

## Natural Orifice Specimen Extraction: The Past, Present and Future

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At the turn of the century, there was a debate as to the role and safety of laparoscopic colorectal surgery. A decade later, we have ample evidence to support the use of minimally invasive approach in colorectal cancer surgery. The advantage of less postoperative pain, shorter hospital stay and faster recovery was well proven [1]. The issues of attaining a non-inferior oncological outcome compared to the open approach and no increased postoperative complications were well addressed and reassured by high quality trials [2,3] Thereafter, attention was turned into further refinement of minimally invasive colorectal surgery. Examples included single incision laparoscopy and natural orifice transluminal surgery. These were in the spotlight for a few years but enthusiasm quickly waned. There are multiple reasons; yet, technological limitations were a major contributing factor.

One of these techniques to refine minimally invasive colorectal surgery is natural orifice specimen extraction (NOSE). In fact, this is not a novel technique but was described by Franklin in 1993 [4]. This technique obviates the need to make a separate incision for specimen retrieval after laparoscopic mobilization and transection of colon. Instead specimens are retrieved via a natural orifice, i.e. transanal or transvaginal. It has the potential to decrease surgical trauma and hence postoperative pain. External exposure to the intra-abdominal viscera would be minimized. The ultimate aim is to hasten recovery and provide better cosmetic result.

There are multiple variations to this technique. It depends on which segment of bowel one would like to resect and how the anastomosis is going to be performed. For example, for rectal cancer, one could perform a low anterior resection and retrieve the specimen by performing a transanal pull through. The proximal colon is returned to the peritoneal cavity after fixation of the anvil. The rectal stump is either stapled (double-stapling technique) or closed with sutures (single-stapling technique) to facilitate a stapled colorectal anastomosis. On the other hand, for a very low rectal tumor, one could also perform a ultra-low anterior resection, whereby an intersphincter resection is performed [5]. The anastomosis, after performing transanal pull-through and retrieval of specimen, is a hand-sewn coloanal anastomosis without the need to close the rectal stump. For high anterior resections where pull-through is not practical, the anvil is introduced into the peritoneal cavity via a rectotomy and fixed to the proximal sigmoid colon via a colotomy. The proximal and distal transections would be performed intracorporeally, followed by transanal extraction of the specimen [6]. There are also reports of right hemicolectomies with transvaginal extraction of specimen [7]. The extraction site is protected by the use of retrieval bag, wound protector or the Transanal endoscopic operation (TEO) device (Karl Storz, Germany).

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The technical feasibility of NOSE is not a major issue, as sophisticated instrument is not a must. But the following questions immediately follow. Does it produce actual clinical benefit? Does this technique cause increased risk of complications, e.g. pelvic collections due to contamination? Is there a risk of tumor seedling and is it oncologically safe for cancer patients? Does it cause unnecessary extraction site morbidities? Does it actually increase patient satisfaction by better cosmetic outcome?

Ma published a meta-analysis, which included nine studies that compared NOSE with conventional wound extraction of specimen [8]. A total of 837 patients were involved in these studies. One out of the nine studies was a randomized controlled trial. The rest were either prospective or retrospective comparative studies. The NOSE technique was associated with an additional 20.97 minutes [95% CI 4.33, 37.62] operating time. Yet, NOSE was associated with faster return of flatus for 0.59 days [95% CI 0.78, 0.41], lower postoperative pain score of 1.43 [95% CI 1.95, 0.90] and shorter hospital stay of 0.62 days [95% CI 0.95, 0.28]. All studies commented on postoperative complications and NOSE was associated with fewer complications, with an odds ratio of 0.51 [95% CI 0.36, 0.74]. This is mainly a result of reduced incidence of wound complications in the NOSE group. The disease free survival was only commented by two studies and both group were comparable. Cosmetic result were scored and compared in two studies. Pooled analysis showed 1.37 [95% CI 0.59, 2.14] point higher cosmetic rating in the NOSE group. Interestingly none of these studies reported a higher incidence of pelvic sepsis in NOSE or dyspareunia in patients with transvaginal specimen extraction. Wolthuis et al published a randomized control trial comparing NOSE colectomy and conventional laparoscopic colectomy [9].

The Cleveland Clinic Incontinence Score and anal manometric readings were comparable at 6 weeks and 3 months after surgery.

20 years later, Franklin, the one who popularized the technique of NOSE, published his own series of 303 patients. 277 patients underwent transanal specimen extraction and 26 had transvaginal extraction [10]. While this represents the largest case series of NOSE in the literature so far, the number of patients was far less than expected. Indeed on average there were only 1.26 patients undergoing this procedure a month. This leads to the question: what is hampering the application of NOSE? Indeed NOSE has to be very selective. One obvious determining factor is tumor size. The usual limit was 5 to 6cm. For obese patients, they are more prone to wound complications and should benefit from NOSE. However, one may hesitate from applying NOSE in this

group of patients, which increases the complexity to an already challenging operation. Other limiting factors for transvaginal extraction include gender, history of endometriosis and narrow vagina.

Yet we are seeing a surge in the amount of publications related to NOSE in recent years [11]: especially transanal extraction of specimen. This is largely a result of a novel technique: transanal total mesorectal excision. This is a down-to-up rectal dissection approach popularized by Sylla [12], Zorron [13] and Lacy [14]. With this type of rectal mobilization, specimen would be retrieved by transanal pull-through, except bulky tumors. Awaiting more data on the short and long-term clinical outcomes of transanal total mesorectal excision, we expect to see an increase in NOSE application, in particular transanal specimen extraction in the coming future.

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