


Transanal and Transvaginal Specimen Extraction in Laparoscopic Colorectal Surgery

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ABSTRACT

Due to its advantages, minimally invasive surgery has become a standard treatment approach in many surgical operations today. To address the complications associated with enlarged wounds for specimen extraction after minimally invasive surgery, the natural orifice specimen extraction (NOSE) method has been developed, allowing specimens to be extracted through natural openings. In addition to the existing advantages of laparoscopy, this method significantly reduces the rates of postoperative pain, infection, and hernia development.

Laparoscopic colectomy is frequently used in colorectal surgery. However, the specimen is typically extracted via mini-laparotomy. There are four potential approaches for extracting the specimen through natural openings after laparoscopic resection: transanal, transurethral, transoral, and transvaginal. In colorectal surgery, NOSE is generally categorized into two main approaches: the transanal and transvaginal routes, depending on the type of specimen extraction. Each of these methods has its own advantages and disadvantages.

This article aims to provide information on the transanal and transvaginal methods used for specimen extraction through natural openings in laparoscopic colorectal surgery and to compare these two approaches. Although specimen extraction via natural openings is a complex surgical procedure, it offers potential advantages. However, it requires advanced laparoscopic expertise. The transanal route can be used safely, particularly for early-stage and small-scale tumors, while the transvaginal route can be safely applied in female patients with larger lesions.

1. Introduction

Minimally invasive surgery has become a standard treatment approach in many surgical procedures today due to its well-known advantages such as shortening hospital stay, reducing wound complications, and improving cosmesis.^[1,2] Although complex surgical procedures are performed in minimally invasive surgery, enlargement of the trocar entry site or additional incisions from a different area of the abdominal wall are often needed to extract the specimen. The increase in incision size contradicts the main aim of minimally invasive surgery.^[3] This issue has led to the development of methods called natural orifices specimen extraction surgery (NOSES).^[4]

Laparoscopy is frequently used because of its significant contributions to the treatment of colorectal diseases. Laparoscopic surgery has proven advantages.^[5,6] The advantages of NOSES include an even shorter recovery time.

Consequently, the incidence of abdominal wall hernia, surgical site infection, and postoperative pain is reduced.^[7-9]

There are four potential approaches for extracting the specimen from natural openings after laparoscopic resection: transanal, transurethral, transoral, and transvaginal. In some studies in the literature, the term transanal is further subdivided into transanal, transrectal, and transcolonic. In colorectal surgery, NOSES is generally categorized into two types, transanal and transvaginal NOSES, based on the type of specimen extraction.^[10]

2. History

Laparoscopic colon resection was first reported by Jacobs in 1991.^[11] Franklin et al.^[5] described the first transanal specimen extraction via flexible sigmoidoscopy in 1993. In 1996, Redwine et al.^[6] first performed transvaginal extraction of the colon after laparoscopic segmental colectomy.

In the same year, Kim et al.^[12] performed transvaginal extraction of the rectum after laparoscopic low anterior resection.

The only study in the literature comparing transanal and transvaginal specimen extraction in laparoscopic colon surgery was conducted by Franklin et al.^[4]

3. Techniques

In general, the method used by the authors for NOSES is similar. Patients are operated on under general anesthesia in the modified Lloyd-Davies position. The transanal and transvaginal areas to be used for extraction are routinely lavaged with povidone-iodine solution. Pneumoperitoneum is created through the umbilicus using a Veress needle. Trocar sites are arranged according to the resection area. In most cases, four trocars (12 mm, 10 mm, and 2×0.5 mm) are used. The camera trocar is placed in the umbilical region, while the other trocars are positioned based on the disease's location.

Following radical surgical principles, the operation is performed laparoscopically. Subsequently, different procedures are applied for the laparoscopic-assisted approach and NOSES.

For specimen extraction after laparoscopic resection, the transanal route is chosen as the first option. If this fails or is deemed unsuitable, the transvaginal route is attempted in female patients. If both methods fail, the specimen is considered unsuitable for NOSES and is extracted through an abdominal wall incision.

3.1. Transanal Specimen Extraction Technique

The distal border is separated with staples. If the distal border is long enough, the stapled part of the rectal stump is resected, and the specimen is transanally extracted from the lumen. The upper limit of the anal region is determined and resected, and the anvil is placed into the abdomen through this site. The proximal end, closed with the stapler, is reopened, and the anvil is pushed into the proximal intestine. An end-to-side or end-to-end anastomosis is then performed.

3.2. Transvaginal Extraction Technique

After laparoscopic resection, the specimen is placed in a protective sheath. Using a grasper, the end of the bag is brought closer to the lower part of the abdomen, towards the Douglas pouch. The patient is positioned in the Trendelenburg and lithotomy positions. The uterus is tractioned. An orifice approximately 3 cm in size is opened and widened with a horizontal incision from the posterior superior vagina through the transvaginal route. A clamp is inserted through this opening, and the specimen bag with its contents is extracted. The posterior fornix is then closed with absorbable sutures.

Laparoscopic colon and rectal surgery requires experience with open methods as well as mastery of advanced laparoscopic techniques. Initially, port site metastases

and technical difficulties hindered the rapid adoption of laparoscopic colon surgery compared to other laparoscopic procedures. Later, comparative multicenter studies demonstrated that laparoscopy is at least as safe as open methods, leading to its broader acceptance.^[7]

Laparoscopic-assisted colectomy is the most frequently performed method in colorectal surgery worldwide. After the colon is released laparoscopically, the specimen is removed via minilaparotomy. In global literature, laparoscopic-assisted colectomy is generally referred to as laparoscopic colectomy or conventional laparoscopic colectomy. In real terms, total laparoscopic colectomy involves the extraction of the specimen through natural orifices and intracorporeal anastomosis. NOSES achieves this goal.

3.3. Extraction of the Specimen

The transanal route is primarily preferred for specimen extraction after resection. However, if the lesion is located close to the anal verge or the mass is too large to be extracted through the anal canal, transvaginal extraction is preferred in suitable female patients.

There is a risk of rectal injury with transvaginal extraction. Compared to transanal access, adjacent organs, especially the sigmoid colon and rectum, are more easily injured during transvaginal specimen extraction, which can result in longer recovery and hospital stays.^[3] To minimize the risk of rectal injury during transvaginal extractions, it is beneficial to protect the rectum with a horizontal incision from the transvaginal posterior fornix and, if necessary, enlarge the incision horizontally. It is also crucial to make the incision as posterior-superior as possible so that it overlaps the peritoneal reflection.

Complications can be avoided by using the laparoscope's light to observe the transluminal view from the posterior cervix and by monitoring intra-abdominal localization during uterus traction while making the posterior fornix incision. If the patient has undergone a hysterectomy, performing a vaginotomy at the apex of the vagina instead of the posterior fornix is more practical. Additionally, since exposure is better in patients who have undergone hysterectomy, manipulations become easier.

In the study by Sanchez et al.,^[13] the vagina was identified as the most practical and widely used area for specimen extraction. Since the bowel segment is resected in front of the rectum during transanal extraction, exposure can be more comfortable. This can be an advantage for transanal extractions.

3.4. Intracorporeal Anastomosis

In our opinion, the most reliable type of anastomosis in NOSE surgery involves the proximal and distal closure of the lesion with a stapler, resection, specimen extraction through the natural orifice, and performing an intracorporeal end-to-side or end-to-end anastomosis using an anvil inserted through the same route. However, since intracorporeal anastomosis requires advanced technical expertise, the learning curve is long.

4. Risk of Infection

One of the most debated issues in NOSES is the risk of abscess formation due to the leakage of intestinal contents into the peritoneum during perioperative opening of the intestine. However, studies have shown that findings after transanal specimen extraction do not significantly impact the inflammatory response or infectious morbidity.^[14] Additionally, it is known that surgical site infections are less common in transvaginal extractions due to the rich blood circulation of the vagina.^[15]

Costantino et al.^[14] prospectively evaluated peritoneal contamination after NOSE surgery and found that 100% of sample fluid cultures were positive. However, they demonstrated that, despite contamination, it did not result in infectious morbidity, and there was no significant difference in clinical outcomes compared to those in the conventional laparoscopic approach.^[14]

5. Anal Dilation

In transanal extractions, anal dilation is typically performed first. This procedure may be beneficial for both specimen extraction and the use of a circular stapler. However, it may lead to complications related to continence. For this reason, it is advisable to perform anal dilation selectively in patients where extraction can be performed through the anus but requires dilation or in cases where the passage of the stapler would be complicated.

It is also important to extract the specimen gently during this process. Sphincter dysfunction due to anal dilation or specimen extraction can be considered a disadvantage for transanal NOSES. In female patients with a high risk of sphincter dysfunction during transanal extraction, transvaginal extraction may be preferred, especially if the patient has completed her family and the specimen size is large.

6. Using a Protective Sheath

Studies have shown that a protective sheath is generally used in transanal incisions.^[16,17] However, some authors have reported not using it.^[16] Using a protective sheath prior to transanal extraction may be impractical, as the sheath's volume can make extraction more difficult. Nonetheless, it is beneficial to use a protective sheath in transvaginal extractions, particularly for malignant lesions, to avoid seeding.

Transvaginal extraction is often more feasible than transanal extraction due to the flexibility of the vagina. In the study by Zhou et al.,^[18] it was observed that NOSES did not increase the risk of local recurrence, and that recurrence and long-term outcomes were comparable to conventional laparoscopic surgery, particularly at transanal extraction sites and port areas.^[18]

Concerns regarding local recurrence and long-term onco-

logical outcomes after colorectal NOSES have led to studies comparing it with conventional laparoscopic surgery.^[3,19] These studies have demonstrated that NOSES alleviates such concerns completely.^[3]

In two studies comparing abdominal and vaginal tract surgeries related to transvaginal extraction, no postoperative differences were observed in vaginal sensation, ability to achieve orgasm, pregnancy rates, or dyspareunia rates.^[20,21]

7. Closing the Vaginal Opening

Although some publications state that the opening created in the posterior cervix does not need to be closed, it is typically closed routinely with absorbable suture material.^[22] This closure is usually performed transvaginally; however, in cases where transvaginal closure is difficult, laparoscopic closure may be performed intracorporeally.

8. Rectovaginal Fistula

In cases of an anastomotic leak in the rectum following transvaginal extraction, the weakest point is often the area of the vagina where the incision was made. This can lead to the development of a rectovaginal fistula. Interestingly, this situation can sometimes be beneficial for controlling leakage and may even be considered advantageous in uncomplicated cases. In the study by Franklin et al.,^[5] the rate of anastomotic leakage was reported as 1.1% in transanal extractions.

9. Disruption of the Integrity of the Specimen

One of the criticisms of colorectal NOSES is the division of the mesocolon or mesorectum. It may be necessary to divide the mesocolon or mesorectum to facilitate specimen extraction. However, this practice is not fully aligned with oncological principles and remains a topic of debate.

Although dividing the mesocolon or mesorectum is performed using vessel-sealing devices, there is a concern about the potential for tumor seeding. While this procedure is performed safely in benign diseases, it is subject to criticism in malignant cases. In my opinion, this is the weakest point of NOSES.

10. Limitations of the Procedure

Male gender, patient disapproval, inappropriate vaginal access, and large masses are limitations of the procedure. Additionally, inconsistency between the specimen size and the posterior fornix of the vagina, as well as a tumoral mass larger than 8-12 cm, can cause technical difficulties.

NOSES is not applied in locally advanced tumors, cases of acute intestinal obstruction, or tumor perforation. Transvaginal extraction is most suitable for T2 and T3 tumors, patients with a body mass index (BMI) of 30-35 kg/m², and specimens with a largest diameter of 3-5 cm. How-

ever, transvaginal extraction should not be recommended for young women who have not completed their families.

If the largest circumferential diameter of the specimen is less than 3 cm and the BMI is below 30 kg/m², transanal extraction is more appropriate. Transanal extraction is not suitable in the presence of anal stenosis or anal dysfunction.^[3]

Conclusion

Despite its potential advantages, NOSES is a complicated surgical procedure that requires advanced technical expertise and is more time-consuming. Moreover, the surgeon must have significant experience in advanced laparoscopy.

In colorectal lesions, NOSES can be safely applied via the transanal route, particularly for benign lesions, early-stage tumors, or small lesions, and via the transvaginal route for larger lesions in female patients.

Informed Consent

Retrospective study.

Peer-review

Externally peer-reviewed.

Conflict of Interest

None declared.

REFERENCES

- Julliard O, Hauters P, Possoz J, Malvaux P, Landenne J, Gherardi D. Incisional hernia after single-incision laparoscopic cholecystectomy: Incidence and predictive factors. *Surg Endosc* 2016;30:4539–43. [CrossRef]
- Chin YH, Decruz GM, Ng CH, Tan HQM, Lim F, Foo FJ, 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. [CrossRef]
- Guan X, Liu Z, Longo A, Cai JC, Tzu-Liang Chen W, Chen LC, et al. International consensus on natural orifice specimen extraction surgery (NOSES) for colorectal cancer. *Gastroenterol Rep (Oxf)* 2019;7:24–31. [CrossRef]
- Franklin ME Jr, Liang S, Russek K. Natural orifice specimen extraction in laparoscopic colorectal surgery: Transanal and transvaginal approaches. *Tech Coloproctol* 2013;17:S63–7. [CrossRef]
- Franklin ME Jr, Ramos R, Rosenthal D, Schuessler W. Laparoscopic colonic procedures. *World J Surg* 1993;17:51–6. [CrossRef]
- Redwine DB, Koning M, Sharpe DR. Laparoscopically assisted transvaginal segmental resection of the rectosigmoid colon for endometriosis. *Fertil Steril* 1996;65:193–7. [CrossRef]
- Nussbaum DP, Speicher PJ, Ganapathi AM, Englum BR, Keenan JE, Mantyh CR, et al. Laparoscopic versus open low anterior resection for rectal cancer: Results from the national cancer data base. *J Gastrointest Surg* 2015;19:124–31. [CrossRef]
- Masubuchi S, Okuda J, Yamamoto M, Inoue Y, Tanaka K, Uchiyama K. Natural orifice specimen extraction in laparoscopic colorectal cancer surgery: A case series study. *Int J Surg Case Rep* 2021;78:204–9. [CrossRef]
- Lin J, Lin S, Chen Z, Zheng B, Lin Y, Zheng Y, et al. Meta-analysis of natural orifice specimen extraction versus conventional laparoscopy for colorectal cancer. *Langenbecks Arch Surg* 2021;406:283–99. [CrossRef]
- Abu Gazala M, Wexner SD. Re-appraisal and consideration of minimally invasive surgery in colorectal cancer. *Gastroenterol Rep (Oxf)* 2017;5:1–10. [CrossRef]
- Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). *Surg Laparosc Endosc* 1991;1:144–50.
- Kim J, Shim M, Kwun K. Laparoscopic-assisted transvaginal resection of the rectum. *Dis Colon Rectum* 1996;39:582–3. [CrossRef]
- Sanchez JE, Marcet JE. Colorectal natural orifice transluminal endoscopic surgery (NOTES) and transvaginal/transrectal specimen extraction. *Tech Coloproctol* 2013;17:S69–73. [CrossRef]
- Costantino FA, Diana M, Wall J, Leroy J, Mutter D, 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. [CrossRef]
- Lomanto D, Chua HC, Myat MM, So J, Shabbir A, Ho L. Microbiological contamination during transgastric and transvaginal endoscopic techniques. *J Laparoendosc Adv Surg Tech A* 2009;19:465–9. [CrossRef]
- Wolthuis AM, de Buck van Overstraeten A, D'Hoore A. Laparoscopic natural orifice specimen extraction-colectomy: A systematic review. *World J Gastroenterol* 2014;20:12981–92. [CrossRef]
- Cai JC, Hong XY. Laparoscopic-assisted natural orifice specimen extraction radical descending colectomy using a cai tube. *World J Surg* 2016;40:2803–7. [CrossRef]
- Zhou S, Wang X, Zhao C, Pei W, Zhou H, Liu Q, et al. Comparison of short-term and survival outcomes for transanal natural orifice specimen extraction with conventional mini-laparotomy after laparoscopic anterior resection for colorectal cancer. *Cancer Manag Res* 2019;11:5939–48. [CrossRef]
- Park JS, Kang H, Park SY, Kim HJ, Lee IT, Choi GS. 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. [CrossRef]
- Roovers JP, van der Bom JG, van der Vaart CH, van Leeuwen JH, Scholten PC, Heintz AP. A randomized comparison of post-operative pain, quality of life, and physical performance during the first 6 weeks after abdominal or vaginal surgical correction of descensus uteri. *NeuroUrol Urodyn* 2005;24:334–40. [CrossRef]
- Paraiso MF, Barber MD, Muir TW, Walters MD. Rectocele repair: A randomized trial of three surgical techniques including graft augmentation. *Am J Obstet Gynecol* 2006;195:1762–71. [CrossRef]
- Benhidjeb T, Stark M. Natural Orifice Surgery (NOS)-The next step in the evolution of minimally invasive surgery. *J Turk Ger Gynecol Assoc* 2012;13:56–60. [CrossRef]

Laparoskopik Kolorektal Cerrahide Transanal ve Transvajinal Spesmen Ekstraksiyonu

Minimal invaziv cerrahi, avantajları nedeniyle günümüzde birçok cerrahi operasyonda standart tedavi yaklaşımı haline gelmiştir. Minimal invaziv cerrahi sonrasında numunenin çıkarılması için genişlemiş yaraların komplikasyonları nedeniyle, numunenin doğal deliklerden çıkarılmasına olanak tanıyan doğal delikli numune çıkarma yöntemi geliştirilmiştir. Bu yöntemin mevcut laparoskopik avantajlarının yanı sıra ameliyat sonrası ağrı, enfeksiyon ve fıtık gelişme oranını da önemli ölçüde azalttığı gözlemlenmiştir.

Laparoskopik kolektomi kolorektal cerrahide sıklıkla kullanılmaktadır. Ancak spesmen mini lapartomi ile çıkarılmaktadır. Laparoskopik rezeksiyon sonrasında spesmenin doğal deliklerden çıkarılmasının dört olası yöntemi vardır: Transanal, transüretal, transoral ve transvajinal. Kolorektal cerrahide doğal orifislerden spesmen çıkarılma yöntemi, genel olarak transanal ve transvajinal yol olmak üzere iki kategoriye ayrılmaktadır. Bu iki ekstraksiyon yönteminin avantajları ve dezavantajları bulunmaktadır.

Bu makale, laparoskopik kolorektal cerrahide doğal deliklerden örnek çıkarmak için kullanılan transanal ve transvajinal yollar hakkında bilgi vermek ve bu iki yöntemi karşılaştırmak amacıyla yazıldı. Doğal deliklerden numune çıkarılması karmaşık bir cerrahi işlem olmasına rağmen potansiyel avantajlara sahiptir. Ancak ileri düzeyde laparoskopik deneyim gerektirir. Özellikle erken evre ve küçük çaplı tümörlerde transanal yol, lezyonları daha büyük olan kadın hastalarda ise transvajinal yol güvenle kullanılabilir.

Anahtar Sözcükler: Doğal deliklerden spesmen ekstraksiyonu; laparoskopik kolorektal cerrahi; minimal invazif cerrahi; transanal numune ekstraksiyonu; transvajinal numune ekstraksiyonu.