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Spotlight: Psychiatry

Special Feature: Sarcoma

MINIMALLY INVASIVE SURGERY

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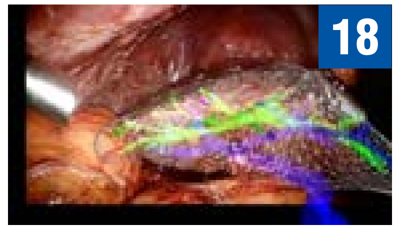
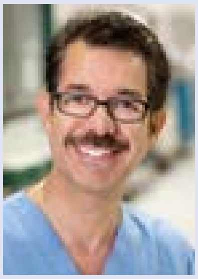


GUEST EDITOR



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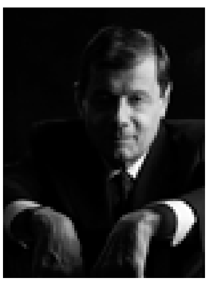

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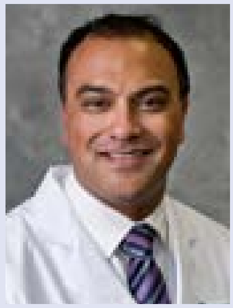

Nikhil L. Shah D.O., MPH serves as the Chief of the Minimal Access and Robotic Surgery at Piedmont Health Care. He has performed thousands of robotic procedures with specific expertise in prostatectomy, nephrectomy and upper tract reconstruction. Dr. Shah completed his Urology and General Surgery training at Henry Ford Hospital in Detroit and followed with subspecialty training in Robotics, Laparoscopy and Urological Oncology. Dr. Shah serves as the President and Founder of the Men's Health and Wellness Center of Atlanta, a not-for-profit organization that works towards educating and informing men in disease prevention.

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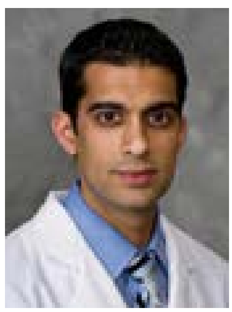

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THE WIDE-RANGING INFLUENCE OF ENDOSCOPY

By Ceana Nezhat, M.D.

Today, endoscopic surgery with and without assistance of the computer-enhanced technology referred to as "robotics" has reached an inflection point.

Many have come to understand the meaning of endoscopic surgery as a form of technology. In spite of some of the most complex procedures performed through small incisions, it is referred to as minimally invasive surgery. A more accurate definition, however, is "small incision maximum access surgery."

Endoscopy views of body cavities enhanced by video magnification of digital cameras and powerful illumination of fiber optics offers a new platform in almost all surgical specialties. When it comes to surgical incisions, size does matter. The caveat is it has to be done properly by adhering to surgical principals as well as the art and science of medicine, not commercial influence as eloquently defined by Lord Moynihan decades ago.

Photo by Patricia O'Driscolls

The great danger surgery is confronted with today is that technical procedures are so easily learned, so frequently practiced and so amply rewarded that men who regard medicine as a commercial career can live prosperous lives without contributing a single fresh thought, the slightest modification of any known procedure or the establishment of any new method to science or art.

The ideal surgeon is not merely one who operates (perhaps with brilliant skill), the necessity for or scope of which is determined by another. He possesses a mind to discover and examine all the clinical features of a case with competence not less than that of a physician and with responsibility far greater, and then acts, when so required, not only as a therapeutic agent, but as one engaged in hominal research. As Lord Moynihan once said, the safe judicious surgeon who applies technical skill, prudence and fine judgment to the relief of human suffering adds greatly to the repute of the profession and to the happiness of the world. (The Lancet, Oct. 11, 1930.)

In this issue, the state of endoscopy surgery, now referred to as minimally invasive surgery, is addressed by some of our community surgeons. A glimpse into the past, the evolution of videolaparoscopy and some of the applications of the current technology is covered.

The story of endoscopy serves as a source of continued inspiration for all of us in our medical community to acquire knowledge and embrace technology for a better way to provide the best care to our patients. ■

IDEAL

Minimally Invasive Surgery

By: Nisha Lakhi, MD and Ceana Nezhat, MD

The history of endoscopy is a story inextricably bound by the human energies of character and charisma, persistence and insistence. Over the course of several centuries, many great thinkers and visionaries have established the rudimentary foundation that minimally invasive surgery stands upon today.

However it was the Persian physician-philosopher Ibn Sina (980-1037 C.E.), commonly known to westerners as Avicenna, who has been credited for one of the most crucial turning points in the history of endoscopy – the use of reflected light.[1] Ibn Sina's endoscopic techniques are generally considered to be the first documented instances of using reflected sunlight and polished glass mirrors to examine internal cavities of the human body.

Several obstacles had to be overcome before endoscopy could be accepted as a legitimate form of surgery. The technical challenges included 1) creating or expanding entrances to the interior of the human body, 2) safely delivering enough light into the interior body cavity, 3) transmitting a clear magnified image back to the eye, and finally 4) expanding the field of vision. Although Ibn Sina was able to overcome the first two of these challenges with his use of reflected sunlight, the world waited several centuries before further technical innovation would shape modern endoscopy.

Endoscopy as a Philosophy

Perhaps the most unique aspect of the history of the endoscope lies in the issue of categorization. Just what is endoscopy anyway? Is it an instrument or technique? Revolution or evolution? Many have come to understand the meaning of endoscopy as merely that of a technology or instrumentation. Because its roots as an almost exclusively diagnostic tool are so recent, this limited conceptualization has been somewhat difficult to escape. A more accurate definition, however, places endoscopy firmly in the realm of a new philosophy, one rooted in what is now referred to as minimally invasive surgery.

One may also interpret much of the Hippocratic Corpus as predominantly advocating this minimalist approach, as can be inferred by the modern version of the Hippocratic ancient edict "First, do no harm." Hippocrates specifically instructed physicians to avoid invasive methods as much as possible.

Sometime between antiquity and the late 19th to early 20th century, however, the favored form of surgical intervention transformed into one dominated by big incisions.

Yet, just like Newtonian physics, these classical theories of surgery would ultimately be challenged by the conceptual breakthroughs driven in part by the burgeoning field of modern operative endoscopy.

Great Leaps Forward

The next great leap forward took place in 1806, when Philipp Bozzini first looked into a human bladder with an apparatus called the Lichtleiter. This first known endoscope utilized a candle as the sole light source.[1]

The scope consisted of a system of strategically angled mirrors that were positioned in such a way as to bring the image back to his eye while simultaneously conveying the distally placed candlelight into the interior body cavity. Thus the third challenge of reflecting images back to the eye was overcome.

With the advent of electricity, exponential growth in the development of endoscopic technology was seen through the 18th and early 19th century. Most notability in 1879, Maximilian Carl-Friedrich Nitze developed the first rigid endoscopic instrument with a built-in light source.

In 1902, the first laparoscopy was performed by the German surgeon Georg Kelling. He inserted a Nitze cystoscope into the peritoneal cavity of a live anesthetized dog and examined its viscera (1). Eight years later, Hans Christian Jacobaeus of Sweden performed the first laparoscopic operation on a human.[1]

A Wave of Opposition

Other surgical specialties were resistant to using this new technology. Surgeons of this era equated "surgical might" with larger incisions (Big Surgeon=Big Incision). By the 1970s, laparoscopic techniques were almost exclusively in the repertoire of gynecologists. In addition, there were reports of deaths caused by insulation complications, electrocautery accidents and intraoperative hemorrhage.

Soon thereafter, urgent congressional hearings and governmental advisory panels were called into session to address these concerns. Symbolic actions were taken against laparoscopy. Most notability the Centers for Disease Control and Prevention (CDC) issued a very strong public rebuke over patient deaths that were apparently linked to monopolar laparoscopic sterilization procedures.

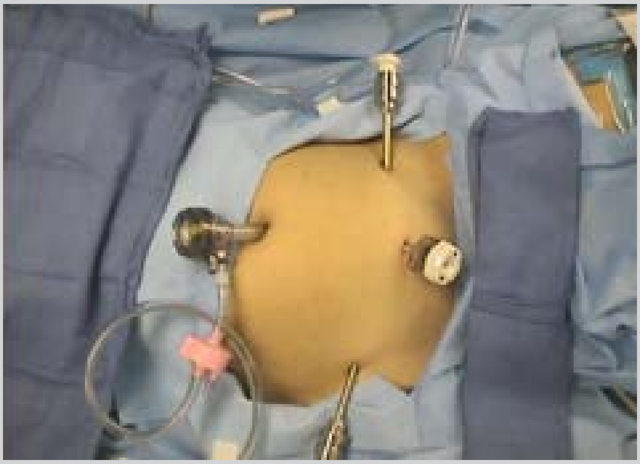
However, one of the most pressing challenges was the ergonomic difficulty inherent to the use of laparoscopic equipment. Until the 1980s, laparoscopy was a one-man, one-eyed, one-handed procedure. The operating surgeon would have to hold the scope with one hand and peer through it as he operated. Thus visualization was limited, and complex operative procedures were not possible.

The Birth of a New Era: Videolaparoscopy

Dr. Camran Nezhat is considered to be the founding father of operative videolaparoscopy.[2]

He used a conventional video camera, and 'rigged' it to an endoscope and a television monitor. This conceptual breakthrough revolutionized modern abdominal and pelvic surgery. Video-laparoscopy refined the endoscopic process by empowering the surgeon with the capacity to operate in a vertical position, to use both hands and both feet simultaneously and to observe an enhanced field of vision on the video monitor while operating directly through the laparoscope.

The foundation of a multi-disciplinary endoscopic approach to complex pathologies was established in Atlanta, at Northside



The history of endoscopy is a story inextricably bound by the human energies of character and charisma, persistence and insistence.

Hospital. The Nezhat brothers, in collaboration with other surgical specialties, performed many complex procedures for the first time by a minimally invasive approach. In the field of urology, along with Drs. Howard Rottenberg, Fred Shessel Bruce Green and Scott Miller, laparoscopic techniques for bladder and ureter resection were pioneered.

Similarly, in collaboration with colorectal surgeons, Drs. Earl Pennington, Wayne Ambroze, Guy Orangio and later on Mary Ann Schertzer, some of the earliest laparoscopic bowel resections were performed.

The general surgeons also began to adopt this new technology. Several notable general surgeons in Atlanta, including Drs. John Harvey, David Ruben and Patrick Luke later joined by Dr. Iqbal Garcha, began applying laparoscopic techniques to various surgical procedures.

Nezhats partnered with renowned gynecologic oncologists in Atlanta, Dr. Benedict Benigno and Dr. Matthew Burrell, and began using laparoscopy for their oncologic procedures. And surgeons of different specialties from around the world have since attended minimally invasive surgery courses conducted since 1984 at Northside Hospital.

During this time, Atlanta became a mecca of laparoscopic innovation. The first laparoscopic cholecystectomy in the United States was performed on June 22, 1988 in Atlanta by Drs. J. Barry McKernan and William B. Saye.[1] At the Second World Congress on Endoscopic Surgery held in March 1990 in Atlanta, general surgeons and gynecologists from all around the world came together. At this meeting, video laparoscopy was validated as a true surgical specialty.[1]

The Age of Robotics

Although videolaparoscopy allowed more complex procedures to be performed laparoscopically, its uptake was limited to select individuals who possessed the necessary skill set and aptitude to carry out these technically challenging procedures working off a two-dimensional video monitor. In 2000, the Da Vinci Surgery System (Sunnyvale, Calif.) was the first robotic-assisted surgery system approved by the FDA for general laparoscopic surgery. The robotic platform offered many advantages, including 3-D vision, enhanced dexterity, tremor filter and articulated instruments. This technology bridged the gap, as it allowed more surgeons to offer a minimally invasive approach to their patients instead of laparotomy.

Thus the enthusiasm and demand for minimally invasive surgery surged. Patients became educated about the advantages of minimally invasive surgery and started requesting robotic and laparoscopic procedures. Due to this increased demand, more providers began to offer a minimally invasive approach to their patients. However, some surgeons were inexperienced and did not understand the principles of laparoscopy, electro-surgery and safe specimen extraction. This resulted in a new surge of fatalities and complications.

From January 2000 to December 2013, 144 deaths and 1,391 patient injuries were attributed to the Da Vinci Surgical System.[3] Several of these complications were due to inadequate surgical expertise. Complications were secondary to unsafe abdominal entry techniques, improper use of electrosurgical instruments, insufficient knowledge of anatomy and lack of adherence to the principles of minimally invasive surgery.[4] Principles of safe specimen extraction were also violated. Collateral injuries and even death were reported secondary to morcellator blades.[3] Additionally, due to unsafe uncontained tissue extraction techniques and poor patient selection for this type of procedure, dissemination of malignant intra-peritoneal pathology also occurred.

In 2014, driven by a broad public campaign, the FDA released a strong warning against the use of power morcellators. This had devastating and far-reaching consequences, as many began to abandon laparoscopy all together.[4, 5] Johnson & Johnson issued a worldwide recall of their morcelator.

Eight months after the FDA warning was issued, one Florida health system observed an 8.7 percent decrease in benign minimally invasive hysterectomies and a 19 percent decrease in minimally invasive myomectomies.[5] It was the first time, despite the decades of innovation and progress that we were reverting back to laparotomy.

Inflection Point Reached

Minimally invasive surgery today has reached an inflection point. We are no longer trying to prove that these procedures can be done. Rather, we must focus on doing these procedures safely and with the proper use of technology. We cannot afford to take steps backward, nor can we revert back to laparotomy or risk abandoning minimally invasive surgery all together. Therefore, we must maintain high standards and keep the art of minimally invasive surgery in the hands of experienced surgeons who can perform these procedures meticulously. An in-depth understanding of surgical anatomy, abdominal entry, port placement, electro-surgical principles, energy devices and tissue extraction techniques is of paramount importance.

The Future

Laparoscopy has revolutionized the practice of modern surgery from simple diagnostic work to advanced operative procedures. In the pursuit of even less invasive means for surgery, mini-laparoscopes and instruments some 3 millimeters or less in diameter have been developed. Mini-laparoscopic technology is a step beyond traditional operative laparoscopy and robotic-assisted surgery in that incisions are even smaller. The benefits are abundant and include reduced incisional pain, less risk of hernia or wound hematoma, no visible scarring, faster recovery and reduced costs.

Northside Hospital is the first hospital in Georgia to offer the new mini-laparoscopy technology. With mini-laparoscopic instruments, we have been able to successfully treat complex diseases including deeply infiltrating endometriosis affecting the bowel, bladder and ureter; removal of mesh embedded in the surrounding organs; or lysis of extensive adhesions.

Offering Patients the Ideal Surgery

We aspire to realize the dreams of the pioneers who spearheaded the revolution in modern-day surgery. To accomplish this goal, we must use our talents and expertise to improve and expand minimally invasive surgery. Our patients desire IDEAL minimally invasive surgery. That is, surgery Individualized, Data-driven, Economical, Advantageous and that offers optimal Long-term results.

Although minimally invasive surgery offers our patients an IDEAL surgical approach, there is a caveat – the surgery must be performed to a high standard of excellence in the hands of a skilled surgeon. Surgical success is dependent upon the knowledge and skill of the surgeon, beginning with an accurate diagnosis and proper selection of patients, determination of surgical access route and, especially, recognition of the surgeon's own limitations.

As technological advances in this field are rapidly increasing, practicing surgeons must become proficient with new instrumentation and new surgical approaches. Therefore, adequate training and continuing education are crucial for success and the prevention of complications. If we truly want to progress and to offer an IDEAL minimally invasive surgical approach to our patients, we must not forget that the safety of our patients is of utmost importance. ■

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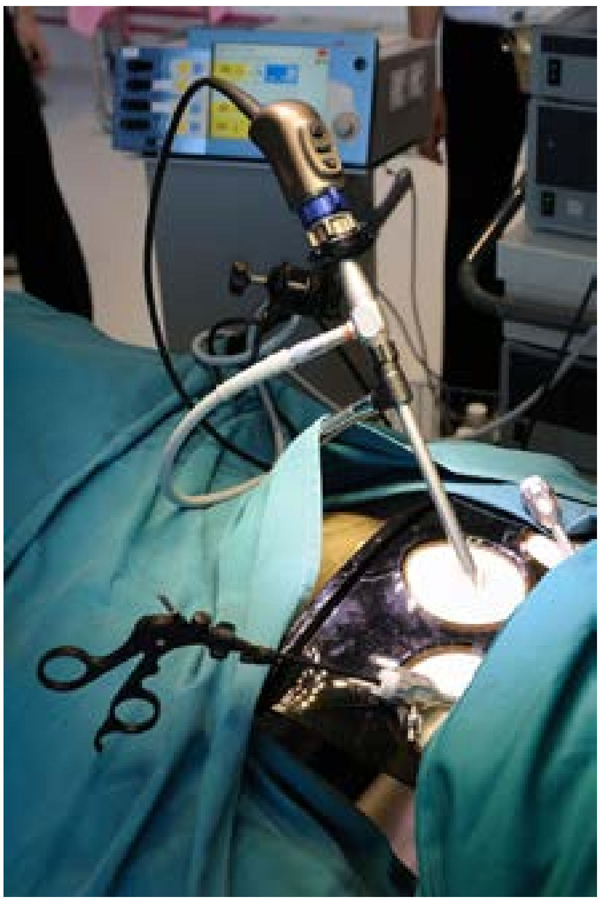
THE ORIGINS OF MINIMALLY INVASIVE SURGERY

The Personal Observations of a Maximalist

By Benedict B. Benigno, M.D.

It all happened so suddenly. As soon as Ephraim McDowell performed his historic operation on Jane Todd Crawford in 1809, gynecologists began using a sharp knife to open the abdomen for all sorts of reasons.

In the 1980s, the Nezhat brothers got together at Northside Hospital and changed all that. Their work would make them icons of late 20th century surgery and propel our hospital into the international arena. I was there when the monumental shift to laparoscopic surgery was first proposed, and it gives me great pleasure to share my memories with you.



Camran and Farr Nezhat came into my operating room one day and invited me to dinner. They were very serious, so I became suspicious. They asked me to choose the restaurant, which was a minor mistake, because I picked Hedgerose Heights Inn, known for both good food and high prices. Then they asked me to choose the wine, which was a major mistake.

I had to wait for the dessert to be served to learn the reason for this sudden burst of generosity. "Ben, we want to change the way you operate." My response was immediate and to the point. "What is wrong with the way I operate?" "Not you personally, the word you is plural and refers to everyone, including us." I couldn't believe this; they were trying to teach me English!

After the coffee was served and the conversation became more relaxed, I began to understand what they were proposing, and I found it fascinating. At that time, minimally invasive surgery involved, for the most part, tubal ligations. The Nezhats wanted to start doing virtually everything laparoscopically and, in so doing, to sound the death knell for the time-honored laparotomy.

Their vision extended to oncologic surgery as well, and I listened intently as they told me that a radical hysterectomy could be done safely and, eventually, more rapidly with this technique. They explained that with the image magnifier, obesity would no longer be a problem, and that the smallest blood vessels could be easily seen and ligated. They told me that they wanted me to stand by in case something hit the fan. This was a Tammy Wynette moment – stand by your minimally invasive surgeon!

"Let me see if I understand you properly," I said. "You are the opera stars and I am the understudy, waiting in the wings in case one of you gets a cold during the performance."

"Absolutely not, professore [their nickname for me]," they said in unison. "Just be available in case we need you. You do this all the time for emergencies in labor and delivery."

I told them that I applauded their new adventure and that I would be most pleased to help. We were the last people in the restaurant, and I exited with a queasy feeling of the unknown enveloping me, and not even a hint that I was witnessing the onset of a sea change that was soon to transform abdomino pelvic surgery.

Most people in such circumstances would test the waters, first with a toe and then, perhaps a month or two later, with the whole foot. Not these two dudes. The first week was the surgical equivalent of the charge of the Light Brigade!

My observation of their activities was easy because our operating rooms were adjacent to one another. The initial patients were carefully chosen and the surgical procedures meticulously performed over many hours.

It was very important that complications were kept to an absolute minimum. Operating rooms are large fish tanks, and we exist in a state of constant observation.

I popped in several times a day to see how things were going. At first they were going very slowly, as technology was not very advanced. Smoke evacuators did not function well, and the instruments were crude and unwieldy. But the Nezhats were patient, and there was no blood loss. the Nezhats took a conventional video camera, rigged it to an endoscope and attached it to a television monitor. Video-laparoscopy soon passed into modern medical terminology and allowed the surgeon to operate in the vertical position using both hands and feet simultaneously.

I must confess, the first time I saw Camran operating in the standing position, feverishly using all four extremities, a fleeting image of the one-man-band briefly traversed my countenance. However, there was nothing comical about this scenario as pure magic evolved, and surgery's Rubicon had been crossed.

Camran and Farr, soon joined by their younger brother, Ceana, performed surgery on patients with stage IV endometriosis on a daily basis at Northside Hospital. Radical hysterectomies for cancer of the cervix as well as surgery for cancer of the endometrium were being performed with full pelvic and para-aortic node dissections.

Even with cancer of the ovary, the tumor would have to be very large to justify an open procedure. Ureters were resected and re-implanted into the bladder. Bowel resections became routine, and vesico-vaginal and recto-vaginal fistulas were repaired, saving patients from many hours of painful and debilitating open surgery.

Sacrocolpopexy and many other complex laparoscopic procedures were performed for the first time by the Nezhats at Northside Hospital. The death knell was transposed into a dirge as the exploratory laparotomy in pelvic surgery was all but buried.

It all happened so suddenly. As soon as Ephraim McDowell performed his historic operation on Jane Todd Crawford in 1809, gynecologists began using a sharp knife to open the abdomen for all sorts of reasons.

I saw the carbon dioxide laser used to blast away nodules of endometriosis, first from the utero-sacral ligaments and the bladder, and soon after that, from the cul-de-sac and rectum. Ureters were dissected away from dense adhesions and tumor nodularity with a level of safety and elegance not seen before.

Then came the bowel resections and the repair of enterotomies, all performed without the need to open the abdomen. The operative time soon eclipsed that of the open procedure, and the patients were going home the next day without significant pain. Soon, everyone realized that patients were going back to work in a week or two, an unheard of scenario after traditional surgery.

It is hard to determine exactly when these new techniques passed into the surgical canon. In the late '70s,

Gynecologic oncologists get so much credit for doing radical hysterectomies, and yet surgery for endometriosis is frequently taken for granted. It has been my experience that endometriosis provides the pelvic surgeon with one of surgery's greatest challenges. Adhesion city confounds the melding of rectum, bladder and ureters within rock hard masses. And, as if these anatomic distortions were not enough, many of these women have never had a child, so preservation of fertility is added to the list of difficulties. Laser video-laparoscopy, a technique invented by the Nezhats, has revolutionized the treatment of this painful and debilitating disease.

Just for the record, I was summoned to their operating room only once, and I entered very quietly and was unobserved when I witnessed a truly unbelievable and most memorable conversation. To this day, I cannot remember which brother started the conversation, but I recall every word of it.

Brother No. 1: "My esteemed brother, I forbid you to cut that structure!"
Brother No. 2: "My esteemed brother, may I respectfully suggest that you go take a hike." (Vocabulary rearrangement courtesy of poetic license.)

I interrupted this tender exchange with a very understandable question, "Why have I been summoned?" All the excitement revolved around a little bit of bleeding that was easily stopped. That was my debut as a stand-by surgeon, and there were no encores – not a bad record for 35 years of minimally invasive surgery!

Fame came later; at first, it was notoriety. I noticed that everyone had stopped saying they could do in 45 minutes through a low transverse incision what was taking three hours to do with the laparoscope. But that was when the jokes started. The most famous one involved the high price that a mechanic charged for repairing a transmission through the tail pipe.

All criticism was ignored, and the Nezhats began to host post-graduate courses so that gynecologists, as well as other surgical specialists, could be trained in this type of surgery. The courses were first held at Northside Hospital, but as their reputations grew, so did the number of attendees. They are now held in large hotels all over the world and, needless to say, minimally invasive surgery is now the very standard of our specialty. Today, it is unheard of for a radical hysterectomy to be performed in any other way, thus validating a prediction made many years ago in an Atlanta restaurant by two daring brothers.

Truth, I am told, is anything that continues, and I have a feeling that these surgical techniques will prevail for quite a while. I find it interesting to examine the reaction to the arrival of minimally invasive surgery within the context of Schopenhauer's famous statement:

All truth passes through three stages.
First, it is ridiculed.
Second, it is violently opposed.
Third, it is accepted as being self-evident.

Colorectal Surgery:
FROM BAMBOO TO ROBOTS

By Aamna Ali, M.D.; Maryam Saidy, M.D.; and Wayne L. Ambroze Jr. M.D.

Progress is impossible without change, and those that cannot change their minds cannot change anything – *George Bernard Shaw*

It has taken centuries of conflict between medically innovative thought and vehement opposition to change to enable progress from bamboo instruments to operative robots.

The earliest published history of colorectal surgery dates from the time of the Pharaoh's Egypt, when Imhotep, an architect and advisor to the Pharaoh, operated on perianal pathology. The earliest major abdominal surgeries on the large bowel were as successful as a flip of the coin. Mortality rates upward of 45 percent were largely due to infectious complications.

The unique challenge surgery on the colon and rectum has always posed is that of operating on the most contaminated organ in the human body. Although the concept of fecal diversion to prevent septic mortality from colorectal surgery was first proposed by the French surgeon Alexis Littre in 1710, the first ostomy was not created for another 60 years thereafter, due to widespread ridicule and criticism of this unfamiliar idea at that time.

The discovery of the medicinal properties of chloroform, inhaled ethers and penicillin in the 19th and 20th centuries broadened the horizons of operative possibilities. Sir William Miles, a pupil of the fathers of colorectal surgery at St Mark's Hospital in London took full advantage of the surgical revolution that ensued. He has, arguably, left the most significant impact on the history of oncologic surgery of the colon and rectum.

Although he was not the first to describe the abdominoperineal resection for rectal cancer, this surgery will always be known as the "Miles' operation" due to his discovery and emphasis of the oncologically critical principle of total mesolectal excision (TME). Though much has changed on management of rectal cancer over the last century, the integrity of TME with negative margins has remained the single most important prognostic factor impacting local recurrence.

There is nothing more difficult to take in hand, more perilous to conduct … than to take the lead in the introduction of a new order of things – *Niccolo Machiavelli*

The revolution of minimally invasive colorectal surgery began with the advent of laparoscopy. Laparoscopic surgery was resisted for almost a century by general and colorectal surgeons, as the concept of laparoscopy challenges the two most important human senses surgeons use to operate: direct vision and tactile sensation.

Although the first diagnostic laparoscopy of the abdomen was performed in 1901, the first laparoscopic bowel surgery (the appendectomy) wasn't performed until 1981 by gynecologist Kurt Semm. The first completely laparoscopic colon resection wasn't performed until 1991.

Although laparoscopy takes a 3-D world and shrinks it to two planes, it excels in visualizing and dissecting the deep recesses of the pelvis, mobilizing high hepatic and splenic flexures with relatively more ease than open laparotomy. Traditionally, two or three keyhole incisions for instrument access to the abdominal cavity are made, along with a slightly larger hand-port or specimen extraction site (Fig. 1).


Fig 1

Initial concerns of whether laparoscopic resection allowed for proper oncologic resection and adequate staging of colorectal malignancy were addressed in the years that followed. The COST study group published the most convincing paper to date in The New England Journal of Medicine in 2004: a prospective randomized trial comparing laparoscopic to open resection of colon cancer. This study provides the best evidence to date that laparoscopic resection of colon cancer is equivalent in oncologic outcome, morbidity and mortality to open surgery. Its data reconfirmed the advantages of laparoscopy: smaller incisions translating to less narcotic use and shorter lengths of postoperative hospital stay.

Interestingly, similar studies performed to assess adequacy of laparoscopic oncologic resection for rectal cancer have shown conflicting data. Historically, a landmark study performed by the MRC CLASICC Trial Group and published in journal The Lancet in 2005 showed equal oncologic outcomes for both laparoscopic and open surgery for colorectal cancer.

The critique of this study has always been that it did not distinguish between cancers of the colon vs. the rectum. Most recently, Fleshman et al. published the initial results of their prospective study (the ACOSOG Z6051 Randomized Clinical Trial) addressing this question in the October 2015 issue of JAMA.

Their patient selection for rectal cancer was uniformly standard (all receiving neoadjuvant therapy, being locally advanced and without distant disease). They failed to show any oncologic advantage of laparoscopic resection of the rectum over open surgery. (More patients in the laparoscopic group had insufficient negative margins and intact rectal specimens on final pathology.) It will be interesting to see what the mid-term and long-term oncologic outcomes of recurrence and survival will be in the follow-up publications of this study in the future.

Americans can always be counted on to do the best thing. … After they have exhausted all the other possibilities – *Winston Churchill.*

Surprisingly, robotic surgery dates back to 1985, when the U.S. military was investigating robotic surgery as a means for physicians to remotely operate on wounded soldiers abroad via wireless technology. Computer Motion (Santa Barbara, CA) created the first commercial robot system used in general surgery, as a camera holder. Shortly thereafter, Integrated Surgical Supply, now Intuitive Surgical (Mountain View, CA), developed the da Vinci® Robot. The da Vinci® consists of three components: the console where the operating surgeon sits, the four robotic limbs docked to the patient and the video screens demonstrating the surgical field (Fig. 2). The da Vinci® system is designed to excel in surgically challenging landscapes, particularly the confines of the difficult, narrow and deep pelvis. The 'endowrist' of the robotic limb acts as an extension of the surgeon's arm, with several joints, allowing 180 degrees of articulation and 540 degrees of rotation.

Initially, the da Vinci® robot was primarily used for benign disease. Once initial studies demonstrated safe outcomes, the indications for robotic surgery today routinely include resections for both malignant and benign disease of the colon and rectum. The most recent large systematic review by Trinh et al. examined 17 articles encompassing 4,000 patients. The results demonstrate robotic surgery is equivalent to laparoscopic colon and rectal resection with respect to lymph node harvest, length of stay, readmission and peri-operative morbidity; however, the robotics cohorts had slightly longer operative time and were more likely to be converted to an open procedure (Table 1).

Fig 2

Ability will never be able to catch up with the demand for it – *Confucius.*

An Italian lab (Scuola Superiore Sant' Anna's CRIM) has developed a Robotic Assembling Reconfigurable Endoluminal Surgical System (ARES), which they postulate will be introduced into the body where it will assemble itself and perform the operation from inside a hollow lumen.

Natural orifice translumenal endoscopic surgery is becoming increasingly popular. Colonoscopic submucosal dissections of villous tumors in the most proximal portions of the colon are stretching the boundaries of minimally invasive procedures performed by colorectal surgeons today. The future of colorectal surgery promises to be as fascinating as its past has been. ■

Table 1. Summary of literature: robotic versus laparoscopic colorectal surgical outcomes

Author (year)	Design	ROB n	LAP n	ROB	LAP n (CA)	ROB n (CA)	LAP n (etc.)	Findings n (etc.)
Weber (2002)	Case series	2	2	0	0	2	2	Longer OR time, Equally safe
Delaney (2003)	Cohort Retrospective	6	0	0	0	6	0	Longer OR time, Equally effective
D'Annibale (2004)	Retrospective Review	53	53	22	42	31	9	Simular times Simular efficacy
Pigazzi (2006)	Retrospective Reviews	6	6	6	6	0	0	Simular times, Simualr efficacy
Park (2012)	Randomized Control Trial	40	40	40	40	0	0	Longer OR time. Equally effective
Tyler (2013)	Retrospective Review	160	2423	58	1032	102	1391	LongerOR time, Equivalent outcomes, Uneequal patient groups
Helvind (2012)	Retrospective case control	010	162	101	162	0	0	Equivalent OR times Equivalent outcomes
Baik (2009)	Prospective Case control	56	57	56	57	0	0	Equivalent or better outcomes Equivalent OR times

ROB=robotic, n= sample size, LAP=laparoscopic, CA=cancer, OR=operating room

Robotic Colon and Rectal Surgery

The Next Frontier in Minimally Invasive Surgery

By Jeffrey S. Cohen, MD FACS FASCRS

Over the last 20 years, minimally invasive colon and rectal surgery has become widely accepted as the optimal approach for both benign and malignant pathologies. Laparoscopy offers the proven benefit of a minimally invasive approach that results in excellent outcomes, shorter hospital stays, decreased patient discomfort and excellent cosmesis.

Though the benefits to a minimally invasive approach to colon and rectal surgery are well-documented, the majority of colon resections are still not performed in a minimally invasive manner. Laparoscopy is limited by two-dimensional visualization on a flat monitor, difficult ergonomics with rigid instrumentation and an unstable operative platform with both camera and instruments held by the surgical team. The technical and physical limitations of laparoscopy may have contributed to less than unanimous adoption. The innovation of robotic colon and rectal surgery has been developed to address all of the limitations of laparoscopic surgery and has given rise to a rapid increase in minimally invasive colon resections.

Since the first robotic colon resection was performed in 2001, there has been a boom in the number and complexity of robotic colon and rectal resections performed. Advantages of robotic surgery include a perfectly stable robotic camera controlled by the operating surgeon, three-dimensional visualization, magnified visualization, elimination of instrument tremor and positions of the operating surgeon in an ergonomic-preferred seated position to minimize surgeon fatigue. Advanced technologies controlled at the surgeon console allow performance of even the most complex surgical procedures in a minimally invasive manner.

Robotic colon and rectal surgery performed on the Intuitive Surgical DaVinci robotic platform is achieved via 8mm ports placed by the operating surgeon at the bedside. Once the camera is instilled in the abdominal cavity, the optimal position of the four operating robotic arms is determined by the robotic computer based on the planned procedure. It is at this point when the operating surgeon moves to the operating console with an assistant remaining at the patient bedside.

It is from the operating console that the overwhelming benefits of robotic surgery are immediately apparent. First, the operating surgeon can now discern the anatomy in a perfect, high-definition 3-D image, which allows superior visualization compared to laparoscopy, resulting in more precise dissection with resultant improvement in oncologic results and preservation of sexual and urinary function.

Compared to rigid laparoscopic instruments, the robotic instrumentation uses Endowrist technology. This allows the operating surgeon to maneuver the instruments as if his hand and wrists were actually in the abdominal cavity. No longer is the surgeon limited by rigid instruments that force the surgeon to modify operations due to the limitations of the laparoscopic instruments.

Advanced robotic technologies now allow the surgeon to control the entire operation form the operating console. No longer is the surgeon dependent on the bedside assistant to control the camera or even the stapling devices. Advanced technologies include the da Vinci Vessel Sealer, which enables the surgeon to cut and seal even the major colic vessels safely and with precise wristed control.

Though the benefits to a minimally invasive approach to colon and rectal surgery are well-documented, the majority of colon resections are still not performed in a minimally invasive manner.

The robotic stapler is another fully wristed instrument that allows the precise stapling of the bowel with much greater articulation and precision than previously encountered with laparoscopy. The da Vinci robotic stapler also uses SmartClamp technology, which assures the surgeon that there is adequate closure of the stapling device prior to firing the stapler.

The most exciting advance in minimally invasive robotic surgery is the ability to perform intracorporeal anastomosis. In order to minimize the incisions, the surgeon is now able to perform not just the bowel resection within the abdominal cavity, but the anastomosis as well.

Firefly Technology has made intracorporeal anastomosis both safe and simple. It uses intravenous administration of indocyanin green (IcG) to verify adequate blood flow using fluorescence to both ends for the bowel prior to anastomosis. Without the ability to confirm adequate blood flow intracorporeally, it was previously necessary to make a large enough incision to visually inspect the bowel outside the abdominal cavity prior to anastomosis.

The combination of Vessel Sealer, Robotic Stapler with Smartclamp and Firefly allows the entire procedure to be performed within the confines of the abdominal cavity, allowing for significantly less trauma, smaller incisions and faster recovery for the patient.

Robotic colon and rectal surgery has shown documented benefits when compared to laparoscopic surgery on many fronts. Patients with diverticulitis, colon and rectal cancer, Crohn's disease and ulcerative colitis all benefit from a robotic approach to their pathology. More recent prospective studies have demonstrated benefit in return of bowel function, length of hospital stay, blood loss, fewer open conversions, improved oncologic resection, lymph node clearance and urinary function as well as sexual function.

It is important to note that these benefits have been demonstrated when robotic colon and rectal surgery is performed by experienced robotic colon and rectal surgeons that have completed their learning curve and are committed to performing many, if not most, of their colon resections robotically. ■

TARGETING THE FUTURE

Minimal Access and Minimally Invasive Surgery in Urology

By Nikhil L. Shah, Do, MPH, and Rajesh Laungani, M.D., FACS

Significant improvements in the surgical approaches and management of disease have been made since the advent of antiseptic surgical technique and the widespread use of antibiotics. During the last quarter century, especially in the last decade, however, there has been an indisputable paradigm shift toward the use of minimally invasive surgery (MIS) for treatment of a variety of diseases. This has benefited the patient in terms of lower morbidity and mortality through less violation of the body's natural protective boundaries.

The morbidity in terms of pain, discomfort and disability often associated with open surgery is typically not encountered with MIS. Put another way, the move towards minimally invasive approaches for surgical disease has resulted in superior outcomes, fewer complications and an overall improvement in health-related quality of life (HRQOL).

Figure 1: AESOP Surgical System, 1994

Recent advances in digital imaging, computer technology and image guidance are providing urologists with a change and challenge toward more precise, sophisticated and improved surgical outcomes. The next phase of innovations will be semi-autonomous and navigable image-guided systems to treat any variety of ailments in respective organs, glands and tissues. Imaging instruments include optical fiber, auto stereoscopic visualization, flexible or rigid endoscopy, fluoroscopy, ultrasonography, MRI, computed tomography (CT), PET or any other imaging technology. While these are not new technologies, their ability to be used as vectors for targeted therapy has barely scratched the surface.

The Emergence of Robotic Surgery

In traditional open surgical procedures, the surgeon is accustomed to the limits on flexibility with regard to the use of his or her hands. The surgeon's actions are coordinated through a series of complex, highly integrated and controlled interaction of visual and tactile feedback.

However, the introduction of robotic-assistance in surgery changed the horizon of minimally invasive surgery. Now, the robotic interface serves as a natural extension of traditional laparoscopy, offering the inherent advantages of minimally invasive surgery while improving the surgeon's ability to perform technically challenging operations that traditional laparoscopy could not.

The initial concept of robotics in surgery involved operating at a site remote from the surgeon. Advantages of robotic manipulation for surgical procedures were described as: 1) superior depiction of anatomy, 2) consistent movement free of tension

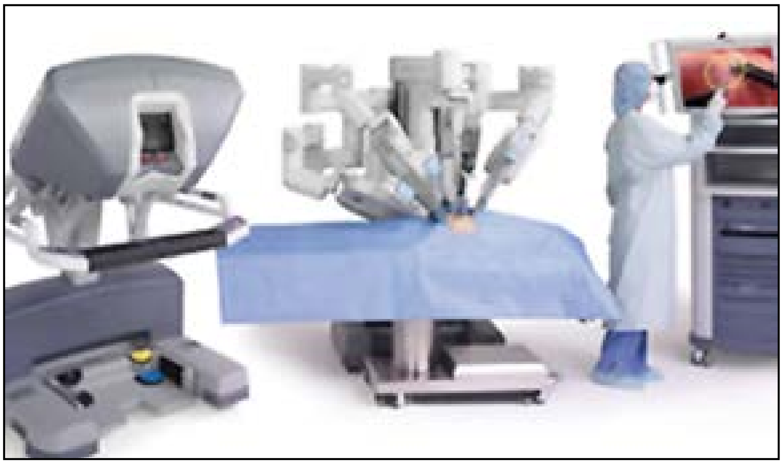


Figure 2. daVinci Surgical System, Sunnyvale, Ca

and tremor, and 3) the ability to work in specific planes and regions not amenable to open surgical techniques. Surgical robots gained success initially in procedures as robotic-assisted radical prostatectomy and robotic-assisted hysterectomy.

To date, many community and academic centers around the world have adopted robotic surgery as part of their "standard of care." Currently, approximately 450,000 procedures are completed across the U.S. annually with robotic assistance, but the use of robotics goes back more than 30 years.

The History of Robotics

Although conceptualized and developed much earlier, the use of robots in the operating theater did not materialize until the 1980s, where their use was pioneered in the fields of orthopedics and neurosurgery.[1] Much of this lag can be attributed to issues surrounding safety, sterility and the ergonomics required to accommodate such bulky devices in the operating room.

The first recorded surgical application of a robot occurred in 1985, where an industrial robot was used as a positioning device to orient a needle for a brain biopsy.[1-3] Robotics in urology was slower to develop and initially focused on image-guided systems. The first, developed in 1989 by the Mechatronics in Medicine Laboratory at the Imperial College in London, was the PROBOT. This was used to aid in Transurethral Resection of the Prostate (TURP) and percutaneous renal access.[3]

In 1994, Potamianos et al. from the Imperial College in London also investigated whether their robotic system could assist with percutaneous access to the kidney, which consisted of a passive, encoded-arm and a 5-dof manipulator equipped with electromagnetic brakes placed directly on the operating table.[2,3] Similarly, in the mid-1990s, the medical robotic research group at Johns Hopkins University (URobotics Laboratory), in conjunction with researchers at IBM, developed the concept of the Remote Center of Motion (RCM) and implemented this onto a robot named LARS.[3,4]

Emergence of Today's Soft-tissue Robotic System

In 1994, an American company called Computer Motion was the first to obtain FDA approval for the use of the AESOP™ (Automated Endoscopic System for Optimal Positioning, Computer Motion, Inc., Goleta, CA) robot arm in the operating room and was perhaps the most successful commercial surgeon-driven robotic system in the late 1990s (Figure 1).[5] The main function of the AESOP™ was to hold and orient the laparoscopic camera under voice-, hand- or foot-command guidance. Using 6-dof for its surgical manipulators, the robot was more compact than its predecessors and was easily mountable on the OR table.[5] During its tenure, the AESOP™ was successful in a variety urologic laparoscopic procedures such as pyeloplasty, prostatectomy, nephrectomy, lymph node dissections and bladder neck suspensions.

In the same genre, researchers at the Stanford Research Institute (SRI, Menlo Park, CA) created a company called Intuitive Surgical Systems (Sunnyvale, CA).[5] They developed the da Vinci™ surgeon-driven robot for laparoscopic surgery and received FDA approval in 2001 (Figure 2).[5] To date, many academic and private centers in the United States and abroad have used the da Vinci™

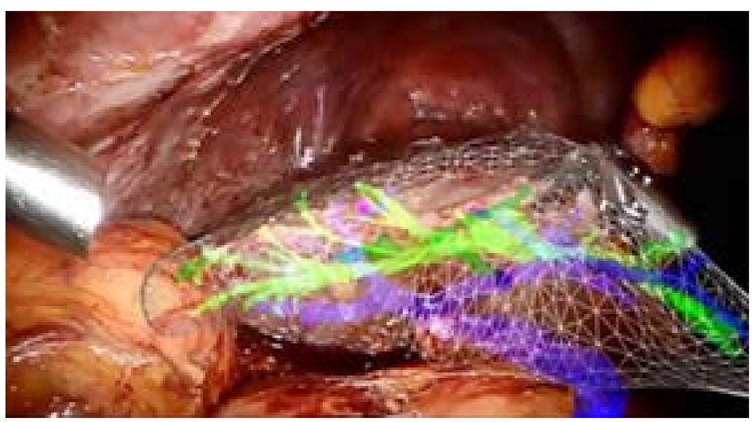


Figure 3. AR image overlay onto live surgical image

The move from open to laparoscopic and then robotic surgery served as disruptive changes to not only urology but to surgery overall.

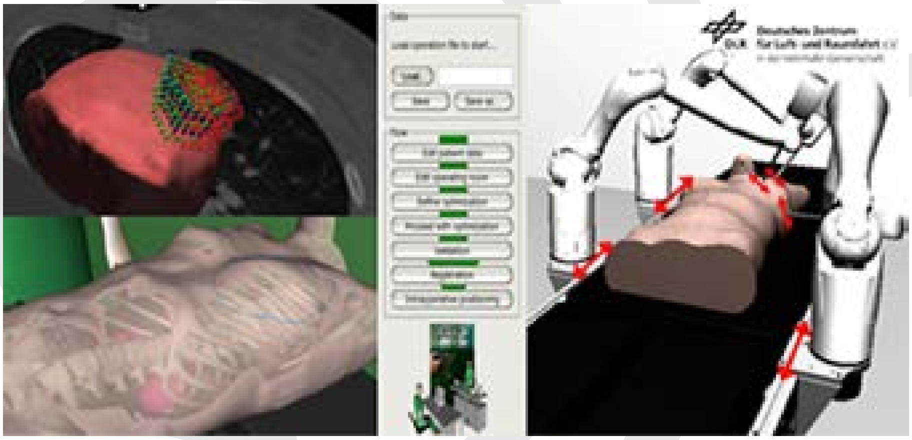


Figure 4. Surgical Pre-Planning for Port Placement

to perform a variety of urologic procedures such as radical prostatectomy, nephrectomy, lymphadenectomy, cystectomy and pyeloplasty.

Emerging Technology – Augmented Reality

For several decades, the most popular modality for image guidance has been ultrasonography, because it was modular, portable, provided real-time results, was a relatively lower cost and was easy to handle. It was also already familiar to the urologist. The role of MRI is now increasing in the era of minimally invasive urology, because of its capability of precision in planning and with both diagnostic and therapeutic implications.

Further technological advances of digital imaging technology with computer technology are now providing a new opportunity to hybridize stereoscopic 3-D vision of the endoscope by overlaying tailor-made 3-D surgical models, composed of multi-sliced CT, MRI, PET, Doppler/contrast enhanced ultrasonography or 3-D ultrasonography.[6,7] Researchers have recently proposed new image-guided surgical systems, with a computer-aided imaging-overlay between the live endoscopic view and a reconstructed 3-D surgical model of the targeted anatomy (Figure 3).[7-9] This is termed Augmented Reality (AR).

AR employs intra-operative surgical navigation to provide a 3-D image superimposed onto the live surgical view, to display 3-D anatomy beyond the surgical view, and thus, to reveal the anatomical orientation of the targeted pathology and surrounding tissues before surgical exposure. In AR, all the surgical team and supportive system are able to share the 3-D spatial information of the surgical target even beyond the real vision. Such computer-aided image guidance, being integrated with robotic controlled systems, is likely to herald higher precision surgery in the near future (Figure 4).

Simulation can additionally be used to train urological surgeons in laparoscopic and robotic skills that traditionally involve box-trainers. However, this lacks an objective assessment of performance with real surgical materials. Although the potential role of augmented reality would guide the real surgical procedure in the operation room, augmented reality can be digitally recorded. It can therefore be used for training purposes, as well, to be overlaid onto a recorded real endoscopic video with greater reality than that obtained by virtual reality simulators.[9,10]

AR is commercially available technology, first pioneered clinically in neurosurgery.[1,12] In 2004, Marescaux and coworkers reported using AR during laparoscopic adrenal surgery.(10) Two years later, Ukimura and Gill demonstrated its use during a live laparoscopic partial nephrectomy at the World Congress of Endourology Annual Meeting in 2006.[8,9]

Many issues remain to be resolved before its clinical widespread use in dealing with soft tissue surgery. Surgical targets and surrounding structures are not static, and their movement intraoperatively by respirations or surgical manipulations must be accounted for. Over the last 5 years, a renowned interest in image-guided systems has emerged. Computer-aided targeted therapy involves image acquisition, segmentation, registration, visualization and navigation.[12] This could be coupled with energy-based ablative machines as well as robotics.

Computer-aided tissue targeting is one of the most significant advances in endourology. This technology enables the surgeon to follow the 3-D anatomical dissection with computer-aided visualization of overlaid or fused images.[12] Difficult-to-understand targeted anatomy with assurance of the critical landmarks could more easily be recognized than using the endoscope alone, and more precise surgical dissection or ablation would be achieved.

The move from open to laparoscopic and then robotic surgery served as disruptive changes to not only urology but to surgery overall. Robotic-assisted urologic surgery offers a wide-range of possibilities toward improving current surgical technique as well as allowing for the possibility of creating newer and improved approaches to improve quality and patient outcomes. The advent of emerging technology with computer-assisted targeted therapy could serve to augment the attributes of minimal access and minimal invasion in laparoscopic and robotic urological surgery. Furthermore, the advent of navigation would allow integration of preoperative planning with adjustments, as needed, in real-time during the actual procedure.

Development of a computer-assisted, image-guided, tissue-targeting navigation system might be considered true “automonous" - aka robotic surgery. This is vastly different than the current robotic system(s) of today, which are surgeon-controlled and not autonomous but rather tele-remote systems with computer assistance. ■

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MINIMALLY INVASIVE ROBOTIC HEPATO-PANCREATO-BILIARY (HPB) SURGERY

Kevin Tri Nguyen, MD PhD FACS

The evolution of minimally invasive Hepato-Pancreato-Biliary (HPB) surgery started with the first laparoscopic cholecystectomy by Mühe in 1985.[1] Laparoscopy has since seen exponential expansion in the field of general surgery, but much slower adoption in HPB surgery (Hepatectomy and Pancreatectomy) mainly due to the complexity of the operations.

For major hepatectomies and pancreatectomies, the gold standard surgical approach is to perform an open abdominal incision; however, the minor peripheral hepatectomies (segments 2 – 6) and distal pancreatectomies are increasingly approached minimally invasively. Major hepatectomies (right and left hepatectomies) and pancreaticoduodenectomies (Whipple procedures) have been performed minimally invasively, but by more experienced HPB surgeons with minimally invasive surgical skills and mainly in selected cases.

The robotic platform has allowed HPB surgeons to approach the more difficult HPB surgical cases with increasing frequency, allowing for increased dexterity with suturing and tying, 3-D visualization, surgeon control of the camera and three working arms, and less tremors.

Fig. 1

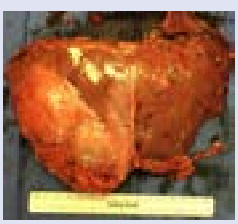

Fig. 2

Case 1

Mrs. IN is a morbidly obese 57-year-old female with metastatic ovarian cancer. She had a large left liver lobe cystic mass on CT scan consistent with the metastatic ovarian cancer to the liver (Fig. 1).

She was morbidly obese with a BMI of 52 and desperately wanted a minimally invasive approach to minimize her incisional pain and improve her recovery. We completed a robotic left hepatectomy. The specimen (Fig. 2) was removed through an extension of the peri-umbilical port sight.

Historical Perspectives

The first laparoscopic liver resection was performed by Dr. Michel Gagner in 1992. Since then, the expansion has been exponential with greater than 2,800 reported in the literature in 2009.[2, 3]

The Consensus Conference on Laparoscopic Liver Surgery in Louisville, Ky., in 2008 concluded that laparoscopic liver surgery was safe and effective in the hands of surgeons experienced with HPB and laparoscopy.[4] The consensus from the conference was that: (1) laparoscopic liver resection was best indicated for solitary lesions, (2) the laparoscopic left lateral sectionectomy should be the standard of care, and (3) laparoscopic major hepatectomies should be reserved for experienced surgeons skilled in advanced laparoscopy.

The advent for the robotic platform has allowed surgeons to overcome some of the limitations attributed to laparoscopy and have allowed surgeons with less advanced laparoscopic skills to approach more challenging cases minimally invasively.

Minimally Invasive HPB Surgery

Pancreatic surgery is one of the most complex intra-abdominal operations, currently requiring fellowship training beyond general surgery residency in order to feel comfortable performing the operation with an open incisional approach.

A minimally invasive approach to pancreatic surgery adds an even greater complexity to an already long and complicated surgery. The minimally invasive distal pancreatectomy, with or without splenectomy, is technically less challenging compared to the Whipple procedure due to the lack of anastomosis that is required.

The advantages of a minimally invasive approach compared to an open approach has been clearly defined, with smaller incisions, less associated post-operative pain and shorter length of stay. Thus, pancreatic surgeons have more readily incorporated a laparoscopic or robotic approach to a distal pancreatectomy and splenectomy.

The laparoscopic Whipple was first introduced in 1994,[5] and the robotic-assisted approach was first reported in 2003.[6] Since then, only a few centers around the world are performing these operations with a minimally invasive approach on a consistent basis.

Currently, only a handful of surgeons are technically skilled laparoscopically to perform the Whipple procedure with a purely laparoscopic approach. The robotic platform has allowed more pancreatic surgeons to attempt the Whipple procedure with a minimally invasive approach. However, the advantages seen in a minimally invasive distal pancreatectomy are not readily seen with a minimally invasive Whipple procedure. The learning curve is steep, with 80 cases usually suggested to feel comfortable with a robotic Whipple.[7] The operative time is long, with a weighted mean operation time of approximately 8.5 hours.

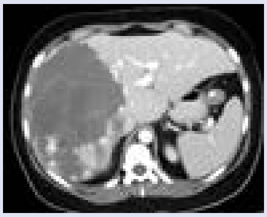

Fig. 3

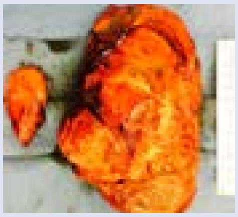

Fig. 4

Fig. 5

Case 2

Mrs. KT is a 50-year-old female with a giant symptomatic liver hemangioma encompassing the entire right lobe of her liver (Fig. 3).

Surprisingly, she did not have pain or fullness. She had symptoms of inflammation, anemia and thrombocytopenia consistent with Kasabach-Merritt syndrome. We completed a robotic anatomical right hepatectomy. The specimen (Fig. 4) was retrieved through a Pfannenstiel incision (Figures 5).

The conversion to open rate is 16.4 percent for an attempted robotic Whipple. Morbidity rates were 30.7 percent (most frequently associated with pancreatic fistulae) and mortality rates of 1.6 percent.[8] Thus, the robotic operations are significantly longer, the length of stays are not shorter and the pancreatic fistula rates are not improved. Although, it has been demonstrated to be safe and feasible in experienced hands, it has not been readily adopted by most pancreatic surgeons around the world.

Case Studies

In our department, we apply the full range of surgical approaches, from open to laparoscopic to robotic, to a range of benign and malignant diseases. We offer robotic cholecystectomies (multiport and single port), robotic liver resections (left lateral sectionectomy, left hepatic lobectomy, right hepatic lobectomy and partial non-anatomical hepatectomy), and robotic pancreatectomy (distal pancreatectomy and splenectomy). Below are some examples of patients who presented to our institution for surgical consideration with complex HPB disease(s).

Although I have personally completed 17 robotic pancreaticoduodenectomies (Whipple procedures), our outcomes as well as those of others have not shown oncologic improvement over open Whipple procedures, which can usually be completed in 3-5 hours and a hospital stay of approximately 7 days. Therefore, most Whipple procedures are offered with an open incisional approach.

In turn, we feel that not all cancer operations can or should be completed minimally invasively (e.g., large resections where a big incision is required just to remove the specimen, major vascular involvement requiring vascular reconstruction, or major liver with biliary resection and multi-quadrant bowel and biliary anastomosis).

Quite often, patients with large, advanced, but resectable cancer ask me, "Can this operation be done with small Band-Aid incisions?" I always remind them that my goals for them are three-fold: (1) keeping them alive during the operation ("There's no point going in and not coming out"),(2) completing a good cancer operation, i.e. removing the entire cancer, achieving negative margins and obtaining an appropriate amount of lymph node samples for adequate staging, and (3) approaching it minimally invasively. The first two are my main goals. Goal #3 is just icing on the cake. ■

Fig. 6

Fig. 7

Case 3

Mrs. VM is a 64-year-old female with a BMI of 40 and a pancreatic tail mass concerning for adenocarcinoma (Fig. 6). CT imaging revealed resectable disease.

She underwent a robotic distal pancreatectomy and splenectomy. The specimen was retrieved through an extension of the peri-umbilical port site (Fig. 7). Final pathology revealed a 4.8-cm poorly differentiated pancreatic adenocarcinoma with negative pancreatic margin. One out of 15 lymph nodes was positive for lymph node metastasis.

She was discharged on post-op day No. 4 and started adjuvant chemotherapy 4 weeks after surgery.

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The Changing World of Hysteroscopy

While still an operating-room process in some cases, newer technology is moving hysteroscopy to the office setting for many procedures

By Carla Roberts, M.D., Ph.D.

Hysteroscopy is the inspection of the uterine cavity by endoscopy with access through the cervix. It allows for the diagnosis of intrauterine pathology and serves as a method for surgical intervention, also called operative hysteroscopy.

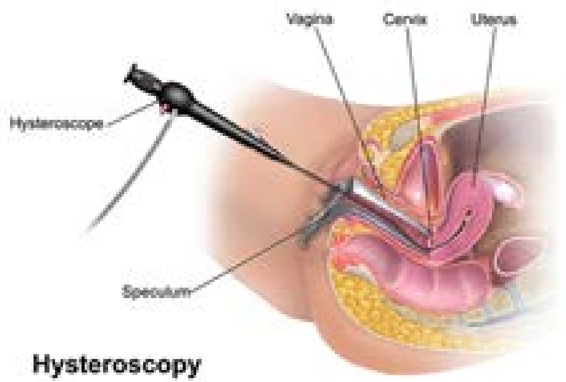

Figure 1. Diagram depicting a hysteroscopic procedure.

Although the first reported uterine endoscopy was in 1869, the modern-day hysteroscopy did not become popular until the 1970s, when technology yielded more practical and usable instruments. The use of liquid distention media became routine by the 1980s, and many new hysteroscopic procedures, including endometrial ablation, were developed.

By the mid-1980s, hysteroscopic procedures had nearly replaced dilation and curettage (D&C) for diagnosing intrauterine pathology. They are now routinely used for diagnosis and treatment for abnormal bleeding, infertility evaluation, proximal tubal cannulation, transcervical sterilization, difficult removal of IUDs, intrauterine polyps, submucosal myomas, intrauterine adhesions and correction of müllerian anomalies.

Over the past few decades, refinements in optic and fiberoptic technology and inventions of new surgical accessories have dramatically improved visual resolution and surgical techniques. Many hysteroscopic procedures have replaced old, invasive techniques. As instruments become smaller, office hysteroscopy is replacing operating-room procedures. One of the most recent hysteroscopic procedures approved by the U.S. Food and Drug Administration (FDA) is female sterilization (Essure, Conceptus, Incorporated, Mountain View, Calif), which can be performed in the gynecologist's office.

Hysteroscopes and Instruments

The telescope consists of 3 parts: the eyepiece, the barrel and the objective lens. The focal length and angle of the distal tip of the instrument are important for visualization (as are the fiberoptics of the light source). If not a solitary unit, a sheath is required to allow for inflow and outflow of distension media. Angle options include 0°, 12°, 15°, 25°, 30° and 70°. A 0° hysteroscope provides a panoramic view, whereas an angled one might improve the view of the ostia in an abnormally shaped cavity.

Rigid hysteroscopes are the most common, and they are available in a wide range of diameters for both in-office and complex operating-room procedures. Of the narrow options (3-5 mm in diameter), the 4-mm scope offers the sharpest and clearest view. It accommodates surgical instruments but is small enough to require minimal cervical dilation. In addition, patients tolerate this instrument well with only paracervical block anesthesia.

Rigid scopes larger than 5 mm in diameter (commonly 7-10 mm) require increased cervical dilation for insertion. Therefore, they are most frequently used in the operating room with intravenous sedation or general anesthesia. Large instruments include an outer sheath to introduce and remove media and to provide ports to accommodate surgical instruments. The most widely used surgical instruments include scissors, biopsy forceps, graspers, rollerball, loop electrode, vaporizing electrode and the morcellator.

The flexible hysteroscope is most commonly used for office hysteroscopy. It is notable for its flexibility, with a tip that deflects over a range of 120-160°. Its most appropriate use is to accommodate the irregularly shaped uterus and to navigate around intrauterine lesions. It is also used for diagnostic and operative procedures. During insertion, the flexible contour accommodates to the cervix more easily than a rigid scope of a similarly small diameter.

Recent improvements in specific operating instruments for the hysteroscope incorporates a suction channel and a pump to aid in removing pieces of tissue during resection. This improves visibility and decreases time spent emptying the pieces from the endometrial cavity. Another recently available instrument is a hysteroscopic morcellator, which may reduce myomectomy and polypectomy time by morcellating and removing tissue in one movement under direct visualization. These come in a variety of diameters from 6 to 9 mm. While these require cervical dilation, the smaller diameter morcella-

Figure 2. 5 mm Rigid Hysteroscope

Figure 3. Instruments for the rigid hysteroscope. Top to bottom: biopsy forceps, tissue graspers and scissors.

tors may be useful in the office setting.

A variety of energy sources have been employed with the hysteroscopic technique, including monopolar and bipolar electricity as well as fiber optic lasers including potassium-titanyl-phosphate (KTP), argon, and Nd:YAG lasers. They all have different wavelengths, though the KTP and argon lasers have similar properties.

Distension Media

Table 1 compares the various types of media used to distend the uterine cavity, aid in the visualization of intrauterine pathology and provide an appropriate operative field. There are pros and cons to each type.

Pre-Operative Evaluation. Appropriate procedure should be proceeded by accurate history taking, physical examination, and careful workup of the suspected pathology. In preparation for hysteroscopic procedures, the following may be useful: CBC, electrolytes, ß-hCG, Pap smear, cervical cultures, endometrial biopsy and imaging such as a hysterosalpingogram (HSG) or CT/MRI.

Antibiotic prophylaxis is not indicated unless the patient has clinically significant valvular disease or a history of tubal occlusion due to pelvic inflammatory disease.

Office Hysterosocpy. Office hysteroscopy offers many benefits and is becoming more acceptable among patients and gynecologists for both diagnostic and operative procedures. Despite clear advantages, many gynecologists remain hesitant to perform in-office procedures out of fear that the patient, who is generally awake, will experience significant discomfort.

The success of diagnostic and operative hysteroscopic procedures with minimal and acceptable levels of patient discomfort in the office depends, therefore, on multiple factors. Procedural factors affecting the outcome of hysteroscopy include the size of the instrument used, the type and length of the procedure, the use of preprocedure anesthesia or analgesia, and a vaginoscopic approach.

The skill of the surgeon also affects the hysteroscopic experience and outcome. In addition, patient variables such as menopausal status, anatomic distortion (eg, cervical stenosis) and anxiety may adversely affect the patient's experience.

Future Uses of Hysteroscopy

In 1869, Pantaleoni used a modified cystocope lit with reflected candlelight to examine the uterine cavity of a patient with post menopausal bleeding. Although Pantaleoni blindly used silver nitrate to cauterize the observed bleeding polyps, the ability to treat intrauterine pathology by direct visualization has been ever expanding.

Since that time, the technology surrounding hysteroscopic surgery has continued to expand to meet both physicians' and patients' demands for safe, cost-effective and minimally invasive treatments. We can expect to see smaller and smaller instruments with improved visualization to enable more procedures to be done comfortably in the office setting.

In the future, combining hysteroscopy with tissue sampling of the fallopian tubes to test for abnormal pathology may revolutionize ovarian cancer prevention. To be able to do this in an office setting with minimal to no anesthesia would be a development that is beneficial to all of our female patients. ■

Figure 1

Media Type	Maximum Flow rate	Pros	Cons	Volume Discrepancy	Complications
CO2 gas	• Cannot use laparoscopic insufflators, • Flow rate of 40-60mL/min • Maximum pressure 100mm Hg	• Rapidly absorbed gas easily flows through narrow channels in office	• Cannot Clear Blood from the scope		• Higher pressures and rates can cause cardiac arrtythmias embolism and arrest
0.9 % Saline and Lactated Ringers	• Maximum pressure 75 - 100 mm Hg	• Isotonic, • Conductive • Low viscosity • Safe with mechanical, laser, bipolar energy	• Miscible with blood (increased pressures to clear field) • Excellent conductivity (precludes standard monopolar*)		
3% Sorbitol, 1.5% Glycine, Mannitol**	• Maximum pressure 75 - 100 mm Hg	• Hyptonic • Low viscosity • Non-conductive • Miscible with blood but improved visibility over saline		• Stop at 2 liters ***	• Risk of volume overload and hyponaremia with intravascular absorption
Dextran 70		• High viscosity • Non-electrolyte • Non-conductive • Immiscible with blood		• Stop at 500ml	• Allergic reactions and anaphylaxis • Fluid overload • Disseminated intravasuclar coagulopathy • Destruction of instruments

* Monopolar systems with the ERA sleeve or Opera Star systems may be used with these solutions.
**Mannitol can only be used with monopolar operative systems
*** All impose a risk of volume overload and hyponatremia from intravascular absorption (particularly > 2 L). Therefore, careful fluid monitoring is required during their use. When intravasation of 5% mannitol occurs, it stays in the extracellular compartment; treatment of this condition is discontinuing the procedure and administering diuretics. 3% sorbitol is broken down into fructose and glucose and therefore has an added risk of hyperglycemia when absorbed in excess. Use 1.5% glycine with caution in patients with impaired hepatic function because glycine is metabolized to ammonia.

A Rare Disease Receives Specialized Treatment:

NORTHSIDE HOSPITAL CANCER INSTITUTE'S SARCOMA PROGRAM

By Helen K. Kelley

A multidisciplinary team comprised of highly specialized board-certified physicians is bringing hope to people suffering from sarcoma. A very rare disease, sarcoma accounts for approximately 1% of all adult solid malignancies, with only about 14,000 new incidences per year in the U.S.

According to Jonathan Lee, M.D., surgical oncologist and Medical Director of Northside Hospital Cancer Institute's Sarcoma Program, the rarity of the cancer has resulted in limited resources and expertise in detecting and treating it.

"It's very unnerving for a person to be diagnosed with a disease that his or her doctor admits to not knowing much about," he said. "One of the key things the medical community can do to improve treatment is to increase awareness of the disease."

While there are more than 50 different types of sarcoma, the disease can be divided into two main groups: soft tissue sarcoma and bone sarcoma. Northside's Sarcoma Program developed a very personalized program that specializes in treating soft tissue sarcoma.

Comprehensive Approach is Effective

Lee says that a multidisciplinary, multi-modality approach to sarcoma treatment has contributed to major advances in patient care.

"What we have here at Northside is rather unique," said Lee. "We are able to offer patients a team of highly specialized physicians who have made it their mission to treat sarcoma. Our Sarcoma Program combines both the expertise found in academic centers and patient-centered philosophy of community hospitals – a true hybrid model."

The Sarcoma Program Multidisciplinary Team is Comprised of:

- Sarcoma Pathologist
- Radiologists
- Medical Oncologists
- Radiation Oncologists
- Surgical Oncologists
- Plastic Surgeons
- Sarcoma Oncology Nurse Navigator
- Research Nurses
- Genetic Counselors

Each week, the entire team gathers to discuss individual cases, share expertise and recommendations and determine the best course of treatment.

"I think the key to a successful program is in having multidisciplinary input," said B. Scott Davidson, M.D., a surgical oncologist with the Sarcoma Program.

"For example, there are times when I will see a patient as the initial introduction into the program and I may identify that the patient needs radiation and possibly chemotherapy before they have surgery. Even though my role is primarily to perform the surgery, I'm also coordinating the care of that patient," he explained. "Therefore, I will bring the case to the multidisciplinary conference, where we all come up with a game plan. Sometimes, the determination will be that the patient's care will be turned over to the radiation oncologist first and then surgery will be scheduled later."

Lee adds that this kind of overlap is important in determining the most effective treatment plan for each patient.

"The radiation oncologists, medical oncologists and surgical oncologists are all important, and they may share some parts of their skill sets," he said. "However, their specializations are unique and it is their differences that make each one such a valuable piece of our integrated team."

Advanced Treatments, Research

While early-stage soft tissue sarcoma is largely treated with surgery, other regimens such as radiation and chemotherapy may be used singly or in combination with surgery. Northside also offers brachytherapy, an advanced treatment that delivers targeted radiation to the cancer and is helpful in limb preservation.

The Challenge of Diagnosing Sarcoma

Because of its rarity, sarcoma is hard to detect early. In fact, many patients may show no signs or symptoms until the disease has reached an advanced stage. Determining whether a soft tissue mass is benign or malignant usually requires a biopsy. Northside recommends evaluation for any lump that is:

- Greater than 5 cm in diameter (the size of a golf ball)
- Increasing in size
- Causing pain or other symptoms
- Growing in a scar where another tumor was removed or surgery performed
- In a muscle or deeper (rather than just below the skin)
- Has concerning appearance on an x-ray

Brachytherapy involves placing a radioactive source directly into the tumor bed. Since soft tissue involves muscle, fat, blood vessels, nerves, tendons and synovial tissues, this targeted radiation delivery method is helpful in reducing the size of the tumor while preserving the surrounding body structures.

Due to the rarity and difficulty to diagnose, it is paramount to have team members like Gina D'Amato, M.D. a medicial oncologist who for the past 15-20 years has seen the evolution of sarcoma treatment.

"When I first started my career, we used to lump all types of soft tissue sarcomas together. There was only one chemotherapy regimen available for treatment and we found that it didn't work for all 50 types," she said. "Today, we're smarter. We're conducting clinical trials on different sub-types of the disease so that specific chemotherapy regimens can be developed for those specific sub-types."

D'Amato adds that there have been advancements in anticancer medicines that were previously targeted for other cancers, but there are actually more known genetic abnormalities in people who have the disease. Thus, obtaining a detailed family history and prospectively contemplating genetic factors become very important.

Genetic counselors are a fundamental part of the Sarcoma Program team, helping individuals and families understand the red flags and risks for an inherited medical condition. Currently, the counselors, along with the rest of the team, are working on a screening mechanism that will help with early detection of sarcoma.

"Right now, we are gathering information on an individual patient basis," Lee said. "For example, we might take a closer look at a patient who has a history of multiple cancers. We're looking for risk factors. We ask, 'Does this patient have a family history of certain cancers, including sarcoma?' In other words, we document the red flags."

D'Amato says that growing knowledge of the disease and its causes have made the role of genetics counselors increasingly important.

Jonathan Lee, M.D.

B. Scott Davidson, M.D.

Gina D'Amato, M.D.

Key Statistics, Soft Tissue Sarcoma

The American Cancer Society's estimates for soft tissue sarcomas in the United States for 2016 are (these statistics include both adults and children):

- About 12,310 new soft tissue sarcomas will be diagnosed (6,980 cases in males and 5,330 cases in females).
- 4,990 Americans (2,680 males and 2,310 females) are expected to die of soft tissue sarcomas.

have proven to be effective in treating sarcoma as well. There has also been an increase in clinical trials available to patients with sarcoma.

"At this point, we don't know what treatment works best for every type of sarcoma. We're always researching and updating our knowledge, and clinical trials are our best way to do that," she said. "I attend conferences for organizations like the American Society of Clinical Oncology, Connective Tissue Oncology Society and Sarcoma Alliance for Research Collaboration, and meet with other sarcoma specialists and pharmaceutical company representatives to learn about the latest research and bring new trials to Northside."

Currently, Northside's Sarcoma Program has three open clinical trials and three more that will be opening within the next few months.

The Role of Genetics in Sarcoma

Genetic susceptibility is a way of not only defining the nature of a certain cancer, but also can help determine strategies for early detection, intervention and prevention. Since sarcoma is a very narrow field of medicine,

"We are learning more and more about specific genes and hereditary conditions that can cause sarcoma," she said. "If I'm worried about a specific gene, counselors are available to the patient right away. And I think that can help the patient feel more confident about their treatment."

Future of the Program

"The Sarcoma Program is modeled after the Northside Hospital Melanoma Program that has experienced tremendous growth. Our Interdisciplinary team approach focuses on delivery of personalized care to people suffering with sarcoma," said Lee. "We are energized by the progress that has been accomplished over the past 2 years and know there is always room for growth.

Lee says that future plans for the Sarcoma Program include creating a sarcoma database, increasing the number of robust clinical trials in which sarcoma patients can participate, and finding new ways to improve community outreach and increase awareness of the disease.

PSYCHIATRY SPOTLIGHT

By Helen K. Kelley

Georgia physicians are at the forefront of developing innovative programs and research in the field of psychiatry. Here, we explore how they are increasing the knowledge and skills of new doctors, improving the lives of an underserved population with mental illness and more.

Peer specialist has important role in training medical students and junior doctors

The Department of Psychiatry at Medical College of Georgia (MCG) at Augusta University has developed a unique program that helps people with mental illness in their recovery while, at the same time, training residents and medical students in treating mental illness. According to Dean Peter F. Buckley, M.D., the program is modeled on the recovery peer approach, which is based upon the premise that an individual with a "lived experience" is uniquely able to contribute to the rehabilitation and recovery of a person needing services.

Citing the New Freedom Commission on Mental Health established by President George W. Bush in 2002 to conduct a comprehensive study of the United States mental health service delivery system and make recommendations for improvements, Buckley says it is vital that doctors receive training that will sensitize them to become more holistic in their views of people with mental illness.

"We posed the question, 'If it is so important in our nation to have policies to guide how we treat people for mental illness, shouldn't we be training our doctors in that way?'" he said. "Our program has incorporated people who have experienced mental illness, but are more stable and far along in their recovery, to help others in their recovery. And then we took this model a step further by introducing it into the arena of training doctors and medical students. They now have the opportunity to care for people with mental illness with the benefit of guidance from a peer support specialist."

Buckley adds that departments of psychiatry at other schools around the country have shown interest in MCG's model.

"We've written and published about our philosophy and model," he said. "Today, the peer support specialist, to us, is no longer unique and has been mainstreamed into what we do."

Competency restoration program helps jail inmates

A partnership between Emory University, the state of Georgia and Fulton County is helping inmates with mental illness move forward through the justice system.

Some inmates remain locked up for months because they have been deemed incompetent to stand trial, yet they cannot proceed to trial until they receive the medication and/or therapy they need to become competent. It's the ultimate Catch-22.

According to Peter Ash, M.D., a professor in Emory's Department of Psychiatry and Behavioral Sciences who serves as director of the Fulton County Jail program, many of these inmates haven't committed serious offenses.

"They've been arrested on relatively minor offenses, but they've gotten caught up in the system due to their mental

Peter F. Buckley, M.D.

Peter Ash, M.D.

Georgia physicians are at the forefront of developing innovative programs and research in the field of psychiatry.

illness," he said. "It's better to get these people effective treatment so that they don't keep repeating their actions."

The Fulton County Jail, the state and Emory worked together to set up an intensive psychiatric unit inside the jail, where a team of medical professionals evaluates inmates for needed treatment and therapy. The program has eased the burden in several ways. Previously, mentally ill inmates often lingered in jail, having been placed on a long wait list to get into Georgia Regional Hospital for evaluation. Now, with onsite evaluation and treatment, the backlog is disappearing and many inmates have been stabilized.

Ash says that research on the efficacy of the restoration program has shown excellent outcomes, sped up the recovery of those treated and saved money.

"Right now, the program is primarily for men. We're also doing outcome studies and piloting a new program aimed at helping women with mental illness who are in the criminal justice system," he said. "We're always looking at how we can deliver a more careful assessment of the person's level of problem and tailor their treatment to their level of need."

Behavior therapy could benefit children with autism

More young children 2 to 5 years of age receiving care for attention-deficit/hyperactivity disorder (ADHD) could benefit from psychological services – including the recommended treatment of behavior therapy, according to The Centers for Disease Control and Prevention (CDC). The CDC's latest Vital Signs report urges healthcare providers to refer parents of young children with ADHD for training in behavior therapy before prescribing medicine to treat the disorder.

The American Academy of Pediatrics recommends that before prescribing medicine to a young child, healthcare providers refer parents to training in behavior therapy. However, according to the Vital Signs report, about 75% of young children being treated for ADHD received medicine, and only about half received any form of psychological services, which might have included behavior therapy.

The report looks at healthcare claims data from at least 5 million young children (2-5 years of age) each year insured by Medicaid (2008-2011) and about 1 million young children insured each year through employer-sponsored insurance (ESI) (2008-2014). In both groups, just over 75% of young children diagnosed with ADHD received ADHD medicine. Only 54% of young children with Medicaid and 45% of young children with ESI (2011) received any form of psychological services annually, which might have included parent training in behavior therapy. The percentage of children with ADHD receiving psychological services has not increased over time. ■

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