controversial topics in surgery

Natural orifice transluminal endoscopic surgery (NOTES)

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Twenty years ago, the majority of general surgeons were highly sceptical about the new procedure of laparoscopic cholecystectomy; indeed, laparoscopic general surgery was threatened by adverse media publicity against such developments on account of some well-publicised poor outcomes. Now, minimally invasive surgery has advanced to such a degree that organs from the oesophagus to the prostate can be extirpated safely using these techniques – to the advantage of patients. Mr Austin draws attention to the problems of intentional 'viscerotomy' and of current instrument performance in NOTES. Further commercial research and development of tissue glues, instruments, both manoeuvrable yet stable, and computer-driven navigation systems will be technically as exciting and

challenging to the new generation of consultant surgeons as laparoscopic surgery has been to the more senior of the readership. If NOTES surgery is to be undertaken in the endoscopy suite under intravenous sedation, as opposed to the operating theatre under general anaesthesia, even health commissioners may share the excitement! If training is closely regulated and the lessons from the initial experiences of laparoscopic surgery learned, then NOTES will surely find a place in the surgical practice of the future.

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Natural orifice transluminal endoscopic surgery (NOTES) – scar free or scary?

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Natural orifice transluminal endoscopic surgery (NOTES) involves flexible endoscopic access to internal body cavities, such as the peritoneum, via natural body orifices hence extending the concept of minimally invasive surgery allowing procedures to be performed without visible scars or somatic pain. Against these gains, NOTES requires some form of 'viscerotomy' – the deliberate perforation of an organ (not usually required by the operation itself) with the consequent risk of leakage. Whilst use of a dual-channel endoscope allows procedures to be performed in a manner approximating that of laparoscopic surgery (but using smaller, much less effective endoscopic instruments), employment of both hands in this way requires another operator to control the endoscope itself and endoscopic architecture (with the biopsy channels being close to and parallel to the camera) leads to loss of triangulation and a more technically challenging procedure. Finally, because the endoscope and instruments are flexible, attempting to push organs away for retraction purposes may lead

instead to flexing of the instrument and/or scope creating an unstable operative platform.

Technique

The main NOTES entry routes are oral (transgastric), anal (transcolonic/transrectal), urethral (transvesical) and transvaginal requiring a gastrotomy, colotomy, cystotomy and posterior colpotomy, respectively. In the transgastric approach, a standard gastroscopy is performed and a needle knife is used to create a small hole in the stomach wall through which a guidewire is threaded. An endoscopic balloon passed over the guidewire is then used to dilate the hole, through which the endoscope is then rail-roaded, following the balloon, into the peritoneal cavity. The gastroscopy, therefore, enters the peritoneal cavity through little more than a (balloon dilated) pinhole resulting in a tight seal around the gastroscopy, minimising leakage and leaving a

relatively small defect to close at the end of the procedure. However, although various clips, snares and prototype endoscopic suturing techniques have been used and are under development, reliable methods for closing even this relatively small enterotomy are presently lacking, leading to concerns regarding the possibility of postoperative leaks with consequent major sequelae for the patient. A further disadvantage of enterotomy creation from within the lumen is the inability to see outside the wall leading to the risk of damage to an external structure or to the enterotomy being wrongly sited (for example, into the lesser sac rather than the peritoneal cavity).

The transanal route (analogous to a colonoscopy with enterotomy creation in the colon or rectum) is similar to the transgastric route but with the increased risk of contamination due to the faecal bacterial load. The transurethral route has the advantages that the bladder is usually sterile and the small cystotomy required will heal without need for formal closure if a urinary catheter is left *in situ* for a few days. It has the disadvantage that, although it may allow peritoneoscopy, the size of the urethra will limit the removal of anything other than small biopsies via this approach. Its use to supplement NOTES procedures performed via other entry routes helping overcome triangulation problems encountered with the use of a single endoscope has been suggested.

The transvaginal route, having the advantages of both long-term experience (posterior colpotomy being a standard gynaecological procedure) and a safe (direct suture) closure mechanism, is presently the most commonly used access route in clinical NOTES work and allows a straight approach to the upper abdominal organs such as the gallbladder which is mechanically advantageous compared with the transgastric approach. However, this route excludes 50% of the population and its wide-spread use probably reflects the lack of a mechanism for safe gastrotomy creation and closure.

Technological challenges

The technical challenges of NOTES surgery resulting from poor instrumentation, lack of platform stability and loss of triangulation may be solved with technological advances. For example, inserting an 18-mm overtube from the entry orifice through the viscerotomy and locking it into position provides platform stability¹ and allows multiple 5-mm instruments (such as a camera, scissors and grasper) to be passed down it solving triangulation problems and creating an analogous situation to 18-mm single-port laparoscopy. Other technological advances such as robotic-armed or computer-driven endoscopes are at the prototype stage or beyond, but will have to be paid for and, like Concorde or putting men on the moon, what is technologically possible

may not be affordable unless driven by external forces such as patient demand.

The viscerotomy

One of the main arguments against the NOTES approach is the requirement for deliberate visceral perforation which may not otherwise be necessitated by the procedure being undertaken (a cholecystectomy, for example) clearly increasing the risks to the patient.^{2,5} However, much larger enterotomies than those required for NOTES access are already created in the closed abdomen during laparoscopic bypass or intra-abdominal colonic anastomosis procedures and there are reports of full-thickness, intraperitoneal colonic resections using transanal endoscopic microsurgery (TEMS) approaches without major sequelae; hence, the argument that the creation of an enterotomy (even a colonic one) in a closed abdomen is unsafe does not hold up.^{4,6} What is true is that (as described and unlike the laparoscopic procedures) safe methods for creating, and more importantly, closing the NOTES enterotomy are presently lacking⁷ and the question then becomes whether the risks of a viscerotomy are worth taking when balanced against the avoidance of the 3 or 4 small scars required to perform a much more straightforward laparoscopic procedure?

However, NOTES is not simply aimed at cosmesis; it also reduces somatic pain due to the absence of external incisions. (To compare the difference between somatic and visceral sensation consider the example of haemorrhoidal banding in which the rectal mucosa can be banded without sensation but, if the band is placed too close to the dentate line, the patient complains of severe pain). It is, therefore, likely that the viscerotomy itself may be entirely painless. Whilst it is true that much of the pain from laparoscopy may come from carbonic acid resulting from the CO₂ used to create the pneumoperitoneum rather than the small incisions themselves, the former might be avoided with the use of other insufflation gases such as helium. It is, therefore, theoretically possible that the reductions in pain possible using a NOTES approach would allow these procedures to take place under sedation in the gastroscopy suite rather than in main theatres under general anaesthesia giving NOTES an advantage over standard operative techniques.

Summary

The long-term promise of NOTES is not the avoidance of a few laparoscopic scars or in performing transvaginal cholecystectomy but in the possibility of performing surgery under sedation rather than general anaesthesia. Whilst present limitations in NOTES techniques mean both that it may currently be far from that stage and that almost all of the 400 or so NOTES-type procedures performed in human

patients to date have been performed transvaginally and involved a degree of laparoscopic help ('hybrid' procedures), many limitations may be solved via advances in technology. This may, however, be at some expense which may act as a further limiting factor in these days of healthcare rationing.

References

1. Swanstrom LL, Whiteford M, Khajanchee Y. Developing essential tools to enable trans-gastric surgery. *Surg Endosc* 2008; **22**: 600–4.
2. Buess G, Cuschieri A. Raising our heads above the parapet: ES not NOTES. *Surg Endosc* 2007; **21**: 835–7.
3. Agarwal BB, Agarwal S. Surgical pilgrimage – the need to avoid navigation through drains, medicine or 'medisin': our notes on NOTES. *Surg Endosc* 2008; **22**: 271–2.
4. Gavagan JA, Whiteford MH, Swanstrom LL. Full-thickness intraperitoneal excision by transanal endoscopic microsurgery does not increase short-term complications. *Am J Surg* 2004; **187**: 630–4.
5. Winter H, Lang RA, Spelsberg FW, Jauch KW, Hüttl TP. Laparoscopic colonoscopic rendezvous procedures for the treatment of polyps and early stage carcinomas of the colon. *Int J Colorectal Dis* 2007; **22**: 1377–81.
6. Narula VK, Hazey JW, Renton DB, Reavis KM, Paul CM, Hinshaw KE *et al*. Transgastric instrumentation and bacterial contamination of the peritoneal cavity. *Surg Endosc* 2008; **22**: 605–11.
7. Sclabas GM, Swain P, Swanstrom LL. Endoluminal methods for gastrotomy closure in natural orifice transenteric surgery (NOTES). *Surg Innovat* 2006; **13**: 23–30.

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