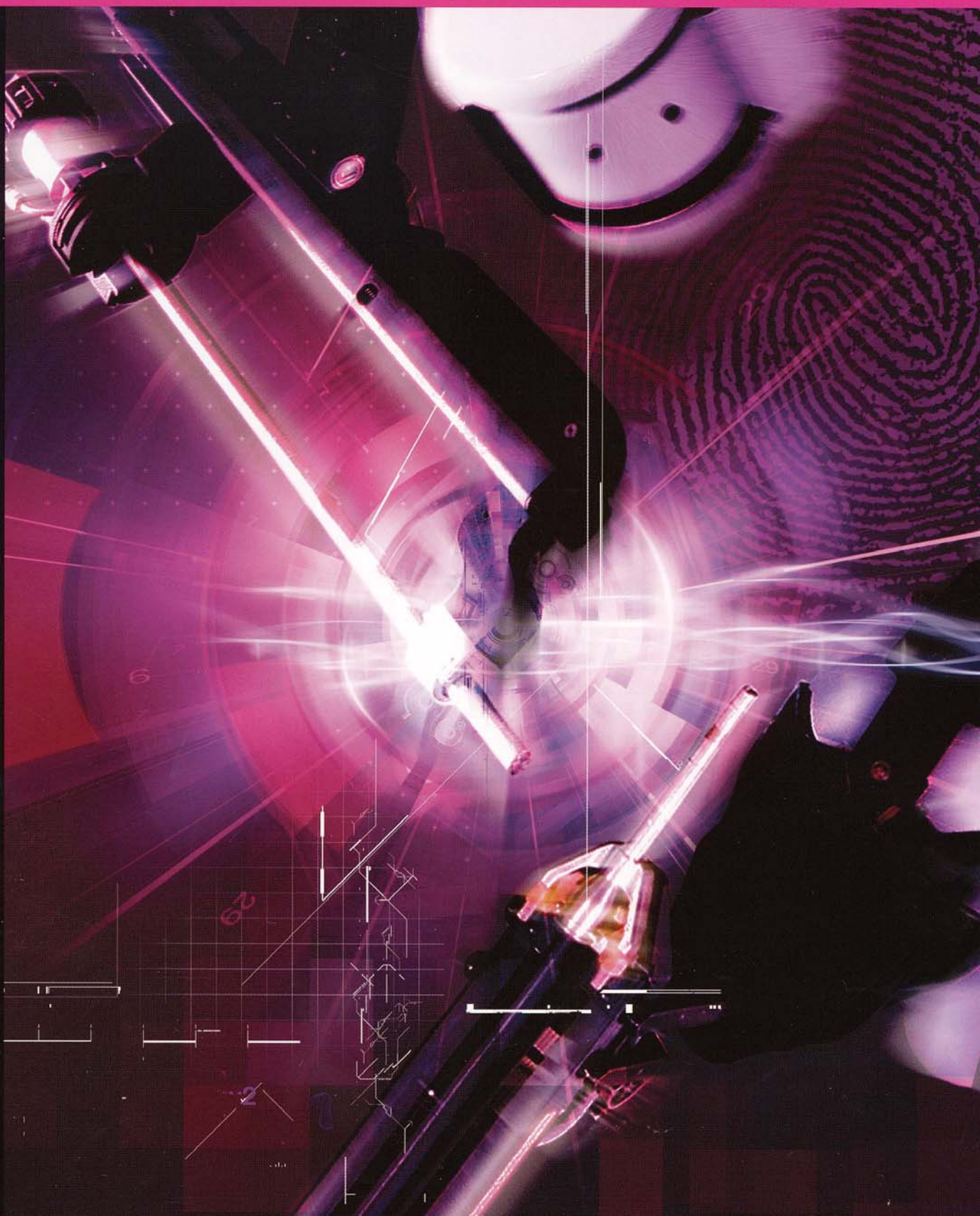
Expanding Surgical Frontiers | New Pathways to Discovery | Tribute to Ed Holmes, M.D.



the KINDEST

By Sarah Lifton

NEW PATIENT-FRIENDLY TECHNIQUES

There's a 2,000-pound gorilla in the operating room these days, but unlike its metaphorical 800-pound cousin, everyone is eager to talk about it. Paradoxically, this behemoth, a robotic surgical system named Da Vinci, encourages surgeons to think small, enabling them to carry out many procedures with smaller incisions, greater accuracy, reduced pain, minimal blood loss, shorter hospital stays, less scarring, lower risk of infection, and swifter recovery. Not surprisingly, it is well on its way to becoming an indispensable member of the surgical team.

(Left-Right)
Jessica Agost, O.R.T.
Mark Talamini, M.D.
Josie Yuzon, R.N.
Linda Freeman, R.N.

CUT

EXPAND TOMORROW'S SURGICAL FRONTIERS

"Surgery is one of the last medical fields to take advantage of computer technology in the care of patients," explains Mark Talamini, M.D., Chairman of UCSD's Department of Surgery, one of the nation's leading authorities in the field of minimally invasive surgery and a pioneer in the development and application of robotic technology in surgery. "Detroit long ago switched to robotics for building cars because it is cheaper and more reliable. Robotic devices can do tiresome, repetitive tasks without fatigue and far more precision. There are many areas of surgery where that is applicable, but surgeons are very conservative. They like to have their hands on patients. But the time for change has come, and the minimally invasive revolution is making surgery wonderfully innovative and exciting."

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When one of the most significant advances in that revolution, video laparoscopic surgery, debuted in the late 1980s, it became possible for surgeons to operate by inserting a tiny video camera and several thin instruments the size of chopsticks through a few small incisions while viewing the surgical field on a computer monitor. These techniques require considerable training, practice, and skill because surgeons forfeit three-dimensional vision and the ability to feel what they are doing. The advantages to the patient, however, are irrefutable. In gall bladder surgery, for example, one of the first operations in general surgery where laparoscopy overtook conventional surgery, a traditional open procedure requires a four–to-five inch incision over the right rib cage, which cuts through all the abdominal muscles and necessitates a three-to-five day stay in the hospital. During recovery, the patient experiences considerable postoperative pain while simply breathing, talking, and walking. The laparoscopic procedure, by contrast, uses three or four holes of no more than an inch, and the patient generally is able to go home the same day and return to work the following week.

The Da Vinci surgical robot, which arrived at UCSD's Thornton Hospital last year, evolved from laparoscopic surgery but expands on the technology by separating surgeons physically from their patients and providing them with vivid 3-D vision, 10X magnification, wristlike capabilities, and six degrees of freedom in the abdomen. From a console several feet away, they manipulate multiple robotic arms that wield the camera and surgical instruments.

"Laparoscopic surgery, in terms of holes in the belly wall, is not different with the Da Vinci," Talamini explains. "What we think it will do is allow a broader spectrum of surgeons to take advantage of minimally invasive surgery."

MINIMAL INVASION, MAXIMUM RESULT

Even without the robot, UCSD physicians are regularly performing complex surgeries that once required large incisions but are now possible using minimally invasive techniques. Last May, for example, Sonia Ramamoorthy, M.D., an Assistant Professor in Residence in the Department of Surgery, removed the colon of 15-year-old Jessica Redon, an accomplished Escondido gymnast who had developed severe ulcerative colitis. Hospitalized for three months, Jessica had lost 20 pounds and received 20 units of blood, and her condition was not responding to medication. Surgery was her only option. Ramamoorthy performed the procedure laparoscopically, including a reconstruction called a J-pouch, which allowed her to have intestinal continence and lead a normal life. She was out of the hospital within a week and quickly started to regain her weight and strength. Today, with the disease behind her, Jessica has resumed her normal activities and hopes to continue competing nationally in gymnastics.

Discomfort and recovery time are also dramatically reduced in the latest approach to hemorrhoidectomy. A new instrument makes it possible for surgeons to eliminate hemorrhoids without cutting out tissue; instead they reduce blood flow to the dilated veins by stapling them deep inside the rectum where there is less sensation. Rather than enduring the pain and a three-to-five week recovery time of the conventional procedure, patients are back in action in about seven days.

Niren Angle, M.D. with portable C-Arm

"These techniques are good for society and for family health care in general," observes Ramamoorthy. "We can't approach every patient with a minimally invasive technique, but as the technology gets better, we will overcome the current obstacles and will be able to offer every patient some alternative."

Vascular surgeon Niren Angle, M.D., who treats diseases of the arteries, veins, and lymphatic system (exclusive of the heart and brain), has also observed a surge of enthusiasm for minimally invasive

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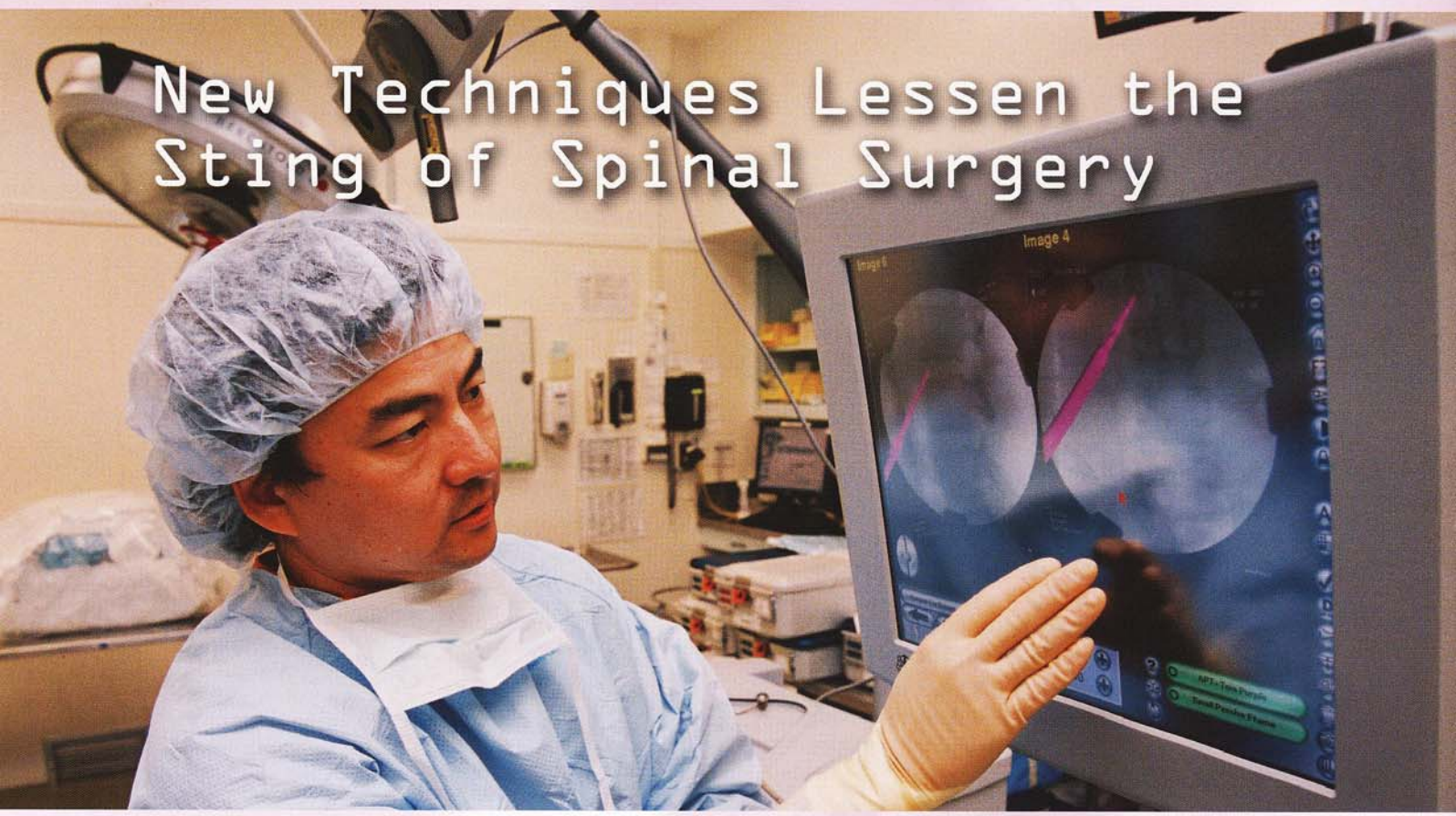
New Techniques Lessen the Sting of Spinal Surgery



Choll Kim, M.D., Ph.D

Back in the 1970s, when Americans followed the weekly exploits of the "Six Million Dollar Man" and "Bionic Woman" on TV, few could have imagined a time when implanting synthetic body parts in humans would be routine. Today's orthopaedic surgeons can't yet offer their patients the kind of superhuman performance those fictional characters enjoyed, but they regularly restore normal function in people whose original equipment has been damaged or worn out, using replacement implants.

"We can fix things now that we couldn't have 20 years ago," says Choll Kim, M.D., Ph.D., Assistant Professor in the UCSD Department of Orthopaedic Surgery and a specialist in computer-assisted minimally invasive spine surgery. "We used to put most spine fracture patients in a total body cast and prescribe bed rest for three months, which was fraught with complications. Now we can use screws and rods to hold everything together. The whole purpose is to get the patient walking as soon as possible after surgery."

As early as 10 years ago, orthopaedic surgery meant large incisions, extensive soft tissue damage, considerable blood loss, and pain. These were long hospital stays, and spinal surgery had the largest incisions, the greatest blood loss, and the most pain. Today, however, the field is being transformed by minimally invasive techniques, and UCSD is at the forefront, with one of the nation's few centers of excellence for minimally invasive spinal surgery. In addition to housing one of the top fellowship programs in the country and a burgeoning clinical trials program, UCSD also boasts Kim, who is a rare expert in a highly specialized field. The program attracts many patients who come specifically to UCSD so they can have minimally invasive surgery, and Kim typically performs one or two such procedures a week.

"It's extremely challenging technically—like building a ship in a bottle," he says. "You're doing a lot of work through a little opening. But depending on the surgery, the recovery time can be a third to half as long as it is with traditional techniques."

Until recently, minimally invasive spine surgery has required live x-rays, which expose both the patient and the surgical team to considerable radiation. Precautions like thyroid shields and lead gowns, gloves and glasses limit the surgeons' exposure, but these are unwieldy and uncomfortable. Concerned about the effects of a lifetime of exposure, Kim began searching for alternatives. Over the past year, he has begun to incorporate a computer-assisted image guidance system into many procedures. The system, which produces images of comparable quality to live x-rays, uses a special computer to track the instruments in 3-D space, much like a GPS tracks a car's location on the roadways. Best of all, it doesn't expose the surgical team to radiation during the operation.

This system is just one of many technological innovations, including robotics, that Kim believes will become commonplace in the orthopaedic operating room. He envisions a day when teams of highly trained surgeons, guided by a master surgeon, will use technology to collaborate in flexible ways at regional centers of excellence.

"The whole idea of UCSD's orthopaedic spine service is to make it that entity," Kim says. "We want people to call on us from all over the world to help with surgeries. We want to be *that* center of excellence."

techniques in his field over the past five to eight years, specifically endovascular therapies that treat conditions such as stenosis or aneurysm inside the arterial lumen, or lining. These techniques include familiar approaches such as angioplasty and stenting, as well as atherectomy, which removes blockages by reaming them out with a tiny rotating knife. While Angle cautions that these new procedures tend to be less durable than conventional open surgical therapies, they have the advantage of less morbidity and don't require the patient to stay overnight in the hospital.

"They are one more tool in the armamentarium," he says. "The beauty of vascular surgery is that most of us these days are trained in both conventional and minimally invasive concepts and have no vested interest in deciding whether we want to do X or Y. We can do either, depending on the best interest of the patient."

New advances have also made it possible for surgeons like Angle to prevent drastic measures such as amputations in diabetic patients, who often develop severe circulatory problems placing them at high risk. Whereas 15 to 20 years ago, serious conditions like gangrene in the extremities were considered hopeless, today surgeons can bypass small vessels and save diseased legs and feet.

COLLABORATION+ IMAGINATION = INNOVATION

Because surgery by nature is a collaborative specialty, and scientific progress requires teamwork as well as imagination, UCSD, with its long tradition of cross-disciplinary endeavors, is both an adopter and creator of surgical innovations in the clinic, operating room, laboratory, across medical fields, and even across disciplines.

"We don't work in a vacuum," says Talamini. "Virtually every field of surgery depends on collaboration with other fields of medicine—usually more than one—and vice versa. The only successful surgeons in the future are going to be those who are able to work with other groups."

Art Nelson, a general contractor from Temecula, recently benefited directly from UCSD's collaborative spirit. During a routine screening colonoscopy last spring, Nelson's physician found a precancerous polyp, which needed to be removed right away. Unfortunately, because of its shape and its location, it could not be taken out through a standard colonoscopy. Nelson, 60, faced major surgery that would remove part of his colon along with the polyp, requiring five days in the hospital and three or four weeks of recovery. His doctor referred him to Ramamoorthy.

"When I went down to see her, I was expecting to have a conventional procedure," he says. But Ramamoorthy told him he was a candidate for a new, minimally invasive procedure. In late May, he underwent a laparoscopic-assisted endoscopic polypectomy at Thornton Hospital. Ramamoorthy collaborated with her colleague Mary Krinsky, M.D., a gastroenterologist, in the procedure. A small scope was placed in his abdomen, and the polyp was injected with a saline solution, which popped it up and allowed Krinsky to remove it with the colonoscope. Had she been unable to remove it, or had the procedure punctured his colon wall, Ramamoorthy would have stepped in and performed a conventional procedure. Nelson went home the same day and was back at work in less than a week.

"These kinds of collaborations help us get to the root of the matter," Angle says. "They stimulate the mind and create a better surgeon and a synergy that will lead to better understanding of a disease process so we can come up with more innovative forms of therapy. That's the natural fruit of these kinds of endeavors."

"It wasn't a major deal for me," Nelson says. "I recovered right away and had absolutely no pain. It's a great procedure as far as I'm concerned, and I can't speak highly enough of how I was treated."

In UCSD laboratories, surgeons are working with other physicians, scientists, and even engineers to devise new technologies. "If you ask individual surgeons who they're working with in the lab, everyone is collaborating with someone outside the department," says Ramamoorthy. "Surgeons realize that they can take better care of their patients when they have their tentacles out."

Angle is collaborating with a colleague in the Jacobs School's Bioengineering Department to develop a

Sonia Ramamoorthy, M.D.

"Would I like to see us put out of business? Absolutely!" Ramamoorthy says. "I would love to not have to operate on patients, to treat them without having to make an incision."

prosthetic graft capable of carpeting its surfaces with a patient's own endothelial cells, which line the blood vessels—a critical advance that would allow artificial bypasses to remain open much longer than they currently do. He is also working with David Cheresh, Ph.D., Professor of Pathology, to explore the mechanisms underlying ischemic reperfusion—a phenomenon that occurs when blood flow to tissue is interrupted, then restored. Muscles can swell up and die if pressure isn't released, and there is still no effective therapy to prevent it. In severe cases, other organs, such as the lungs and liver, may be damaged as well—with fatal consequences. Being able to stop or modulate the condition is critical.

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FORECASTING THE FUTURE

Today's surgeons are generally more comfortable gazing into computer monitors than crystal balls, but many feel the advances of recent years signal the beginning of a new era. Talamini predicts a growing use of computer technology in surgery and believes the Da Vinci system is just the first step in a series of collaborations among surgeons, engineers, and industry. He foresees a time when telemedicine is a reality, dramatically changing the role of the academic surgeon. If a surgeon on board a navy ship or in a rural location needs help from someone who does a procedure extremely well, for example, he or she could request assistance for part of an operation, and the expert could go to the computer console of an intuitive system like the Da Vinci and help the surgeon in the remote setting complete the procedure.

Talamini says, "It's currently a pie-in-the-sky dream, but it's possible."

He also anticipates the growth of natural orifice trans-esophageal surgery. Rather than making an incision in the abdominal wall, a surgeon could put a scope in a patient's stomach and a hole in the belly cavity, then pull a diseased organ into the stomach and up through the mouth. In Talamini's lab, research fellow Yoav Mintz, M.D., has already removed a gall bladder and performed a tubal ligation in an animal model using this technique.

Ramamoorthy notes that surgeons at some centers, including UCSD, are starting to use the robot to perform similar natural orifice or minimal no-scar surgery, in which they remove a diseased colon through the intestine with a colonoscope, minimizing incisions and improving patients' recovery and quality of life.

"We went from making major incisions for colon surgery to minimizing incisions with laparoscopic surgery, to trying not to make any incision larger than a centimeter," she says. "It takes an appropriate candidate—someone who's never had an abdominal surgery before and who's not overweight. But as we get better at it, these conditions will become liberalized."

Regardless of where surgery is headed, Talamini believes strongly that UCSD is uniquely positioned to become a world-class clinical presence. "There's an incredible research opportunity here," he says. "UCSD doesn't take a back seat to any institution in the country, and with the engineering school, research institutes, and biotechs lined up and down Interstate-5, there's an extraordinary environment that is not replicated anywhere. There's an amazing opportunity for the Department of Surgery to collaborate with these groups."

For her part, Ramamoorthy predicts these broad collaborations may eventually make surgery as we know it—obsolete."Would I like to see us put out of business? Absolutely!" she says. "I would love to not have to operate on patients, to treat them without having to make an incision."

That's a dream that is sure to please patients as well. And with the work taking place at UCSD, it may be within reach sooner than anyone imagines.