

Overview of Natural Orifices Specimen Extraction in Colorectal Surgery

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Abstract: For the last three decades, different colorectal related to minimally invasive surgery techniques were developed. Those techniques reduced postoperative pain; wound complications also enhanced early reinitiating of bowel function and also decreased hospital stay duration. But incision formation for colorectal specimen retraction through abdominal wall 'mini-laparotomy' negatively impacts those advantages of minimally invasive surgery. Natural orifice specimen extraction (NOSE), which is the extraction of the specimen via normal anatomical openings connected to the external environment such as Anus and Vagina. The establishment of this technique is to eliminate the abdominal wall incision needed for the specimen retraction, which improves surgical trauma induced problems and brings positive outcomes. The beneficial outcomes observed in laparoscopic-assisted NOSE in colorectal cancer resections include postoperative pain reduction and less demand for analgesics, faster return of intestinal function and decrease of hospital stay time. Besides the demonstration of the goodness of this technique in colorectal surgery, some shortage also had reported. Since there are no standardized and generalized criteria of patient selections, who could optimally benefit from NOSE procedures still needs further and deeper defining. In this review, we are focusing on the two most practised NOSE methods; transanal and transvaginal NOSEs in terms of their benefits and hazards.

Keywords: Natural orifices specimen extraction; Colorectal surgery; NOSE

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Data resource

A search of the literature was performed using Pub Med(MEDLINE) and EMBASE database. We used the following keywords for literature searching: Natural orifices specimen extraction; Colorectal; Minimal invasive with(transanal or transvaginal extraction); and Colorectal NOSE feasibility. And the publication language was restricted as merely English.

I. Background

Colorectal cancer is the third most common cancer globally with nearly 1.7 million new cases diagnosed and over 800,000 deaths per year^[1].

Laparoscopic colorectal cancer resections are associated with improved outcomes and lesser complications compared to open surgery^[2,3]. Even though laparoscopic colorectal has those advantages, but still has a significant morbidity associated with abdominal wall incisions for specimen extraction, which the size of the incision is dependent on that size of the specimen needed to extract, those incisions impact postoperative somatic pain, post portative infections and surgical site hernia^[4-7]. So Natural orifice specimen extraction (NOSE). Has been designated for abdominal cavity specimen extraction via natural anatomic pathways or channels instead of trans-abdominal incisions^[8-14] to eliminate surgically or at least further reduce wound-related complications, which generally happens in trans-abdominal wall extractions.

In early 1990s Stewert et.al^[15] and Nezhat^[16] were among those who first demonstrated transvaginal colectomy specimen extraction, but now this skill is successfully introduced in the treatment of inflammatory bowel disease, diverticulitis as well as colorectal malignances^[17]. In 1993 Franklin^[18] first reported transanal segmental colectomy. And present day there is a large number of cases undertaken via either trans-anal, vaginal, colon or rectum NOSEs for cancer lesions or benign pathologies from the cecum to rectum^[17]. In 2006 Person et al.^[19] reported successful total mesocolon resection (TMR) excision with NOSE. In this review, we are focusing on the benefits and adverse outcomes of the two most frequently used NOSE techniques(transanal and transvaginal procedures) and the recent progresses made.

Benefit and Adverse Of NOSEs

Transvaginal and Transanal specimen extraction are the two most frequently used NOSE approaches for their safety and feasibility in colorectal surgery. In this article, we are focusing on these two methods, even though there are some other NOSE routes include transrectal and transcolon methods. Each of transanal and transvaginal procedures improves the physiological and psychological conditions of the patients since these procedures eliminated abdominal wall incisions. Which might have negative impacts on patients feeling about their physical outlook.

The transvaginal method was first used for gallbladder retrieve^[20] and later progressed for colon, renal and spleen extractions^[21-23]. Vaginal route plays a dominant role in NOSE because of its elasticity and preferable healing^[24, 25], but its limitations are that it is only beneficial for female patients and requires an extra incision of noninvolved organ^[26]. So, in colorectal cancer resections, most surgeons put transvaginal as their second option after transanal route as this is gender independent. And they switch into transvaginal when transanal extraction couldn't accomplish intraoperatively or when was not expected to be possible ahead surgery^[27]. Comparing conventional laparoscopic colorectal surgery with abdominal extractions to open surgery, they both share incisional induced complications, since both of them affect abdominal wall intact. Performing NOSE technique in colorectal lesion reduces these problems. Previous studies have shown that laparoscopic- assisted NOSEs had diminished postoperative analgesic need, reduced trauma complications, lowered pain scores, also decreased hospital stay time and enhanced early return of physiologic bowel function^[28-33], incisional hernia is one of most often happen complication with incidence rate of as high as 17% at incision site, which falls into 0% when performing NOSEs^[34]. There some worry, whether the NOSEs could induce tumour plantation of the orifices during specimen extraction when the specimen contains tumour cells since some studies already suggested that trans-abdominal extraction could induce extraction and portal sites metastasis^[17]. And two years follow up of patients underwent transanal extraction without wound protection showed no extraction site metastasis using recto-anal povidone-iodine cleaning before and after the procedure^[35]. Another issue of questioning is that of the infection of the organ for extraction. There are studies shown even though there are higher contaminations(100%) in NOSE in comparison to conventional extractions(89%), but this has no clinical infectious outcome differences between the two^[36-38]. In transvaginal route, there are concerns over the posterior colpotomy to induce unintended complications such as dyspareunia or infections. But previous studies have shown that colpotomy is safe and not induce dyspareunia, site infections or post-operation morbidity^[39,40], and gynecologists leave this without closing after specimen extraction routinely^[41]. Patients with short or thick mesentery and or deep abdominal wall will benefit from NOSEs because this group of patients normally come across with difficulties in transabdominal specimen removal^[42,43]. Cosmesis is another advantage achieved by laparoscopic-assisted NOSEs compared to conventional laparoscopic surgery^[43]. All these positive advantages in previous studies are results of strict patient selection inclusion criteria, and following characteristics of the patients in these studies one can formulate who could most benefit from NOSE procedures, to get optimal treatment outcomes.

Factors impacting NOSE feasibility

Factors that could influence the feasibility of the procedure consists of patient factors and specimen factors.

Gender of the patient, size and bulkiness of specimen or the tumor, the location of the lesion, body mass index and anatomical structure differences among patients, all these are factors that affect laparoscopic assisted NOSEs success or failure rates^[44].

Patient factors

Sex

Large specimens are the major reason for unsuccessful NOSE in colorectal cancer. Because female patients can go through transvaginal route, which has capable for bulky specimen extraction. This is a significant factor for successful NOSE in females compared to men. The elastic characteristic of the vagina allows retrieval of more bulky specimen and when fail to extract via anus it could more easily remove via vagina. The mean size of retrieved through the two routes; vagina/anus were 3.5±3.1 and 5.4±1.4cm respectively^[44]. But some other studies shown extraction of as large as 8~9cm sized specimens through vagina^[45]. Even though most studies haven't designed pelvic shape of the two sexes as a criteria for or influencing factor for anal or vaginal NOSE failure, but this also could contribute in some extent and should kept in mind.

Body mass index(BMI)

Large BMI has a negative impact on colorectal NOSE, and overweighed patients have technical difficulties when performing NOSE procedures. As the BMI increases the overall visceral fat increases too.

Which leads enlargement or bulkiness of the specimen^[46]. So in most literature reports, BMI>30kg/m² is excluded from the selection, or if included, the success rate is not promised^[46]. So one should carefully make the patient selection in the basis of BMI, to reduce the failure rate of NOSEs.

Other medical co morbidities and previous surgeries also affects the NOSE procedures.

Specimen factors

Size

When the size of the specimen is big enough, it is hard to exteriorize from anal canal, and then switched to transvagina which is more capable for large-sized specimens, and the more the size increases the more failure rate increases. In most literature related to NOSE procedure in colorectal surgery, demonstrate length, width of the specimen and or tumor size, but a few of them describe characteristic of the specimens failed to retrieve via natural orifices. Most of the studies define tumor size >6.5cm as exclusion criteria. One study have shown >90% of success rates in small size specimens^[44]. In this study included big range of specimen sizes(width 4.6±3.4cm; and length of 25.2±22.6cm). the shape, location and consistency of the specimen also have an impact on the feasibility of the procedure.

Pathology character and location

In colorectal cancer, when lesion size is bigger, it increases the failure of NOSE procedure. In other colorectal inflammatory diseases such as diverticulitis and inflammatory bowel disease increase the bulkiness and the size of the specimen which also have negative impact on the NOSE success. And this still remains to clarify in the future studies, since no previous studies focused on this particular issue^[47].

Anatomy location of the specimen is another affecting factor of NOSE failure, whenever the disease location is far proximal, the transanal NOSE become more difficult to carry out. And distal lesions have more success rates than the proximal ones and have reported 96.7% success rates in rectal disease and 54.5%^[44] in colon lesions. Right hemi-colon pathologies is more feasible trans-vaginal NOSE than the transanal, which is only possible in females^[18, 48, 49].

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