



PUT



JUST ANOTHER MINIMALLY INVASIVE
LIVER RESECTION | BY ELAINE VITONE

A BAND-AID ON THAT INCISION

If you were to observe David Geller (Res '96, Fel '98) prepping for surgery on UPMC Montefiore's fifth floor, at first, you might get the impression that he has an imaginary friend.

"Sidney... Sidney?" Geller says, apparently to no one in particular, as he sits at a computer by the door. Masked staff members circle the room arranging instruments and supplies. They chat pleasantly with one another, but no one answers Geller, who is the Richard L. Simmons Professor of Surgery and codirector of the Liver Cancer Center.

"Sidney..." Geller tries again, and this time, the OR's voice-activated software program, SIDNE (Stryker Intelligent Device Network), responds with a ding. With a few short spoken phrases, Geller adjusts the lights, the patient's bed, and the camera that feeds digital still images to the three flat-screen monitors above the patient's head.

ILLUSTRATION | ROB KELLY

"We have a nice stereo in here with surround sound," Geller, 44, says proudly, plugging his MP3 player into the computer. As his Beatles play list begins, you can practically see him smiling through his mask—a gadget guy in hog heaven here in Room 30, which he calls the OR of the future.

Eighty-two-year-old Agnes Ricci (we've changed her name) lies sedated in the middle of the room, all but her stomach covered in blue sterile drapes. Her swollen, Betadine-orange belly looms large.

"That's her CAT scan up on the plasma screen there," Geller tells me. On the large monitor on the wall, he points out the cause of Ricci's condition—a giant, benign liver cyst that covers three-quarters of a cross-section of her torso. "She feels full and is in pain," he says. "She's unable to leave the house. Her bile ducts are quite swollen. She's close to getting jaundiced."

Ricci first learned of her cyst eight years ago, when it was just the size of a lemon. Her surgeon at the time discovered it while operating on her for another condition, and so he drained it—a temporary fix. He knew it would surely reseal and refill. It was the best he could do at the time. He told Ricci cysts like hers were common—as far as he knew, it was nothing to worry about. Besides, attempting to remove it would be too dangerous.

But things are much different here in the OR of the future. Ricci ended up with a 12-inch scar from the open surgery she had eight years ago—which left this cyst. Today's laparoscopic surgery to remove it will leave Ricci with merely a 12-millimeter incision just below her navel.

Surgical fellow Jason Heckman assists Geller in threading through the hole a laparoscope with a light and camera at the end. Then Heckman holds it steady in his left hand. Ricci's stomach glows—illuminated from the inside out, like ET's chest. George Harrison's voice drifts through the room: *Here comes the sun. And I say it's all right.*

High-resolution footage of the giant, tan, water-balloon-like culprit fills the screens. The cyst has made itself at home in Ricci, spreading scar tissue and connecting itself to her colon, duodenum, and gallbladder.

Through four additional, 5-millimeter holes in Ricci's skin, Geller inserts rods tipped with tiny metal tools. Many of these graspers, scissors, hooks, staplers, and other cutting, cauterizing, and hemming instruments Geller and Heckman refer to with pet names like "the

duckbill" and "the alligator." Their bills and jaws only measure an inch or two, but they look much bigger on the monitors.

Geller pierces the surface of the cyst wall.

He drains the cyst of its contents—3.8 liters of dark-brown bile the color and consistency of café mocha. Siphoned through a tube, it spills out into a large, clear-plastic container at Ricci's side.

With graspers, Geller holds open what looks like some beastly maw. It's a swamp in there, all spongy, slimy, and dark brown. "Sidney... Sidney... digital capture," he says, taking a quick snapshot for the Riccis. (Yes, many families do actually want these souvenirs.) He then sets to work on suctioning that last thick, mud-like sludge out from the inside of the cyst. "Hard Day's Night" plays on the stereo, as if on cue.

In the next hour, Geller carefully cuts and burns around the cyst to sever its connections with Ricci's body. He then cuts most of the loose flap of cyst wall out, all in one large piece. In his final, climactic move, he uses a long, blunt, gray instrument dubbed "the silver bullet" to pull out the cyst-wall piece through the 12-millimeter laparoscopic incision, then places it on a tray at Ricci's feet. It's innocent-looking enough now—about 5 by 3 inches—and shaped vaguely like Illinois.

Geller first started here at Pitt as an intern in 1988, back when liver surgeries were "big, gross, and bloody." If you'd have told him 20

"Here it comes. It's huge. We can do this. We can take out half a liver laparoscopically. It's like delivering a baby."

or even 10 years ago that he'd be performing laparoscopic surgery on cysts and tumors of the liver—that large, infamously bleeding-prone organ that surgeons consider one of the most intimidating to work on—he would've laughed. And yet here he stands, wrapping up lap liver number 184, sewing five tiny incisions and covering them with ordinary Band-Aids. Another successful, virtually bloodless procedure. All in a hard day's night.

That evening, at the Liver Cancer Center on the third floor of the Kaufmann Building, Geller clicks away at his computer, opening a series of video clips from previous surgeries—success stories unfolding on-screen before us.

"Watch this—it's a young woman your

age [around 30]," he says. "She sent us her records, and I told her, 'I can cut this out [laparoscopically].' She flew up from Florida. There's my hand in there. Yes, this is still a laparoscopic surgery, but it's hand-assisted. The incision is just a little bit longer—nothing like the big cuts for open surgery."

He double-clicks on another patient's file. "And look, here's a bigger-than-softball-size tumor. Let me speed this up," he says, skimming through hours of careful cutting and tumor taming. "Here it comes. It's huge. We can do this. We can take out half a liver laparoscopically. It's like delivering a baby."

It's 7 p.m. on the Friday before a three-day weekend, but Geller is not eyeing his watch. He wouldn't miss a chance to share his message: Things are changing fast in terms of how surgeons can approach the liver. Because of this, he has been able to offer hope to many patients with liver cancer.

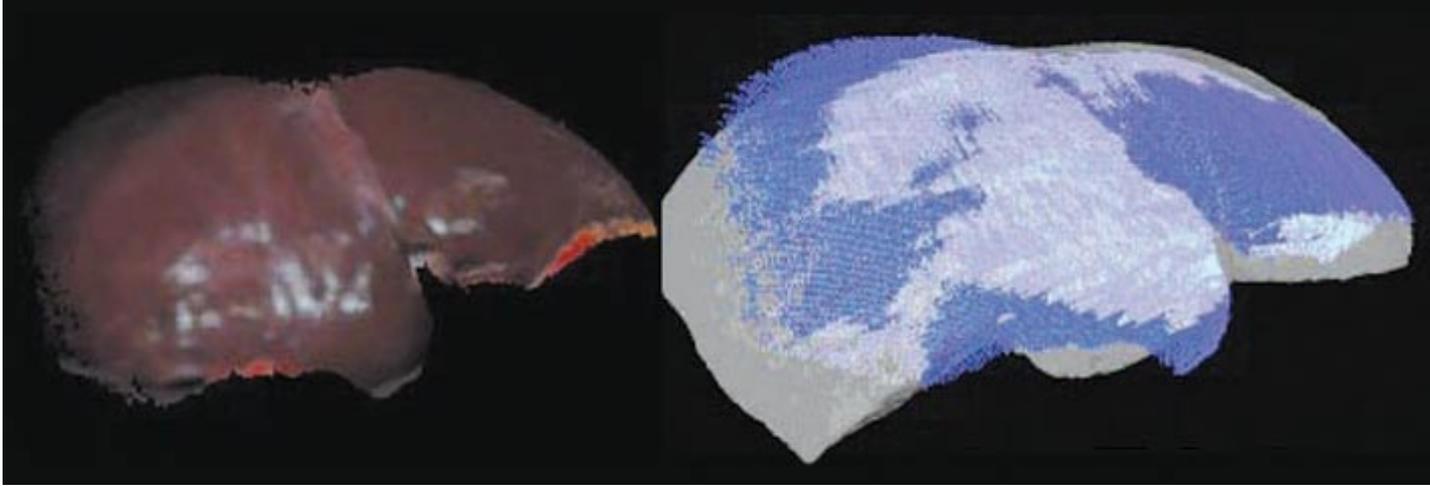
Liver cancer is more common than most people may realize. The most prevalent type of liver cancer doesn't originate in the liver, but spreads from the colon. Some 150,000 new cases of colorectal cancer are reported each year, making it among the four most common cancers. Of these patients, 60 percent will eventually develop liver cancer.

Cancer that does originate from the liver, known as primary liver cancer or hepatocellular carcinoma (HCC), is one of the few cancers that's killing more people each year. With the

rise of hepatitis C, HCC cases have doubled in this country in the last two decades, bringing the annual death toll to 16,000. Nationally, only 10–20 percent of HCC cases are considered operable; the other patients usually die within three to six months.

"Historically many patients have been told that liver cancer is a death sentence, that there's nothing more to do but go home and die," Geller says. "But we're able offer some form of treatment to about 95 percent of patients that we see."

The Liver Cancer Center began in 2001 as an extension of the liver-tumor service of the Thomas E. Starzl Transplantation Institute. Its doctors saw 500 patients in the first year. Since then, that number has quadrupled, and the center has quickly become one of the top



two authoritative centers on laparoscopic liver surgery nationwide. Until his recent retirement, it was codirected by Brian Carr, professor of medicine and surgery, who is known for his work with targeted chemotherapy. In December 2006, Geller and a colleague at Northwestern University coauthored a paper on laparoscopic surgery for *Hepatology* at the editor's invitation.

The Liver Cancer Center treats patients with surgical, systemic, and regional therapies, as well as novel approaches that are available through clinical trials. For about 25 percent of their patients, the center can offer a cure. Many patients in the other 75 percent are adding months—even years—to their lives.

Colon cancer that has spread to the liver was once a devastating diagnosis; it's now gradually becoming more of a chronic disease, says Geller. Eighty-two-year-old Lawrence Cohen is living proof. Cohen was first diagnosed with colorectal cancer in 2001. After that first surgery, his doctor told Cohen's family that he only had about six months left.

"I fooled 'em all," Cohen says. "In March it'll be seven years."

Geller has performed open liver surgery on Cohen three times (two-thirds of the doctor's surgeries are not laparoscopic), removing sections of Cohen's liver each time. Although the side effects of chemo and radiation therapy have been trying, it has all been worthwhile for Cohen.

"I've been fortunate," he says. "I have two daughters and two granddaughters here in the city that I'm very, very close with. It's a reason for living."

"Between all these [operations and therapies], I do everything. I'm driving again. I was a road salesman, so it comes naturally to me. I'm president of the men's club at our synagogue. I've signed up for a stained-glass class and a clay-mold class."

"There are a lot of things I still would like to do," says Cohen, "and as long as I feel good and have the energy, I'm going to do them."

The Liver Cancer Center's regional liver-

Pitt's new prototype image-guided system provides three-dimensional renderings to aid surgeons in distinguishing among the liver's healthy tissue, tumor masses, and major blood vessels. On the left is a 3-D map of the liver, generated from an intraoperative laser scanner. On the right, a blue "point cloud" of the liver surface generated from the laser scanner is mapped on a surface created from a pre-op CT scan to allow for real-time GPS tracking of the tumor position. The Liver Cancer Center will begin using this system in a clinical trial of image-guided hepatic surgery in early 2008.

cancer treatment program is run by Clark Gamblin, assistant professor of surgery. His group can poison tumors with localized chemotherapy, cauterize them, choke their blood supply off with radioactive microspheres, or any combination thereof. These methods can stave off recurrence, serve as a lifeboat during that treacherous last stint before a transplant, and fend off inoperable tumors.

Within the next several months Gamblin will launch a new gene-therapy trial of 30 patients in the first-ever use of vaccinia—the virus that was used to eradicate smallpox—to treat HCC. It's one of several studies that the Liver Cancer Center staff have been hard at work on since the center was established.

Within the past several years, the center's J. Wallis Marsh, professor of surgery, has published several articles on a genotyping pilot study he conducted on 183 post-op liver-transplant patients. His team compared mutation rates in a panel of nine microsatellites—parts of the chromosome that serve as markers for certain genes—in the patients throughout a five-year period. They wanted to learn a better way of determining risk of HCC recurrence after transplant. They believe the panel predicts recurrence in 90 percent of patients.

The Liver Cancer Center is using this genotyping strategy to identify patients who need extra monitoring and treatment. It's still too early to say how effectively the strategy is working, but Marsh is optimistic. He believes the microsatellite panel could improve the United Network for Organ Sharing (UNOS) criteria.

Under the current guidelines, an HCC patient must have either one tumor less than 5 centimeters or no more than 3 tumors,

none of which is greater than 3 centimeters. Otherwise, the risk of recurrence is considered too high for a transplant.

"We think this is too restrictive," Marsh says, adding that it leaves many low-recurrence-risk patients out.

To strengthen the case, UPMC is planning a new, longer-term study that will include genotyping in the pre-op phase.

For Geller and his colleagues, it's a victory each time the center is mentioned in a story about novel cancer research, like the prototype device they're testing, designed to use targeted radio waves to kill cancer cells noninvasively (it was featured on CBS's *The Early Show* in August); or the *Pittsburgh Post-Gazette* article on Geller's recent gene-therapy trial on patients with colorectal cancer that has spread to the liver (results are due out in 2008); or the phase II trial the center conducted on Nexavar, the first-ever chemotherapy pill, which made ink in the *Wall Street Journal* in June.

"Every time one of these stories runs," he says, "we get half a dozen people calling and saying, 'Can you treat my spouse?' 'Can you treat me?' 'Can you treat my dog?'"

Because of Pitt's growing reputation as one of the top liver-cancer centers in the country, Pathfinder Therapeutics, a Nashville-based medical-device company, selected the Liver Cancer Center to conduct a trial with a prototype image-guided system this October. It's a kind of GPS for surgeons, a way to more accurately navigate the liver, the tumor masses inside it, and the major blood vessels within and around it. The trial is funded by a National Institutes of Health Small Business Innovation Research grant.

That first phone call from Pathfinder

cofounder Will Chapman, who contacted Geller to ask whether he wanted his center to work with the prototype, made this gadget guy very happy. “I’m like, ‘Wait, wait, wait. You’re telling me you’ve got the money already, you’ve got the coolest toy in the world, and all I have to do is say yes and find the patients?’” says Geller.

There was no textbook on laparoscopic liver surgery when Geller started developing his techniques in 2001. He had to learn to see the anatomy from the inside out, to use both hands equally, and to accomplish his work through the tiniest of incisions. He started with a much less intimidating organ—the gallbladder—then worked his way up to liver resections, first with benign lesions, then tumors. As better instruments became available, he tested them on pigs.

As with any surgery, laparoscopic liver procedures still come with risk. Ninety-seven percent of Geller’s surgeries are bloodless, but for the other 3 percent, there are tense moments.

In fact, in another patient’s surgery just hours after Geller quelled the 3.8-liter monster in Ricci’s abdomen, a small, benign liver cyst proved potentially dangerous. It had wrapped around the patient’s adrenal gland, and Geller’s effort to cut it loose inadvertently went a hair too far. A line of blood trickled out and pooled inside the patient, darkening

the monitor overhead.

Geller quickly located and stopped the bleeding, a relief to more than one adrenal gland in the room.

“You learn how to get out of trouble from having been there hundreds of times with open surgery,” he says. “You need those kinds of high-blood-loss cases to understand the anatomy.”

Geller says it was his background in both liver surgery and minimally invasive surgery that enabled him to take the step toward laparoscopic liver work. For others with similar qualifications, Geller is sharing his rare, hard-won expertise. In September 2003, he taught the first workshop on laparoscopic liver surgery in the United States. Since then, he has taught five more here in Pittsburgh and elsewhere. Every one has been booked solid.

José Cunha-Melo, a senior surgeon specializing in liver and pancreatic cancer surgery and a professor of surgery at Federal University of Minas Gerais in Belo Horizonte, Brazil, has attended two of Geller’s workshops—one in 2004 focusing on the liver and another on both the liver and pancreas in 2006.

“Laparoscopic liver surgery is quite revolutionary,” Cunha-Melo says. “There were doctors at the workshops from all over.”

During a workshop Geller held three years ago, patient Louise Hawk agreed to have her surgery—a laparoscopic left lobectomy for a

golf-ball-size HCC tumor—filmed live and shared with a group of attendees in the adjacent building. She remains cancer-free today, has never needed chemo or radiation, and is still working full-time at age 76.

“I haven’t had any trouble since the operation. And it’s a beautiful, smooth scar—as beautiful as a scar can be,” she says. “I feel great, but I’m ready to retire again. Who knows if [retirement] will stick.”

Marshall Webster (Res ’70), president and chief executive officer of the University of Pittsburgh Physicians and a professor of surgery, is a mentor of Geller’s and has known him since he was an intern. He calls Geller “an excellent clinician, teacher, and researcher—a true triple threat.”

“And not only is he doing minimally invasive liver resections—an incredible advance over even five years ago—but in addition to Presby, he’s also doing this at a community hospital, which is not the norm,” says Webster, referring to UPMC Passavant in the North Hills of Pittsburgh. Geller began doing surgeries there in 2005 to help patients whose insurance wouldn’t cover them on the Oakland campus.

“Most people would’ve thought laparoscopic liver surgery is kind of crazy,” Webster adds with a laugh, “but it’s the young people that reinvent the world.”

Two weeks after the surgery that freed her from her basketball-size cyst, Agnes Ricci is recovering well. No more pains that sharpen when she stands or sits upright. No more hiding in zipped-up slack suits and snipped waistbands. No more leaning off-kilter and struggling with her balance. No more walker.

“For years I just lived with the notion that this was the way it was going to be,” she says. “I consider myself very fortunate.”

Soon, her Band-Aid-size cuts will heal completely, and she’ll go out shopping for new clothes. This will be the first time in months that she’ll leave the house for something other than a doctor’s appointment. Just the thought of exercise and fresh air has a healing power all its own.

Here comes the sun. ■

David Geller also directs Pitt’s Liver and Pancreas Institute. In our next issue, we’ll see how his colleagues are changing the understanding and treatment of pancreatic disease, including cancer of the pancreas.

HALO EFFECT?

In this age of minimally invasive surgery, when even liver lobectomies are going the way of tiny instruments and big plasma screens, we can’t help but wonder: Is mastering video games the first step toward a surgical career?

The University of Pittsburgh’s David Geller, codirector of the Liver Cancer Center and head of the center’s minimally invasive hepato-pancreato-biliary surgery fellowship, says that was definitely the assumption when he was a Pitt resident back in the early days of laparoscopic surgery. He recalls that in 1991, senior surgeons said they would stick to traditional techniques and leave the minimally invasive controls to the Nintendo-playing, ambidextrous young bucks.

“But a year later everyone was doing laparoscopic gallbladder surgery, or they were giving up those patients,” he says.

The Xboxing-surgeon stereotype may have some truth to it. Recent studies in the *Archives of Surgery* and elsewhere suggest a possible link between gaming ability and minimally invasive surgery performance. But for Geller, it only went as far as a bit of Atari and Pac-Man “a million years ago.”

In evaluating fellowship candidates, Geller looks for strong backgrounds in either liver surgery, minimally invasive techniques, or both. “Surgery is so specialized now that it’s not uncommon for a fellow to consider doing two fellowships in a row,” he says.

And a young laparoscopic-liver surgeon’s most important trait?

“Enthusiasm for learning,” Geller says, adding that the tools of the trade are constantly evolving. Without a willingness to continue evaluating new technologies, it’s Game Over. —EV