

Endoscopic ultrasound's vision: Probing our way to NOTES

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Natural orifice transluminal endoscopic surgery (NOTES) is a promising alternative to conventional surgery that can be performed with an endoscope passed through a natural orifice then through an internal incision in the stomach, vagina, or colon, thus avoiding any external incisions or scars and incision-related complications. The development of flexible endoscopic therapies has enabled more aggressive therapeutic endoscopy such as endoscopic submucosal dissection, full thickness resection and endoscopic necrosectomy. These techniques allow endoscopic treatment of an ever increasing array of diseases, including but not limited to extrinsic lesions to gastrointestinal (GI) tract.

Endoscopic ultrasound (EUS) can be used to look for a way to detect these lesions. Some studies show that EUS is feasible in providing evaluation and performing of NOTES procedures. It promises potential as a platform for future EUS-based NOTES.^[1-4] EUS-guided drainage of pseudocyst and EUS-guided transluminal retroperitoneal endoscopic necrosectomy of walled-off necrosis has now become accepted procedure over the past decade.^[5] Actually, this is the real day to day NOTES technique thus far. EUS has been shown to be safe and effective and is the first-line therapeutic method for uncomplicated pseudocysts. Although there

is still some debate on walled-off pancreatic necrosis (WOPN), multiple studies have now shown that these WOPNs also can be treated endoscopically with low morbidity and mortality rates. Although there is limited literature in this regard, EUS-guided drainage and debridement can also be successfully applied to others areas, such as the treatment of abscesses in the lower and upper abdomen.

Another revolutionary and ever increasing use of the NOTES technique is the endoscopic full thickness resection (EFTR) of GI stromal tumors (GISTs) which had needed open or laparoscopic surgery in the past. For GISTs, EUS is not only the first option for diagnosis, but also can be applied in predicting the maneuvers for EFTR^[6] and tunnel-type endoscopic submucosal dissection.^[7] Recently, the indications of ERTR have been expanded to early gastric cancer.^[8] I think the use of EUS will become a very valuable tool in detecting and helping to resect the lymph nodes surrounding the GI tract endoscopically in the foreseeable future.

Recently, several animal studies using EUS-based NOTES has been encouraging.^[1-4]

The 10-animal study^[1] has shown that transgastric NOTES interventions with a forward-viewing endoscopic ultrasound is a feasible technique. The procedures carried out included EUS evaluation and endoscopic biopsy of intraperitoneal organs, EUS-guided fine-needle aspiration, EUS-guided radiofrequency ablation, and argon plasma coagulation for hemostatic control. Saftoiu *et al.*^[4] reported

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EUS-guided cholecysto-gastrostomy in a porcine model is feasible based on prototype devices for access in the gallbladder and transgastric stent placement. The new stent can make a fistula between the GI tract and the gallbladder, which can be used to remove the stones from gallbladders. Therefore in the future, less and less gallbladders will be resected by surgery.

Matthes *et al.*^[3] reported that EUS is also a very good tool for NOTES study. In the study, the creation of artificial pancreatic tumors via EUS guidance is feasible. And it showed that pancreatic tumor enucleation using a transgastric NOTES approach is technically feasible and could be an alternative to laparoscopic distal pancreatectomy.

Although there is still a long way to go for NOTES, EUS has shown its guidance value for NOTES surgery. In the future, the GI tract will be considered as the service tunnel of human body using EUS, which not only can detect the lesions surrounding the GI tract, but also can be applied to find the perfect spot to perform the NOTES procedure. Further adoption and adaptation of EUS-based NOTES will require the development of more sophisticated specialized EUS and NOTES equipment to improve the safety profile of the procedure.

With the rapid development of new EUS techniques, the EUS journal has been indexed by PubMed and Science Citation Index Expanded. It really has been a dream coming true for all endosonographers. It

has created a new chapter in the history of EUS by raising its profile in the field of medical science. I now firmly believe the journal will continue to promote the development of all the new cutting edge techniques of EUS, including EUS-based NOTES.

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