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Editorial

Looking Back and Forward at Natural Orifice Transluminal Endoscopic Surgery[☆]



Pasado y futuro de la cirugía endoscópica transluminal a través de orificios naturales

It has been nearly a decade since the term “NOTES” was coined and hence it is appropriate to look back and assess some of the successes and disappointments that have ensued, as well as forward to the promises that are as yet unfulfilled. NOTES—an acronym for Natural Orifice Transluminal Endoscopic Surgery—was around for many years prior to Kalloo’s sentinel presentation of transgastric peritoneoscopy at the Digestive Disease week in 2002. Gynecologists had used transvaginal access to the peritoneal cavity for decades to treat conditions of the fallopian tubes, and ovaries for nearly a century. In fact the first natural orifice transvaginal cholecystectomy was performed by a gynecologist, Daniel Tsin in 2003, well before the term NOTES existed.¹ However, it was the circulation of a short video documenting a human transgastric appendectomy by Reddy and Rao that caught the attention of surgeons, gastroenterologists, and device makers and energized their respective professional societies to deal with the potential challenges posed by a new disruptive technology.

In 2005 the environment was ripe for the next wave of minimally invasive surgery. Nearly all the laparoscopic procedures we perform today were also being performed 10 years ago. Laparoscopic surgery was losing its novelty in the academic community. Similarly, gastroenterologists were increasingly bolder—armed with better clips, dissecting tools, and other devices that made complex interventions ever more possible. Hence when NOTES burst on the scene it was touted as the next step in the natural evolution to even less invasive therapy. This hype of course proved hard to live up to. However, the leaders of both SAGES (The Society of American Gastrointestinal and Endoscopic Surgeons) and ASGE (American Society of Gastrointestinal Endoscopists) had a more measured view as evidenced in the SAGES/ASGE White Paper on NOTES published in 2006.² In this key publication they laid out an agenda for research that needed to be performed before

NOTES could be considered for more widespread use in humans and also made a plea that when human cases were performed that they be done under Institutional Review Board (IRB) scrutiny. Additionally, an organization to fund research and award grants on a peer reviewed basis was created—i.e. NOSCART (Natural Orifice Surgery Consortium for Assessment and Research). NOSCART raised over 4 million dollars and funded multiple studies at over 25 institutions to answer the questions posed in the SAGES/ASGE White Paper. Similar efforts occurred in Europe under the leadership of the EuroNotes and DuestcheNotes groups. Ultimately the fundamental research questions were answered and human NOTES procedures were performed. In the USA, NOSCART funded a prospective randomized controlled trial comparing laparoscopic cholecystectomy to transvaginal cholecystectomy. In Germany, Lehmann and his colleagues reported their registry of transvaginal cholecystectomies, ultimately reporting the largest series to date.³ This careful and methodical introduction of a radically different modality of surgery stands in stark contrast to the helter-skelter early days of laparoscopic cholecystectomy. One of the success stories of NOTES is that patient safety was prioritized and in fact new NOTES procedures were introduced with complication rates that were similar to, if not lower than the existing standard. Patient deaths attributable to NOTES were virtually unheard of.

Whereas transvaginal cholecystectomy proved the feasibility of NOTES, the question remains as to whether or not NOTES has any advantages over other forms of existing minimally invasive therapies. At the current time there are at least two areas where this appears to be the case: Transanal proctectomy and Per Oral Endoscopic Myotomy (POEM).

In 2007, Whiteford first reported successful transanal colectomy in a cadaver model.⁴ This work was rapidly picked up by Sylla, Lacy, and others and within 3 years, the first

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human "NOTES" resection for rectal cancer was performed in Barcelona.⁵ This procedure continues to evolve and appears to have a permanent place in the treatment of rectal cancer. It offers the advantage of providing superb visualization and easier access to the caudal portions of the pelvis—an area notoriously difficult to easily access trans-abdominally. Laparoscopic assistance is still a useful if not essential adjunct because maneuvers such as splenic flexure mobilization cannot be easily performed with existing tools.

While a number of groups worked out the methods for NOTES access to both the mediastinum and thoracic cavity using a submucosal tunnel in the esophagus, Inoue described the first totally endoscopic esophageal myotomy for achalasia in 2008.⁶ As with transanal proctectomy, POEM has been adopted worldwide with reports published from four continents encompassing over 4000 patients. Although achalasia is a relatively rare condition, POEM has rekindled the interest of the interventional GI community in NOTES with sights now set on endoscopic full thickness resection of gastric and colonic lesions. At the 2014 NOSCAR meeting in Chicago, Kantsevoy presented several cases of totally endoscopic full thickness colon resections for large benign polyps. Using structural supports deployed through the colonoscope, he demonstrated that it was possible to completely resect sizable lesions and then reconstruct the bowel wall integrity with an endoscopic suturing device. There are now numerous case reports published that describe full thickness gastric resections for removal of appropriate GIST tumors.

If one considers that 25 years have elapsed since the first laparoscopic colectomies were reported and yet less than half of all elective colectomies in the USA are performed in a minimally invasive fashion, one would have to conclude that the progress made with the introduction of NOTES is actually ahead of schedule! Looking forward, the growth of NOTES will be slow because both the financial and regulatory environment are very different than they were at the end of the previous century and the easy goals have already been accomplished. The capability to perform full thickness resections using only endoscopic tools is in its infancy. Where this will lead is open to speculation, but proof of concept has been established. The ability of computer assisted surgery to

resolve some of the technical challenges posed by natural orifice access routes will be an intriguing area to keep an eye on as the field evolves. Hence while NOTES has not been quite the revolution that some might have envisioned, NOTES is here to stay and will likely become an important treatment modality in the future.

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