



# Benign and malignant colorectal pathologies for natural orifice specimen extraction surgery

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**Abstract:** Colorectal surgical procedures are frequently performed today. Improvements in technology and surgical techniques, increased experience, and proved better outcomes have provided colorectal surgery (CRS) to evolve from traditional open techniques to minimally invasive techniques. Laparoscopic approaches have many advantages compared to open approaches, and lesser abdominal wall trauma due to smaller incisions plays an important role in these advantages. However, additional incisions may be needed for specimen extraction or anastomosis after laparoscopic resections, and these minimize the benefits of laparoscopy. Therefore, with the aim of reducing surgical incisions and related trauma, natural orifice specimen extraction surgery (NOSES) emerged. To date, NOSES has been performed with success in different benign and malignant colorectal diseases. Furthermore, the comparative studies showed its advantages over conventional laparoscopic surgery (CLS) in terms of postoperative pain, postoperative convalescence, length of hospital stay, and cosmesis. In the literature, most of the studies about NOSES for colorectal diseases focused on malignant indications and there is a paucity of published data on benign ones. Technically, NOSES seems to be safe and feasible to perform in all colorectal pathologies, but it can not be performed on all patients due to patient or specimen-related factors. Finally, it serves as an important transitional step towards achieving scarless surgery, which is the trend in modern surgical practice.

**Keywords:** Natural orifice specimen extraction (NOSE); natural orifice specimen extraction surgery (NOSES); natural orifice surgery; indication; disease

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## Introduction

Colorectal surgical procedures are among the most common surgical procedures in general surgery practice. Technological improvements, advanced surgical techniques, increased experience, and better outcomes have provided colorectal surgery (CRS) to evolve from traditional open techniques to minimally invasive techniques, and this

evolution continues as a dynamic process.

Previously it was proved that laparoscopic CRS is superior to open surgery in terms of short-term outcomes such as hospital stay, complications, and recovery (1). The use of smaller incisions and consequent less abdominal wall trauma have an impact on these advantages of laparoscopy in the early postoperative period. But additional incisions

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may be needed for specimen extraction or anastomosis after laparoscopic resections, and decrease the benefits of laparoscopy. Therefore, to decrease surgical incision related trauma, surgeons try to improve the operative techniques in line with being less invasive. Single port laparoscopic operations, transanal endoscopic operations, and natural orifice specimen extraction surgery (NOSES) emerged as the result of these efforts.

NOSES aims to complete the operations as minimally invasive as possible. For this purpose, dissection, resection, and anastomosis are performed intracorporeally and the specimen is taken out of the abdomen through a hollow organ that opens outside the body such as the mouth, vagina, and anus (2). It eliminates the auxiliary incision for specimen extraction, in this way the only trauma to the abdominal wall remains for trocars. NOSES was performed safely and successfully for many abdominal operations such as adrenalectomy (3), hepatectomy (4), and especially colorectal resections (5,6). It was specified that NOSES has benefits on postoperative pain, recovery, length of hospital stay, and cosmesis in CRS (2).

Most of the studies about NOSES in CRS focused on malignant pathologies (7) and there is very little data on benign pathologies (8). In this article, we aimed to review and present both malignant and benign colorectal pathologies managed with NOSES in the published literature. While the diseases that are commonly studied in the literature were presented under a separate heading, the diseases about which there aren't sufficient specific studies were presented in the "Others" section, with the aim to indicate their names rather than their results.

### Colorectal cancer (CRC)

CRC is one of the most common malignancies, and the main treatment is surgery. It is frequently encountered in CRS practice and is the target of novel surgical approaches such as NOSES. Recently, NOSES has created a new trend in the surgical treatment of CRC, especially in China (9).

The feasibility, safety, and outcomes of NOSES in CRC have been the subject of many studies. A meta-analysis of randomized controlled trials comparing NOSES versus conventional laparoscopic surgery (CLS) in CRC revealed that NOSES had a longer operation time, less intraoperative blood loss, shorter hospital stay, shorter return of bowel function, less postoperative pain, fewer postoperative complications, and better cosmetic results (9). The results of other meta-analyses were also similar to those mentioned

above (10,11). The benefits of NOSES were related to each other as follows; lower postoperative pain causes patients to become active earlier, which results in an earlier return of bowel functions, and earlier return of bowel functions with fewer postoperative complications decreases the length of hospital stay (10). The lower postoperative complication rate in NOSES was mostly related to lower wound-related complications, the anastomotic complications (9-11) and intra-abdominal infections (10,11) didn't differ significantly. In their meta-analysis, Chin *et al.* (8) examined both malignant and benign diseases resected via NOSES or CLS and emphasized that NOSES has more benefits for patients with malignancy. This is especially important, because there may be need for adjuvant therapies due to malignancy, and faster recovery after NOSES may provide adjuvant therapy to begin earlier.

When a novel surgical procedure is suggested for the treatment of a malignant disease, a significant evaluation criterion should be the oncological adequacy of this procedure; the number of harvested lymph nodes (10,11) and the adequacy of surgical margins (11) may be used to assess the oncological outcomes. Several studies showed no significant differences in terms of the number of dissected lymph nodes between NOSES and CLS (10,11). This is already an expected result because in NOSES the dissection part is the same as in CLS (10). In a meta-analysis, although it was mentioned only in three non-randomized controlled trials, no differences were found in proximal and distal resection margins when comparing NOSES and CLS (11). In addition, no difference in circumferential resection margin was detected, although few studies provided that data (11).

For a malignant disease, the effects of a new surgical approach on overall and disease-free survival are significant issues. The studies concluded that NOSES doesn't have a negative effect on overall survival (8-10), recurrence (8,9), and disease-free survival (8,10) when compared with CLS. It should also be noted that, as stated in one study, surgeons tend to perform NOSES on smaller tumors (8). The possibility of iatrogenic tumor cells implantation during specimen extraction via natural orifices worries surgeons. Previous data about port-site metastases after laparoscopy raises this concern (12). In a study by Park *et al.* (13), no extraction site (via vagina or rectum) recurrence was found in 138 patients who underwent NOSES. In another study, peritoneal fluid samples were collected for cytological assessment after NOSES and no malignant cell was encountered (14). Protection instruments (such as a

specimen bag) and careful manipulation were used to avoid implantation and direct contact of the sample with the extraction site (2) and in our opinion, these are essentials for a safe NOSES.

Postoperative anal and vaginal functions are other areas of concern for NOSES practice. With these concerns, pelvic floor function after NOSES and CLS were compared, and no significant differences were observed (15,16). Similar results were also seen in anal function assessments (13,16). Colpotomy performing for transvaginal NOSES may be considered to be risky for sexual dysfunction, but such a complication has not been reported (12).

Some limitations may occur while performing NOSES for malignancy. One of the major limitations is the tumor or specimen size. NOSES is more likely to fail when performed for larger tumors (12). An international consensus has recommended a circumferential specimen diameter <3 cm for transanal NOSES and <5 cm for transvaginal NOSES (2). Other recommendations based on tumor characteristics were no locally advanced tumor, no obstruction or perforation, and <T4 tumor (2). In addition, the location of the lesion may be another limitation. It was previously noted that NOSES may be more successful in distally located lesions (12).

## Endometriosis

Endometriosis is seen in women of reproductive age and has a negative impact on fertility and quality of life. It may present with bowel infiltration and mostly affect the sigmoid colon and rectum in the intestinal system. The laparoscopic approach is the gold standard surgical treatment option in such cases, and some of them are required colorectal resections to obtain complete clearance (17).

In the attempt to minimize surgical incisions as in other surgical fields, NOSES has been performed on patients with endometriosis too. Boni *et al.* (18) performed transvaginal NOSES on 11 patients with severe endometriosis and revealed that this approach is safe and feasible with good outcomes. Similarly, in another study, 33 women with endometriosis underwent totally laparoscopic rectosigmoid resection with transvaginal specimen extraction and no NOSES-related complications were seen (19). The authors also noted that cosmetic concerns may be critical since patients with endometriosis are young and the disease is benign, although it should not be the only factor in the choice of surgical technique (19). Comparative studies found NOSES to be more advantageous in terms of operative

time (20,21), intraoperative blood loss (21), postoperative pain (21), and length of hospital stay (20) compared to CLS in bowel endometriosis.

In the literature, most of the studies on bowel endometriosis and NOSES are case series and there is a lack of comparative, randomized, or prospective studies. Therefore, more data are needed to make more definite conclusions.

## Diverticulitis

Diverticulitis is the inflammation or/and infection of an abnormal intestinal wall pouch called diverticula. It is characterized by acute attacks and can become complicated by causing intra-abdominal abscess, fistula formation, gastrointestinal bleeding, bowel stenosis, bowel perforation, and peritonitis. If diverticulitis becomes complicated or there are chronic relapses that adversely affect the quality of life, surgical therapy may be needed in both elective or emergency conditions (22). NOSES can be considered as an alternative approach when surgical treatment is required.

Diverticulitis may cause bulky specimens due to inflammation, therefore, it may be thought that it is difficult to perform NOSES (12). But successful NOSES were performed for diverticulitis. In a study containing 17 patients who underwent laparoscopic sigmoidectomy with transanal specimen extraction for diverticulitis, only for one patient (5.8%) the extraction was aborted due to a bulky specimen (23). Leroy *et al.* (24) didn't face any intraoperative complications or failure due to specimen extraction in 16 patients who underwent NOSES due to diverticulitis. In addition, the postoperative course was well-tolerated in the patients (24).

Although studies comparing NOSES and CLS are few, in a study in which 75% of the patients had diverticulitis, less postoperative pain, less analgesic requirement, and better cosmesis were observed in the NOSES group (25). In another study, although the need for analgesics was significantly lower in the NOSES group, there was no significant difference in pain scores (23).

Opening the rectum in the peritoneal cavity raises concerns about tumor seeding and peritoneal contamination. Leroy *et al.* (24) reported that all peritoneal cultures were positive for polybacterial growth in patients who underwent sigmoidectomy via NOSES for diverticulitis, while no infective complications were observed. Costantino *et al.* (23) reported a higher level of peritoneal contamination in transanal specimen extraction

in laparoscopic left-sided colorectal resections for sigmoid diverticulitis than in transabdominal extractions. However, the difference was not statistically significant.

## Others

In the literature, there are studies including NOSES performed for different pathologies, but most of them didn't present specific results for specific indications, their results are mostly a composition of more than one pathology (7,25). Additionally, there are small sample size case series for some specific indications.

A review examined 15 total colectomies with NOSES. This study included 11 patients with colonic inertia, two patients with attenuated familial polyposis coli, and one patient with hereditary non-polyposis coli (26). The authors recommended transanal extraction after laparoscopic total colectomy as the first choice for such benign diseases that don't require mesenteric resection (26). Palanivelu *et al.* (27) performed laparoscopic total proctocolectomy and transvaginal specimen extraction due to familial adenomatous polyposis with upper rectal carcinoma in seven women, all the attempts were successful, and no serious complication occurred both intraoperatively or postoperatively.

Ten patients with ileocaecal Crohn's disease were enrolled for endoscopic transcolonic specimen extraction after laparoscopic ileocolic resection by Eshuis *et al.* (28), the success rate was 80%, and extraction was not possible due to large specimen sizes in two patients. The authors stated that the technique is feasible, but its benefit was unclear (28). In another study, 18 patients with large rectal adenoma were treated via laparoscopic resection with transanal specimen extraction, no conversion was needed, and the success rate was 100% (6). Besides, no serious complication was seen both in early or long-term follow-up (6).

Apart from the diseases mentioned above, NOSES has been performed for volvulus (7), stricture (7), perforation (7), rectal prolapse (29), ulcerative colitis (30), and lipoma (31) in various studies in the literature.

## Conclusions

The modern surgical practice has a trend to reduce surgical trauma and incisions. In this way, it is aimed to eliminate incision-related problems and achieve scarless surgery.

NOSES seems to be a safe and feasible technique, which offers benefits for both malignant and benign colorectal diseases. Technically, NOSES can be performed in all colorectal pathologies, but there is an important limitation that it can't be performed on all patients due to some patient-related (the transvaginal route is only used in females, higher body mass index may be associated with larger specimen size and this may affect the NOSES success) or specimen-related (for proximally located pathologies and larger specimens (>3 cm for the transanal route, >5 cm for the transvaginal route) it is harder to perform NOSES) factors.

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## References

1. Wang CL, Qu G, Xu HW. The short- and long-term outcomes of laparoscopic versus open surgery for colorectal cancer: a meta-analysis. *Int J Colorectal Dis* 2014;29:309-20.
2. Guan X, Liu Z, Longo A, et al. International consensus on natural orifice specimen extraction surgery (NOSES) for colorectal cancer. *Gastroenterol Rep (Oxf)* 2019;7:24-31.
3. Sumer F, Bag YM, Aydin MC, et al. Mini-laparoscopic adrenalectomy with transgastric specimen extraction. *Updates Surg* 2021;73:1487-91.
4. Aydin MC, Bag YM, Gunes O, et al. Comparison of Natural Orifice Versus Transabdominal Specimen Extraction Following Laparoscopic Minor Hepatectomy. *Indian J Surg* 2022;84:288-93.
5. Gundogan E, Kayaalp C, Gokler C, et al. Natural orifice specimen extraction versus transabdominal extraction in laparoscopic right hemicolectomy. *Cir Cir* 2021;89:326-33.
6. Zhang XM, Wang Z, Hou HR, et al. A new technique of totally laparoscopic resection with natural orifice specimen extraction (NOSE) for large rectal adenoma. *Tech Coloproctol* 2015;19:355-60.
7. Chen MZ, Cartmill J, Gilmore A. Natural orifice specimen extraction for colorectal surgery: Early adoption in a Western population. *Colorectal Dis* 2021;23:937-43.
8. Chin YH, Decruz GM, Ng CH, et al. Colorectal resection via natural orifice specimen extraction versus conventional laparoscopic extraction: a meta-analysis with meta-regression. *Tech Coloproctol* 2021;25:35-48.
9. Zhou Z, Chen L, Liu J, et al. Laparoscopic Natural Orifice Specimen Extraction Surgery versus Conventional Surgery in Colorectal Cancer: A Meta-Analysis of Randomized Controlled Trials. *Gastroenterol Res Pract* 2022;2022:6661651.
10. Wang S, Tang J, Sun W, et al. The natural orifice specimen extraction surgery compared with conventional laparoscopy for colorectal cancer: A meta-analysis of efficacy and long-term oncological outcomes. *Int J Surg* 2022;97:106196.
11. Lin J, Lin S, Chen Z, et al. Meta-analysis of natural orifice specimen extraction versus conventional laparoscopy for colorectal cancer. *Langenbecks Arch Surg* 2021;406:283-99.
12. Izquierdo KM, Unal E, Marks JH. Natural orifice specimen extraction in colorectal surgery: patient selection and perspectives. *Clin Exp Gastroenterol* 2018;11:265-79.
13. Park JS, Kang H, Park SY, et al. Long-term outcomes after Natural Orifice Specimen Extraction versus conventional laparoscopy-assisted surgery for rectal cancer: a matched case-control study. *Ann Surg Treat Res* 2018;94:26-35.
14. Ngu J, Wong AS. Transanal natural orifice specimen extraction in colorectal surgery: bacteriological and oncological concerns. *ANZ J Surg* 2016;86:299-302.
15. Li XW, Wang CY, Zhang JJ, et al. Short-term efficacy of transvaginal specimen extraction for right colon cancer based on propensity score matching: A retrospective cohort study. *Int J Surg* 2019;72:102-8.
16. Tang Q, Zhu Y, Xiong H, et al. Natural Orifice Specimen Extraction Surgery versus Conventional Laparoscopic-Assisted Resection in the Treatment of Colorectal Cancer: A Propensity-Score Matching Study. *Cancer Manag Res* 2021;13:2247-57.
17. Bravo R, Blaker K, Pigazzi A. Totally intracorporeal robotic en bloc resection for deep infiltrating endometriosis of the rectovaginal wall with natural orifice specimen extraction. *Tech Coloproctol* 2019;23:589-91.
18. Boni L, Tenconi S, Beretta P, et al. Laparoscopic colorectal resections with transvaginal specimen extraction for severe endometriosis. *Surg Oncol* 2007;16 Suppl 1:S157-60.
19. Ghezzi F, Cromi A, Ciravolo G, et al. A new laparoscopic-transvaginal technique for rectosigmoid resection in patients with endometriosis. *Fertil Steril* 2008;90:1964-8.
20. Bokor A, Lukovich P, Csibi N, et al. Natural Orifice Specimen Extraction during Laparoscopic Bowel Resection for Colorectal Endometriosis: Technique and Outcome. *J Minim Invasive Gynecol* 2018;25:1065-74.
21. Wolthuis AM, Meuleman C, Tomassetti C, et al. Laparoscopic sigmoid resection with transrectal specimen extraction: a novel technique for the treatment of bowel endometriosis. *Hum Reprod* 2011;26:1348-55.
22. Lock JF, Galata C, Reißfelder C, et al. The Indications for and Timing of Surgery for Diverticular Disease. *Dtsch Arztebl Int* 2020;117:591-6.
23. Costantino FA, Diana M, Wall J, et al. Prospective evaluation of peritoneal fluid contamination following transabdominal vs. transanal specimen extraction in laparoscopic left-sided colorectal resections. *Surg Endosc* 2012;26:1495-500.
24. Leroy J, Costantino F, Cahill RA, et al. Laparoscopic resection with transanal specimen extraction for sigmoid diverticulitis. *Br J Surg* 2011;98:1327-34.
25. Wolthuis AM, Fieuws S, Van Den Bosch A, et al. Randomized clinical trial of laparoscopic colectomy with or without natural-orifice specimen extraction. *Br J Surg*



- 2015;102:630-7.
26. Gundogan E, Aktas A, Kayaalp C, et al. Two cases of laparoscopic total colectomy with natural orifice specimen extraction and review of the literature. *Wideochir Inne Tech Maloinwazyjne* 2017;12:291-6.
  27. Palanivelu C, Rangarajan M, Jategaonkar PA, et al. An innovative technique for colorectal specimen retrieval: a new era of "natural orifice specimen extraction" (N.O.S.E). *Dis Colon Rectum* 2008;51:1120-4.
  28. Eshuis EJ, Voermans RP, Stokkers PC, et al. Laparoscopic resection with transcolonic specimen extraction for ileocaecal Crohn's disease. *Br J Surg* 2010;97:569-74.
  29. Can MF, Asoglu O, Lapsekili E, et al. Laparoscopic resection rectopexy with preservation of the superior rectal artery, natural orifice specimen extraction, and assessment of anastomotic perfusion using indocyanine green imaging in rectal prolapse. *Dis Colon Rectum* 2014;57:1441.
  30. Lacy AM, Saavedra-Perez D, Bravo R, et al. Minilaparoscopy-assisted natural orifice total colectomy: technical report of a minilaparoscopy-assisted transrectal resection. *Surg Endosc* 2012;26:2080-5.
  31. Wolthuis AM, de Buck van Overstraeten A, Fieuws S, et al. Standardized laparoscopic NOSE-colectomy is feasible with low morbidity. *Surg Endosc* 2015;29:1167-73.

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