Robotic Bariatric Surgery

R. Sudan
No disclosures
Surgeons Perform First Robotic Bariatric Surgery...

WASHINGTON—Surgeons from the University of Nebraska have opened a new chapter in bariatric surgery by becoming the first to perform a biliopancreatic diversion with duodenal switch using robotic surgical equipment.

Professor of general surgery, University of Nebraska Medical Center (UNMC), Omaha. Dr. Sudan presented a video of a robotic biliopancreatic diversion (BPD) with duodenal switch at the 18th Annual Meeting of the American Society for Bariatric Surgery. It was the first time that results of the procedure have been presented.

Douglas S. Hess, MD, bariatric surgeon, Bowling Green, Ohio, developed and performed the first duodenal switch operation in March 1988. After viewing Dr. Sudan's video presentation, Dr. Hess said the operation was "very impressive."

"It's really got a great future in certain applications," said Dr. Hess. "We will need time to see how it's going to turn out in the long term. In bariatric surgery, in particular, you need long-term follow-up to monitor the weight loss and ultimate success of a procedure."

World-renowned surgeons Michel Gagner, MD, chief of laparoscopic surgery, Mount Sinai School of Medicine, New York City, and Robert A. Rubkin, director of the Pacific Institute of Surgery for Obesity, San Francisco, are currently using the laparoscopic approach to BPD with duodenal switch. Dr. Rubkin employs a hand-assisted technique. Surgeons who use the laparoscopic approach tend to use a stapling device to limit the size of the duodenal anastomosis. The robotic device greatly enhances suturing abilities, allowing the procedure to be performed totally intracorporeally with a wide-open duodenal anastomosis along with closure of mesenteric defects, said Dr. Sudan.

"Unlike laparoscopy, the robotics minimize any hand tremors. By doing so, it will extend the working life of surgeons," he said. He used the example of the 85-year-old engineer who donated the equipment to UNMC—"in a test run of the machine the man managed to thread the eye of a suture needle on the first try."

The daVinci system consists of a surgeon's viewing/control console with an integrated high-performance 3-D vision system, a patient-side cart with three robotic arms that maneuver endoscopic instruments, and surgical instruments. The instrument responds in real time to the surgeon's movements while the three-dimensional image at the control console allows the surgeon to perform the procedure while seated. The surgeon places his or her eyes on the view box on the console, and manipulates instruments using hand controls that fit over the thumb, middle and ring fingers, and a foot pedal. The system translates the surgeon's hand, wrist and finger movements into corresponding movements of the instrument tips positioned inside the patient. The robot allows surgeons to work as they do in open surgery, with a sense of depth and without image reversal.

By the end of the summer, UNMC surgeons were expected to complete 15 BPDs using the robotic equipment.

"They have also used the robotic device to perform bowel resections, bile duct reconstruction and exploratory procedures.

"Robotic surgery is still in its infancy. But this is a huge breakthrough, and it is going to dramatically alter the way we do minimally invasive surgery," said Dr. Sudan.

—Christina Frangou
Why Has Robotics Not Taken Off in Bariatric Surgery?
Considerations

- Operative Duration
- Cost issues
- Learning Curve
- Ergonomics
  - Adjustable Gastric Banding
  - Sleeve Gastrectomy
  - Roux-en-Y Gastric Bypass
  - Biliopancreatic Diversion with Duodenal Switch
Review

- Adjustable Gastric Banding
- Sleeve Gastrectomy
- Roux-en-Y Gastric Bypass
- Biliopancreatic Diversion with Duodenal Switch
Adjustable Gastric Banding

- As early as 2003, three surgeons were using the da Vinci to perform adjustable gastric banding.
- Muhlman et al compared the cost and patient outcomes of 10 patients undergoing robotic or laparoscopic AGB.
  - Duration of the operation longer in the robotic group by a mean of 40 minutes.
  - Cost was higher.
- Edelson et al comparing their robotic AGB cases (N=287) with conventional laparoscopy (N=120).
  - Operating time was similar for their overall cohort.
  - Advantage to robot for BMI ≥ 50 kg/m².
Sleeve Gastrectomy

- Diamantis et. al. reported 19 patients with a mean operating time of 95 minutes and no complications.
- Ayloo et al compared robot-assisted (N=30) and laparoscopic (N=39)
  - the duration of the operation in the robotic group was longer by a mean of 21 minutes (135 minutes vs. 114 minutes)
  - 3.3% complications for robot, one conversion in laparoscopic group
- Elli et al. sleeve gastrectomy after liver transplantation
- Hagen et al achalasia simultaneous sleeve gastrectomy and a Heller Myotomy
RYGB

- Technique variable
- Totally robotic RYGB (Mohr et al)
- In 1100 robotic RYGB from 2002 to 2000 (Tieu 2012)
  - Mean operative time 155 minutes (longer)
  - No conversions, no mortality
- Scozzari et al compared robotic sutured (N=110) to laparoscopic EEA (N=423)
  - Longer operative time and higher equipment costs for robot
  - No difference in complication rates or hospital length of stay.
RYGB Cost Considerations

- Duration
- Complications
RYGB

- Marker et al, pooled analysis of 1686 patients
  - Less anastomotic stricture in the robotic group
  - Leaks, complications, duration and hospital stay were equivalent.

- Ayloo et al compared first 45 lap RYGB to next 90 robot RYGB
  - Duration shorter for the robot by about 10 minutes

- Cost study factoring complications has favored the robot (Hagen et al)
Learning Curve RYGB

- Better for novices (Sanchez et al)
- Buchs et al – learning curve of 14 cases
- Hubens et al. First 45 robot cases
  - Duration considerably shorter for the laparoscopic cases (127 vs. 212 min; p < 0.05)
  - Last 10 robotic cases were performed in the same operative duration as the laparoscopic cases (136 vs. 127 min)
- Overall complication rates equivalent
- 11% (N=5) of the patients had intestinal injury resulting from the robotic instruments and needed conversion to open
Biliopancreatic Diversion with Duodenal Switch

- Sudan et al - First case in October 2000
- First 47 patients
  - no mortality, 4 leaks, duration of the operation - 379 minutes.
- The learning curve of the robotic BPD-DS is about 50 cases
Robotic DS technique

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Robotically assisted biliary pancreatic diversion with a duodenal switch: a new technique

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Abstract
Background: Minimally invasive surgical techniques decrease the length of hospitalization and the morbidity for general surgery procedures. Application of minimally invasive techniques to obesity surgery had previously been limited to stapled techniques used primarily for the Roux-en-Y gastric bypass and laparoscopic band placement. The authors present the technique for totally intracorporeal robotically assisted biliary pancreatic diversion with a duodenal switch (BPD/DS) using five ports.
Methods: After development of the technique in animal and human cadaver models, the da Vinci robot was first used in October 2000 to perform BPD/DS using five ports and a totally intracorporeal technique. Patient selection was based on standard surgery guidelines for the morbidly obese.
Results: The technique was used for 19 patients with biliary pancreatic diversion for weight loss purposes, described by Scopinaro et al. [13], is a combined restrictive and malabsorptive procedure. The stomach capacity usually is restricted to 250 ml by an extended antrectomy. Malabsorption is the result of a distal Roux-en-Y type reconstruction in which a common channel of 50 cm and an alimentary limb of 250 cm are created.

The duodenal switch (DS) operation for bariatric surgery was initially described by Hess and Hess [4] as a modification of the Scopinaro biliary pancreatic diversion (BPD). In this operation, a sleeve gastrectomy, instead of an antrectomy, restricts the stomach capacity to approximately 150 ml and preserves the pylorus and first part of the duodenum. A distal bypass is performed in a manner similar to the Scopinaro BPD.

As a result of this modification, Marouani et al. [7] reported a significant decrease in intragastric volume.
Multifactorial Analysis of the Learning Curve of Robot-Assisted Laparoscopic Biliopancreatic Diversion With Duodenal Switch

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Summary and Conclusions

- All major bariatric operations can be performed robotically
- Roux-en-Y gastric bypass is the most commonly performed robotic operation
- The complication rates have been equivalent by experienced surgeons
- Learning curve may be shorter for the robotic procedures
- The expense is likely higher
- Justified when applied to the more complex procedures that are difficult to perform by conventional laparoscopy.