

Surgeon at work

Laparoscopic sleeve gastrectomy with NOTES visualization—a step toward NOTES procedures

João Caetano Marchesini, M.D., Ph.D.*, Almino Ramos Cardoso, M.D., Mário Nora, M.D., Manoel Galvão Neto, M.D., Cláudio Corá Mottin, M.D., Ph.D., Giorgio Baretta, M.D., Alexandre Vontobel Padoin, M.D., Myriam Moretto, M.D., Lucas Maggioni, M.D., Leticia Biscaino Alves, M.D., Carlos Kupski, M.D., Ph.D.

Brazilian Society for Bariatric and Metabolic Surgery

Received June 15, 2008; revised August 6, 2008; accepted August 14, 2008

Abstract

Background: To demonstrate that bariatric procedures can be done with natural orifice visualization (NOTES) at 2 institutions (Núcleo Universitario de Estudos de Notes Centro de Cirurgia Experimental Vila do Conde–Junqueira, Vila do Conde, Portugal and Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, RS, Brasil). NOTES is a new surgical approach that is being developed. It consists of the use of a minimally invasive technique in which the surgical procedure is performed through natural orifices, thereby circumventing incisions through the skin. **Methods:** We performed vertical gastrectomy or laparoscopic sleeve gastrectomy in a porcine model using vaginal route visualization. **Results:** A laparoscopic vertical sleeve gastrectomy with NOTES visualization in a porcine model was performed with safety. **Conclusion:** Bariatric procedures can be done with NOTES with results as good as those using laparoscopic techniques. (*Surg Obes Relat Dis* 2008;4:773–776.) © 2008 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords:

Sleeve gastrectomy; Bariatric surgery; Transvaginal; Natural orifice visualization; NOTES

Since the 1990s, videolaparoscopic surgery has grown to proportions much more than expected. Initially, it was used only as a diagnostic tool; however, it shortly became used as a therapeutic approach for practically all abdominal surgeries. The refinements of laparoscopic surgery have progressed to the point that complex operations such as gastroplasty with Roux-en-Y bypass can be routinely performed using a minimally invasive route. Noted among its great advantages in relation to conventional surgery are a lower inflammatory response, a rapid return to normal activities, a shorter hospitalization, fewer complications of the surgical wound, and a better aesthetic result.

The growing capacity of therapeutic endoscopy led to a new era in the treatment of gastrointestinal pathologic disorders. Since 2004, a new therapeutic approach has been developing and faces obstacles similar to those that occurred with videolaparoscopy 2 decades ago. Natural orifice transluminal endoscopic surgery (NOTES) has revolutionized various surgical procedures. This has been creating conditions for the development of methods even less invasive for the treatment of pathologic findings in the intestinal lumen and abdominal cavity. We believe it is possible that intra-abdominal operations on a large scale can at some point be realized using natural orifices without incisions through the skin.

The first published description of NOTES demonstrated the feasibility and safety of the peroral transgastric approach of the peritoneal cavity, with long-term survival in the porcine model [1]. This report was soon followed by reports of other experimental transgastric procedures in pig models, such as tubal ligation [2],

*Reprint requests: Joao Caetano D. Marchesini, M.D., Ph.D., Department of Surgery, Vita Batel Hospital, Rua Bruno Filgueira 369, 11th Floor, Bairro Batel, Curitiba, PR, Brazil.

E-mail: jcmarchesini@gmail.com

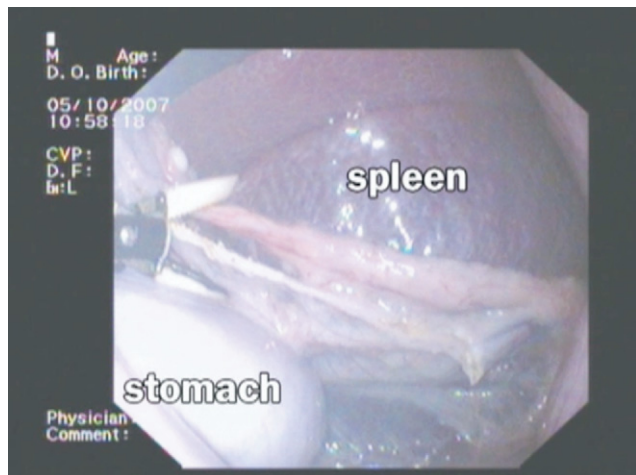


Fig. 1. Release, with ultrasonic scalpel, of the gastric great curvature.

cholecystectomy [3], gastrojejunal anastomosis [4], splenectomy [5], and oophorectomy with tubal resection [6,7]. The first cholecystectomy in humans using transvaginal NOTES was performed in Strasbourg in April 2007 [8].

The vaginal approach, along with the posterior cul-de-sac (posterior colpotomy) is not a new procedure; it has been used for >50 years in gynecologic procedures [9]. More recently, posterior colpotomy was used to remove a surgical specimen during videolaparoscopic surgery [10], circumventing the need for a major abdominal incision. With the aim of broad experience with the use of the posterior colpotomy in other procedures, this route can be used safely for the entrance of instruments proposed for NOTES.

Vertical gastrectomy is a bariatric procedure developed initially as the restrictive part of biliopancreatic bypass with a duodenal switch [11]. This technique has been used in

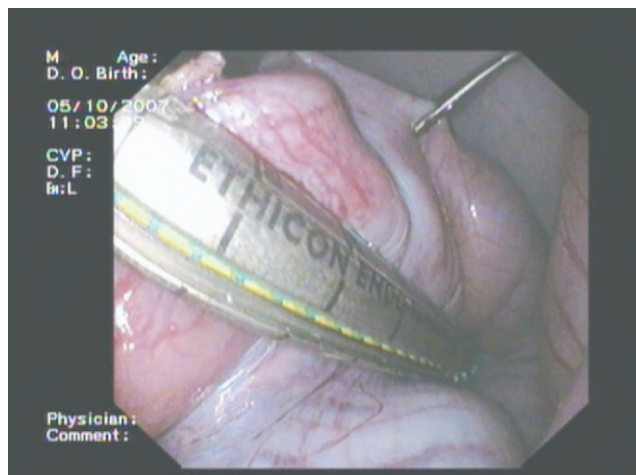


Fig. 2. Stapling of the great curvature from the antrum to the gastric fundus, making the new stomach.

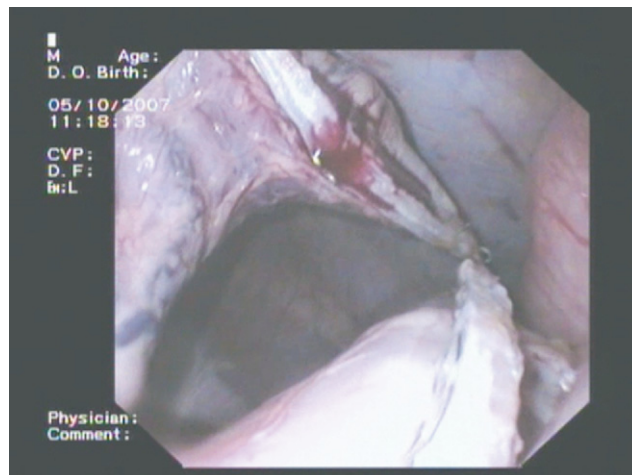


Fig. 3. Final aspect after the stapling, the specimen (in the top and left), and the new stomach (below and right).

super-obese patients to induce weight loss before the definitive procedure and also in obese patients at high risk who would not be able to undergo a definitive procedure or to make their condition amenable to a future gastric or biliopancreatic bypass [12].

We report on vertical gastrectomy performed by NOTES using the transvaginal route in a porcine model with a trocar placed in another natural orifice, the umbilicus.

Methods

We report on the first vertical gastrectomy, or sleeve gastrectomy, performed using transvaginal NOTES in a porcine model at the Center of Experimental Surgery of Vila do Conde in Junqueira, Portugal. The pig used underwent general anesthesia with orotracheal intubation and was placed in the supine position with a slight inclination. The

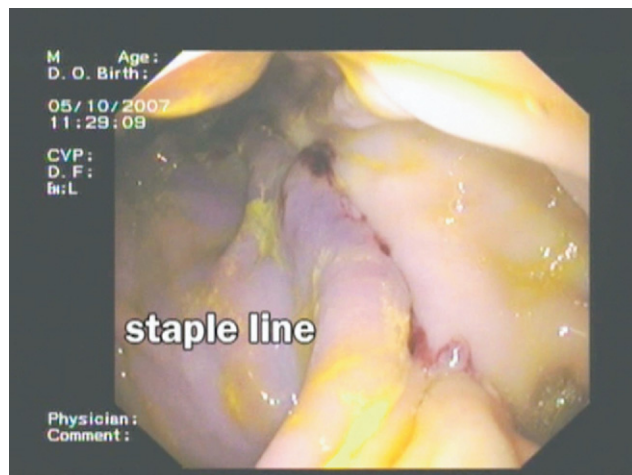


Fig. 4. Endoscopic view of the new stomach (inside view).

pig was prepared by giving it a liquid diet for 72 hours followed by a rectal enema. A carbon dioxide pneumoperitoneum was performed with a Veress needle in the umbilical scar with later placement of a 12-mm Endopath trocar (Johnson & Johnson, Langhorne, PA), for the use of an ultrasonic scalpel (Ultracision ACE, Johnson & Johnson, Cincinnati, OH) and endoluminal Echelon stapler (60 mm), and 2 portals of 2 mm positioned lateral to the umbilical scar to complete the triangulation.

The vaginal route was accessed with a flexible endoscope, Olympus Exera CV-160, by identifying the vaginal cul-de-sac and its opening with a Needle Knife (Johnson & Johnson, Cincinnati, OH), guided by placement of a 30° optic in the umbilical portal. Afterward, traction of the greater gastric curvature was performed with endoscopic traction forceps, and complete release from the greater omentum was effected with an ultrasonic scalpel. This was followed by vertical stapling of the entire greater gastric curvature with the Echelon 60-mm stapler over a 32F bougie to have tube-shaped reservoir. No significant bleeding occurred, and the piece was removed by colpotomy. The total operative time was 84 minutes. The pig was killed by euthanasia 7 days after the procedure. A liquid diet started the second postoperative day was well tolerated by the pig.

Discussion

The first report of NOTES was in 2004 with the performance of transgastric peritoneoscopy by Kalloo et al. [1]. Since then, other procedures, such as tubal ligation, oophorectomy, cholecystectomy, liver biopsy, splenectomy, and gastrojejunal anastomosis, have been developed in various countries worldwide [2–7].

In humans, Reddy and Rao [13] in India performed transgastric appendectomies with excellent results, which were presented at international congresses (Society of American Gastrointestinal and Endoscopic Surgeons, Digestive Disease Week). The first cholecystectomy in humans through the vaginal route was conducted in April 2008 in Strasbourg by Dr. Jacques Marescaux and is known as the Anubis operation [8]. In Brazil, Cardoso and Neto were the pioneers of this technique [14].

In the field of bariatric surgery, it is still not known how all this technology will be useful, but it is certainly promising. As the demand for bariatric surgery has been increasing exponentially, it has become necessary to develop techniques that are less invasive, more rapid, and less expensive for weight loss and the reduction of co-morbidities. This technique of vertical laparoscopic gastrectomy, or laparoscopic sleeve gastrectomy, can be used for weight loss in the super-obese and obese patients with co-morbidities that are contraindications for definitive surgery, including patients with a low BMI who do not fulfill the criteria for a definitive bariatric procedure such as biliopancreatic or gastric bypass, and conversion after placement of an adjustable gastric band [15].

Currently, with the use and development of surgical technique using natural orifices, some of these bariatric procedures such as gastrojejunostomy and vertical gastrectomy have been shown to be possible using by NOTES. Moreover, we believe that the better route, not only for the technique described in our report, but for most intra-abdominal procedures, will be through the umbilical scar. This anatomic region remains a natural orifice, even though occluded after birth. Through the umbilicus, we have resolved one of the most challenging current problems with NOTES, namely contamination of the cavity and fistulas of the entrance orifices. Other advantages include a scarless procedure for a better cosmetic result, a lower inflammatory response, less pain, an early recovery, and short hospitalization. Some disadvantages are that we are dependent on the development and improvement of the equipment, mainly endoscopes and suture instruments.

We believe that bariatric procedures must still be done using a laparoscopic approach. However, NOTES can be used for visualization, the extraction of specimens, and to make the procedures less invasive.

Conclusion

Some bariatric procedures such as vertical sleeve gastrectomy can be done through natural orifices. However, more platforms and instruments must be developed before this can be applied to humans. (Figures 1–4).

Disclosures

The authors claim no commercial associations that might be a conflict of interest in relation to this article.

References

- [1] Kalloo AN, Singh VK, Jagannath SB, et al. Flexible transgastric peritoneoscopy: a novel approach to diagnostic and therapeutic interventions in the peritoneal cavity. *Gastrointest Endosc* 2004;60:114–7.
- [2] Jagannath SB, Kantsevov SV, Vaughn CA, et al. Peroral transgastric endoscopic ligation of fallopian tubes with long-term survival in a porcine model. *Gastrointest Endosc* 2005;61:449–53.
- [3] Park PO, Bergstrom M, Ikeda K, et al. Experimental studies of transgastric gallbladder surgery: cholecystectomy and cholecystogastric anastomosis (videos). *Gastrointest Endosc* 2005;61:601–6.
- [4] Kantsevov SV, Jagannath SB, Niiyama H, et al. Endoscopic gastrojejunostomy with survival in a porcine model. *Gastrointest Endosc* 2005;62:287–92.
- [5] Kantsevov SV, Hu B, Jagannath SB, et al. Transgastric endoscopic splenectomy: is it possible? *Surg Endosc* 2006;20:522–5.
- [6] Wagh MS, Merrifield BF, Thompson CC. Survival studies after endoscopic transgastric oophorectomy and tubectomy in a porcine model. *Gastrointest Endosc* 2006;63:473–8.
- [7] Wagh MS, Merrifield BF, Thompson CC. Endoscopic transgastric abdominal exploration and organ resection: initial experience in a porcine model. *Clin Gastroenterol Hepatol* 2005;3:892–6.

- [8] Marescaux J, Dallemagne B, Perretta S, Wattiez A, Mutter D, Coumaros D. Surgery without scars: report of transluminal cholecystectomy in a human being. *Arch Surg* 2007;142:823–6.
- [9] Bradbury WC. The technique of posterior colpotomy. *Trans Pacif Coast Obstet Gynecol Soc* 1951;19:20–9.
- [10] Zornig C, Emmermann A, von Waldenfels HA, et al. [Colpotomy for specimen removal in laparoscopic surgery]. *Chirurg* 1994;65:883–5.
- [11] Baltasar A, Serra C, Perez N, et al. Re-sleeve gastrectomy. *Obes Surg* 2006;16:1535–8.
- [12] Hamoui N, Anthone GJ, Kaufman HS, et al. Sleeve gastrectomy in the high-risk patient. *Obes Surg* 2006;16:1445–9.
- [13] Baltasar A, Serra C, Perez N, et al. Laparoscopic sleeve gastrectomy: a multi-purpose bariatric operation. *Obes Surg* 2005;15:1124–8.
- [14] Reddy N, Rao VG. Transgastric appendectomy in human. Paper presented at: Digestive Disease Week 2005; May 14–18, 2005; Chicago, Ill.
- [15] Ramos A, Galvão Neto MP. Transvaginal cholecystectomies in humans. Paper presented at: IX Brazilian Congress of Bariatric and Metabolic Surgery 2007; Curitiba, Paraná State, Brazil.