What is NOTES and what happened so far?

MOREL, Philippe

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Natural Orifice Transluminal Endoscopic Surgery (NOTES)

Philippe Morel, philippe.morel@hcuge.ch

Natural orifice transluminal endoscopic surgery (NOTES) represents the intentional puncture of one of the viscera with an endoscope (flexible and/or rigid) to access the abdominal cavity and perform an intra-abdominal operation. Although the expression "NOTES" and the above access concept only gained momentum after Kalloo's first publication describing access of the peritoneal cavity through a transgastric incision in 2004, the method of using flexible instrumentation and perforation of the visera is not new and probably less disastrous than emotionally attributed:

Flexible endoscopic pseudocyst drainage has been practiced for 30 years, percutaneous endoscopic gastrostomy for 25 years. Transgastric retroperitoneal necrosectomy has been used for 5 years. EUS needle guided transgastric endosurgery has been published for transgastric gastropexy to the diaphragm, just as well as hiatus hernia repair and endosurgical anastomosis of the gallbladder to the stomach. However, after 2004 number of experiments, interested doctors and publications has grown rapidly. Rao and Reddy from India have removed appendices with flexible scopes transgastrically in a significant number of patients only shortly after Kallo's first report (presented at several conferences).

Many other trials have been conducted in animals: Performance of anastomoses, liver biopsies, fallopian tube ligation, removal of celiac axis lymph nodes. Several other abdominal operations have evaluated for transgastric approach. Thompson et al has reported survival studies of abdominal organs, including transgastric fallopian tubectomy and oophorectomy. Transcolonic cholecystectomy has just been recently published. During the last year, cholecystectomy has moved to clinical application. Altogether, an estimated number of over 70 patients have been treated with NOTES worldwide until now (Presented at the UCSD NOTES course in San Diego, December 2007).

What are the limitations of NOTES

Still, besides of all enthusiams, NOTES has still major limitations: Flexible endoscopes are currently used for that kind of surgery. Unfortunately, flexible endoscopes cannot deliver a stable platform and the concept of triangulation. Both issues are extremely important for effective surgery. Furthermore, flexible instrumentation is hardly sufficient for surgery at present: suturing is at it's beginning and specially design devices are difficult to use. Also, such devices only exist as prototypes and production for the open market would be very expensive. Flexible stapling on the other hand barely exists right now. Endoscopic hemostasis methods still mostly involve injection and thermal probe methods, which are almost totally ineffective if used on large vessels during intra-abdominal surgery. Flexible endoscopic clips are very small and mostly have gaps which make them useless for hemostasis. A great variety of surgical graspers, dissectors, effective scissors do not exist in flexible endoscopy at present and if, they are too small and too weak for surgery.

Still, the industry is working on new inventions for NOTES: Semi-rigid scopes, a toolbox of more effective flexible instruments for surgery and robots in the field of NOTES are currently in development.

Gastroenterologists or surgeons - who should do NOTES?

The initial use of flexible scopes also arose the question weather the surgeon or the gastroenterologist will be the future practitioner of NOTES. The ideal NOTES executive should be an expert in abdominal anatomy, surgery and the handling of necessary instrumentation - that means at present: flexible scopes. The NOTES physician also has to be able to manage patients pre- and postoperatively and to treat complications. This includes full knowledge of how to convert a NOTES procedure into laparoscopy or open surgery. A considerable number of "older" surgeons have learned flexible endoscopy during their training. However, new curricula for NOTES have to be created. Surgeons of the future have to learn again techniques of advanced endoscopy. Even if flexible scopes are not used in NOTES sometimes in the future, knowledge in this field will still be mandatory for accessing the intraabdominal cavity.

We have have conducted a study comparing the initial performance of surgeons and surgically untrained individuals with flexible endoscopic equipment to the one of endoscopists in an easy, medium and difficult task. We found that the learning curve of surgeons is extremely fast and only after a short period their performance for the easy and medium task was comparable to the one of experienced endoscopists. Both initial performance and early learning curve of surgeons was superior when compared to surgically untrained individuals. These results underline that surgeons will learn the handling of a flexible scope quickly just the way they are able to integrate any other new surgical device into their daily practice. After all, abdominal operations are typically under the purview of the surgeons, not of the gastroenterologist.

Why should we do NOTES?

Still, one major question remains: Why should we do NOTES, what is the benefit? It seems likely that in the future NOTES will be performed without any abdominal wall incisions which could potentially lead to less or no wound infections, hernias, postoperative pain when compared to traditional approaches through the abdominal wall. Some physicians have even suggested that NOTES cases might be performed without anaesthesia. Furthermore, endoscopic, transluminal surgery might result in fewer adhesions...
intra-abdominally\textsuperscript{1}. However, all of these potential benefits have yet to be confirmed in scientific trials and are the subject of ongoing research now and in the future. Whatever results from these studies, one important outcome of NOTES appears already certain: NOTES will result in "scarless surgery". Various articles report that less invasive surgery results in better cosmetic outcomes from a patient's point of view\textsuperscript{16,19,20,21} and superior cosmesis is linked to better body image scores and better quality of life\textsuperscript{2}. Therefore, cosmesis should be rated as an important issue in abdominal surgery and might currently be underestimated. We have conducted a study concerning potential patient's opinion regarding scarless surgery by an onsite poll at the day of the open ward in 2007. We have found that people favor scarless abdominal surgery even if risks are increased. Not only therefore, cosmetic issues of NOTES are a major justification and a rationale for further research and investments. We are certain that the medical field will be once more - just like when laparoscopy started - pushed by the demands of the patient. We are convinced that NOTES will happen. However, even if none of the transluminal procedures become common, benefits will be gained by this ongoing surgical movement: Laparoscopic surgery will improve under this competition and become less invasive by resulting in smaller and fewer incisions. Gastroenterologist will profit greatly by the development of stronger, more surgically oriented instruments for secure and effective intraluminal procedures such as treatment of perforations and gastro-intestinal bleeding. However, besides all enthusiasts, patient's welfare has to remain our primary concern.

References