Comparison of transanal and transvaginal specimen extraction in laparoscopic colorectal surgery

Ismail Ertugrul*, Yunus Emre Altuntas*, Cüneyt Kayaalp**, Hakan Uzunoglu*, Selcuk Kaya*, Onder Altın*, Hasan Fehmi Kücük*

*Department of General Surgery, Kartal Dr. Lutfi Kırdar City Hospital, Istanbul, Turkey
**Department of General Surgery, Faculty of Medicine, Yeditepe University, Istanbul, Turkey

Comparison of transanal and transvaginal specimen extraction in laparoscopic colorectal surgery

AIM: *This study aimed to compare the outcomes of transanal and transvaginal NOSES in patients undergoing laparoscopic colorectal surgery.*
MATERIAL AND METHODS: *This study included 45 patients who were scheduled for NOSES after undergoing laparoscopic colorectal resection in our clinic between January 2019 and March 2020. To ensure homogeneity between the groups, the data of 22 female patients were analyzed in this study. Patients were divided into two groups according to the specimen extraction technique used. Demographic data, preoperative and postoperative findings, as well as the pathology and sizes of the specimens were examined in both the groups.*
RESULTS: *The demographic characteristics and preoperative and early postoperative outcomes were similar in both the groups. The size of the lesion was larger in the transvaginal group than that in the transanal group [4.58 ± 1.28 and 2.71 ± 1.55, respectively (P = 0.039)]. Two complications associated with extraction were observed (%9.09). A patient who underwent transanal extraction developed transient anal incontinence, which spontaneously resolved, and a patient who underwent transvaginal extraction developed anastomotic leakage and rectovaginal fistula associated with anastomotic leakage; a colonic stent was inserted for the management of this condition following which the patient recovered.*
CONCLUSION: *Only the lesion size was statistically significantly different between the transanal and transvaginal routes. Further, avoiding secondary organ injury is essential; therefore, the transanal route is primarily preferred. However, if the diameter of the lesion is large and the patient is female, the transvaginal route can be a useful alternative.*

KEY WORDS: Natural orifice specimen extraction surgery, Laparoscopic colorectal surgery, Minimally invasive surgery

Introduction

Minimally invasive surgical techniques are increasingly used in surgical practice because of their various advantages. In conventional laparoscopy, the resected material is removed either via mini-laparotomy or by expanding the trocar site. This new incision increases the

chances of wound-associated complications and postoperative pain and affects cosmesis [1]. Natural orifice specimen extraction surgery (NOSES) has been developed to reduce these adverse effects; this technique allows the extraction of the specimen through natural orifices [2]. The development of NOSES can be considered as a bridge for pure natural orifices surgery. There are four natural orifices for specimen extraction after laparoscopic resection: mouth, anus, vagina, and urethra.

Recently, laparoscopic surgery is being performed frequently because of its usefulness in the treatment of colorectal diseases (minimal trauma, low complications, and rapid recovery) [3]. In addition to the advantages of laparoscopic surgery, NOSES has a shorter recovery period, diminished incidence of abdominal wall hernia and surgical site infection, as well as reduced postoperative

pain [4]. Only transanal or transvaginal routes can be used for NOSES for specimen collection in colorectal diseases. Although there are numerous studies on NOSES for colorectal diseases in the literature, there are few studies comparing transanal and transvaginal extraction [5]. This study aims to compare the outcomes of transanal and transvaginal NOSES in patients undergoing laparoscopic colorectal surgery.

Material and Methods

This study was planned as a prospective clinical study and was conducted between January 2019 and March 2020 at the general surgical clinic of a tertiary university hospital. The study was approved by the hospital's medical ethics committee (Ethical committee approval no: 2019/514/146/2-28.01.2020). All patients provided informed consent before surgery.

Benign or malignant pathology, specimen size, tumor grade (except metastasis), history of previous surgeries, the segment where the resection will be performed, and body mass index were not considered determinants while determining the route for NOSES. The exclusion criteria included being under the age of 18 years, male, or a virgin; having metastases or anal-vaginal anomalies; and not consenting to the surgery.

All patients were operated under general anesthesia in the modified Lloyd–Davies position. Transanal and transvaginal sites of extraction were cleaned with povidone–iodine solution. Pneumoperitoneum was achieved using the Veress needle through the umbilicus. Trocar locations were identified according to the resection area. In most cases, four trocars (12 mm, 10 mm, and 2 × 0.5 mm) were used. The camera trocar was placed on the umbilical region, whereas other trocars were placed in accordance with the disease location. Laparoscopic colorectal resections were performed using known standard techniques. Before extracting large-volume specimens from malignant lesions, mesorectum was partially separated using sealing devices in parallel with the vascular structures without disturbing the vessel integrity to facilitate the extraction process.

The transanal route was the primary option to extract the specimen after laparoscopic resection; in female cases where it failed, the transvaginal route was attempted. In cases where both failed, the specimen was extracted via an incision of the abdominal wall.

Patients' demographic data, body mass indexes (BMI), American Society of Anesthesiologists Association (ASA) grades, concomitant comorbidities, history of previous abdominal surgeries, diagnoses, tumor locations, operation types, colectomy types, number of trocars, additional organ resections, routes of specimen extraction, anvil localizations, operative times, blood losses, forms of anastomosis, postoperative day 1 visual analog scale (VAS) pain scores, times for onset of oral intake, durations of hospital stay, complications, and pathology reports (type, specimen sizes, and lesion sizes) were analyzed.

Note that 45 patients who were scheduled for NOSES after laparoscopic colorectal resection were included in the study. Seven patients were given conversion for various reasons (ureteral invasion, proximal colon ischemia, inability to detect the tumor in the sigmoid colon, inability to determine the distal part of the tumor; and in three patients, the tumor being locally forward). In addition to these patients, two other patients were not suitable for NOSES because the distal stump of their rectum was short. Specimen extraction was performed via a suprapubic incision after conventional laparoscopic colectomy in these patients. Of the 36 cases, 14 were male; therefore, they were excluded from the study. Finally, the data of a total of 22 remaining patients was analyzed. All operations were performed by the same team; the support of an obstetrician was sought only in transvaginal extractions.

STATISTICAL METHODS

Frequency analysis was used for nominal and ordinal parameters, whereas mean and standard deviation was used for scale parameters. Normality distributions were tested using the Kolmogorov–Smirnov test. Mann–Whitney U test was used for testing non-parametric differences, and an independent sample t-test was used for testing parametric differences. The chi-square and the likelihood ratio chi-square test were used for assessing the differences between categorical variables. SPSS 17.0 was used for data analysis, which was conducted at a significance level of 0.05 and 95% confidence interval.

Results

Table I summarizes the demographic and clinical characteristics of the patient groups. Sigmoid colon tumor (41.7%) and rectal prolapse (41.7%) in the transanal group and rectal endometriosis (40.0%) in the transvaginal group were the predominant diagnoses in terms of the distribution of the diagnoses ($p < 0.05$). There was no difference between the two groups in terms of age, BMI, ASA grade, distribution of comorbidities, history of previous abdominal surgery, and operation technique (Table I).

Table II lists the specimen and operational data. There was no difference between the two groups in terms of lesion location, maximum specimen size, number of trocar, type of anastomosis, and anvil localization. The frequency of additional organ resection was higher in the transvaginal group. Four of the patients who underwent transvaginal extraction were diagnosed with endometriosis, accompanied by excised ovarian cysts. One patient

TABLE I - *Demographic and clinical properties of patient groups*

	Transanal (n=12)	Transvaginal (n=10)	p
Age, mean±SD	59.58±9.22	53.10±15.14	0.256a
BMI, mean±SD	30.05±4.58	28.98±6.09	0.643a
ASA Score, n (%)			
1	1 (8.3)	1 (10.0)	0.533b
2	10 (83.3)	9 (90.0)	
3	1 (8.3)	-	
HT, n (%)	6 (50.0)	2 (20.0)	0.138b
DM, n (%)	3 (25.0)	2 (20.0)	0.780b
Other comorbidity, n (%)	3 (25.0)	1 (10.0)	0.353b
Abdominal Surgery, n (%)			
No	7 (58.3)	4 (40.0)	0.390b
Yes	5 (41.7)	6 (60.0)	
Diagnosis, n (%)			
Rectosigmoid colon tumor	2 (16.7)	1 (10.0)	0.001b
Sigmoid colon tumor	5 (41.7)	-	
Rectal prolapse	5 (41.7)	1 (10.0)	
Rectal endometriosis	-	4 (40.0)	
Diverticulosis coli	-	3 (30.0)	
Other	-	1 (10.0)	
Operation technique, n (%)			
LAR	9 (75.0)	8 (80.0)	0.315b
Frygman Goldberg operation	3 (25.0)	1 (10.0)	
Other	-	1 (10.0)	

a. Independent Samples T-test, b. Chi-Square Likelihood Ratio, SD: Standard Deviation.

TABLE II - *Specimen and operation technical parameter differences between patient groups*

	Transanal (n=12)	Transvaginal (n=10)	p
Lesion localization, n (%)			
Sigmoid colon	5 (41.7)	3 (30.0)	0.562a
Rectum	5 (41.7)	5 (50.0)	
Rectosigmoid	2 (16.6)	1 (10.0)	
Right colon	-	1 (10.0)	
Splenic flexure case			
Max specimen dimension, mean±SD	12.46±4.16	12.20±5.75	0.904b
Max lesion dimension, mean±SD	2.71±1.55	4.58±1.28	0.039b
Number of trocars, mean±SD	4.08±0.29	4.40±0.52	0.228c
Mesentery dissection, n (%)	8 (66.7)	5 (50.0)	0.428a
Organ resection, n (%)			
No	11 (91.7)	6 (60.0)	0.072a
Yes	1 (8.3)	4 (40.0)	
Lesion histopathology, n (%)			
Malign	7 (58.3)	2 (20.0)	0.063a
Benign	5 (41.7)	8 (80.0)	
Anastomosis type, n (%)			
Circular staplers	12 (100.0)	9 (90.0)	0.201a
Linear staplers	-	1 (10.0)	
Colanal			
Anvile localization, n (%)			
Extracorporeal	5 (41.7)	2 (20.0)	0.271a
Intracorporeal	7 (58.3)	8 (80.0)	

a. Chi-Square Likelihood Ratio, b. Independent Samples T-Test, c. Mann Whitney U Test, SD: Standard Deviation.

TABLE III - *Preoperative and postoperative properties of patients*

	Transanal (n=12)	Transvaginal (n=10)	p
Operation duration (min), mean±SD	172.92±47.22	197.00±31.64	0.185a
Blood loss (ml), mean±SD	35.00±20.67	50.00±27.89	0.093b
Oral intake (day), mean±SD	1.75±0.62	1.50±0.71	0.388a
Postop VAS, mean±SD	2.75±1.96	1.90±1.37	0.262a
Drain duration (day), mean±SD	4.92±1.00	4.40±1.07	0.256a
Hospitalization duration (day), mean±SD	5.00±0.95	5.20±1.23	0.672a
Post complications, n (%)			
None	10 (83.4)	7 (70.0)	0.201c
Trocar site hernia	-	-	
Bleeding	-	1 (10.0)	
Atelectasis	1 (8.3)	-	
Temporary anal dysfunction	1 (8.3)	-	
Ileus		1 (10.0)	
Bleeding + Trocar site hernia + Rectovaginal fistul			

a. Independent Samples T-test, b. Mann Whitney U Test, c. Chi-Square Likelihood Ratio, SD: Standard Deviation.

in the transanal group underwent wedge resection of the bladder because of bladder invasion. The incidence of benign pathology was higher in the transvaginal group compared with that in the transanal group. Rectosigmoid tumors and sigmoid colon tumors were more common in the transanal group, whereas rectal endometriosis and diverticulosis coli were more common in the transvaginal group. Maximum lesion diameter was statistically significantly higher in the transvaginal group (p < 0.05). (Table II).

Table III lists the preoperative and postoperative characteristics and the results from the statistical analyses. The differences between these two groups were not significant in terms of operative time, blood loss, oral intake, postoperative VAS, drainage duration, hospital stay, and preoperative and postoperative complications (p > 0.05; Table III).

Discussion

There is a single study in literature comparing transanal and transvaginal specimen extraction in laparoscopic colon surgery [5]. This previous study mostly reports technical information, whereas our study reports preoperative and postoperative findings [5]. There was no significant difference between the two groups in terms of preoperative and postoperative findings in our study, except for lesion size. We always used the transanal route as the first option, and the transvaginal route as an alternative. With this approach, we intended to minimize the rates of complications specific to specimen extraction through natural orifices. We encountered complications associated with extraction only in 2 out of a total of 22

patients (9.09%). One patient (1/12, 8%) who underwent transanal extraction developed transient anal incontinence, which spontaneously recovered after ~25 days, and one patient who underwent transvaginal extraction (1/10, 10%) developed intraabdominal hemorrhage after anterior resection and was medically treated; however, this was followed by anastomotic leakage and the development of a rectovaginal fistula on postoperative day 14 because of the anastomotic leakage. There were complaints of occasional vaginal gas. A colonic stent (BONOSTENT® Colo-Rectal Covered, 22 mm diameter, total length 120 mm, SEWOON MEDICAL) was inserted for treating the fistula, and the patient's clinical picture improved when the stent was removed after a month.

Specimen extraction is often associated with secondary organ injury in transvaginal extraction. Compared with transanal access, adjacent organs, especially the sigmoid colon and rectum, can easily be injured during transvaginal specimen extraction, thereby resulting in longer durations of recovery and hospital stay [5]. We performed transvaginal specimen extraction in one of two cases who had undergone hysterectomy, and performed colpotomy through the apex of the vagina. The procedure was easier in these patients compared with that in those who did not undergo hysterectomy. In a study conducted by Sanchez et al., the vagina was reported to be the most practical and extensively used area for specimen extraction [6]; however, we do not agree with this report. We support the reports of studies related to colorectal NOSES and believe that transanal extraction without access and other organ injuries is the superior option. Transanal extraction offers a more comfortable exposure of the surgical site because the bowel segment in front of the rectum is resected; this can be an advantage for transanal extraction.

One of the most criticized issues in NOSE is the risk of abscess formation caused by the infiltration of intestinal contents into the peritoneum because of the perioperative opening of the intestine. However, studies have shown that the findings obtained after transanal specimen extraction did not have any effect on the inflammatory response and infectious morbidity [7,8].

Furthermore, it is known that infection in the surgical area is less common because of the rich blood circulation of the vagina in cases of transvaginal extraction [9]. Moreover, Costantino et al. prospectively evaluated peritoneal contamination after NOSE surgery and reported that the sample fluid cultures were 100% positive. However, they demonstrated that the contamination did not develop into infectious morbidity, despite its presence, and that there was no significant difference in clinical results compared with the conventional laparoscopic approach [10]. In fact, in our study, we did not encounter infection in both transanal and transvaginal extraction cases. However, there were contradictory results in literature stating that NOSES could increase

the possibility of peritoneal contamination [11,12].

In transanal extractions, anal dilatation is usually performed first. This process can be helpful both in extracting the specimen and in the use of the circulatory stapler. However, this condition can lead to complications associated with continence. Therefore, it is useful to perform anal dilatation in selective patients who are suitable for anal extraction but who need dilatation or complicate the passage of the stapler. It is also important to gently remove the specimen. In our study, a patient had a temporary sphincter dysfunction, and we observed an improvement in the condition on subsequent follow-up. The dysfunction of the sphincter because of anal dilatation or specimen extraction can be considered as a disadvantage for transanal NOSES. In female patients with high probability of developing sphincter dysfunction following transanal extraction, transvaginal extraction can be performed if the patient has no plans for conception in future and the specimen size is large.

We did not use a protective sheath in transanal extraction. We have observed that it is usually used in other studies [13,14]; however, some researchers expressed that they did not use it [13]. Using a protective sheath before transanal extraction may not be practical; the volume of the sheath may make the extraction difficult. However, in transvaginal extractions, especially in cases of malignant lesions, we use protective sheaths to avoid plantation; protective sheaths are more useful in transvaginal extraction than in transanal extraction because of the elasticity of the vagina. The study by Zhou et al. reported that NOSES does not increase the risk of local recurrence and that the recurrence and long-term outcomes in NOSES is the same as that of conventional laparoscopic surgery, particularly in transanal extraction sites and the port region [15]. There are studies comparing the local recurrence and long-term oncological outcomes after colorectal NOSES with that in conventional laparoscopic surgery because of existing concerns [2,26]. These studies have shown that NOSES completely eliminates chances of local recurrence and improves long-term oncological outcomes [2].

Although there are studies stating that the opening created in the posterior cervix does not have to be closed, we routinely close this opening [17]. This closure is usually performed transvaginally, but we have performed intracorporal laparoscopic closure in cases where the opening was sometimes challenging to close through the transvaginal route.

Conclusion

We believe that transanal extraction is more appropriate, especially in left-sided laparoscopic colon surgery. However, if the diameter of the lesion is large and the patient is female, we believe that the transvaginal route can be an alternative extraction route. In studies relat-

ed to colorectal NOSES, transanal extraction without access and other organ injuries is a superior option. However, higher quality and redesigned studies are required to provide evidence in future.

Riassunto

Lo studio è finalizzato a confrontare gli esiti dei NAS transanali e transvaginali in pazienti sottoposti a chirurgia colorettale laparoscopica.

Sono stati considerati 45 pazienti che erano stati programmati per NASI dopo aver subito una resezione laparoscopica del colon-retto nella nostra clinica tra gennaio 2019 e marzo 2020. Per garantire l'omogeneità tra i gruppi, in questo studio sono stati analizzati i dati di 22 pazienti di sesso femminile. Le pazienti sono state divise in due gruppi in base alla tecnica di estrazione del campione utilizzata. I dati demografici, i risultati pre-operatori e postoperatori, nonché la patologia e le dimensioni dei campioni sono stati esaminati in entrambi i gruppi.

RISULTATI: le caratteristiche demografiche e gli esiti pre-operatori e postoperatori precoci sono risultati simili in entrambi i gruppi. La dimensione della lesione era maggiore nel gruppo transvaginale rispetto a quella nel gruppo transanale: 4,58 ± 1,28 e 2,71 ± 1,55, rispettivamente (P = 0,039)]. Sono state osservate due complicanze associate all'estrazione (% 9,09): una paziente sottoposta a estrazione transanale ha sofferto di una incontinenza anale transitoria, che si è risolta spontaneamente; una paziente sottoposta a estrazione transvaginale ha sviluppato una deiscenza anastomotica e fistola rettovaginale associate; è stato inserito uno stent del colon per la gestione di questa condizione a seguito del quale la paziente ha superato la complicazione.

Il conclusione dal punto di vista statistico solo la dimensione della lesione è risultata significativamente diversa tra l'estrazione per via transanale e quella per via transvaginale. Inoltre, è essenziale evitare lesioni agli organi secondari; pertanto, si preferisce principalmente la via transanale. Tuttavia, se le dimensioni della lesione sono ampie e la paziente è di sesso femminile, la via transvaginale può essere un'utile alternativa.

References

1. Farinetti A, Bonetti LR, Migaldi M, et al.: *A comparative analysis between laparoscopy and open colectomy: Assessment of perioperative and oncological outcomes*. Ann Ital Chir, 2015; 86(1):35-4. Article Number: PII S0003469X15022459

2. Guan X, Liu Z, Longo A, Cai J:*I nternational consensus on natural orifice specimen extraction surgery (NOSES) for colorectal cancer*. Gastroenterology Report, 7(1): 2019; 24–31.

3. Awad Z, Griffin R: *Laparoscopic right hemicolectomy: A comparison of natural orifice vs. transabdominal specimen extraction*. Surg Endosc, 2014; 28:2871-876.

4. Ma B, Huang XZ, Gao P, Zhao JH, Song YX, Sun JX, Chen XW, Wang ZN: *Laparoscopic resection with natural orifice specimen extraction versus conventional laparoscopy for colorectal disease: A meta-analysis*. Int J Colorectal Dis, 2015; 30:1479-488.

5. Franklin Jr M E, Liang S, Russek K: *Natural orifice specimen extraction in laparoscopic colorectal surgery: transanal and transvaginal approaches*. Tech Coloproctol, 2013; 17 (Suppl 1):S63–S67

6. Sanchez JE, Marcet JE: *Colorectal natural orifice transluminal endoscopic surgery and transvaginal/transrectal specimen extraction*. Tech Coloproctol 2013; 17 (Suppl 1):S69–S73

7. Costantino FA, Diana M, Wall J, Leroy J, Mutter D, Marescaux J: *Prospective evaluation of peritoneal fluid contamination following transabdominal vs. transanal specimen extraction in laparoscopic left-sided colorectal resections*. Surg Endosc, 2012; 26:1495-1500.

8. Leroy J, Costantino F, Cahill RA, D'Agostino J, Morales A, Mutter D, Marescaux J: *Laparoscopic resection with transanal specimen extraction for sigmoid diverticulitis*. Br J Surg 2011; 98: 1327-334

9. 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; 19:465-69.

10. Costantino FA, Diana M, Wall J, Leroy J, Mutter D, Marescaux J: *Prospective evaluation of peritoneal fluid contamination following transabdominal vs. transanal specimen extraction in laparoscopic left-sided colorectal resections*. Surg Endosc, 2012; 26:1495–1500.

11. Costantino FA, Diana M, Wall J, Leroy J, Mutter D, Marescaux J: *Prospective evaluation of peritoneal fluid contamination following transabdominal vs. transanal specimen extraction in laparoscopic left-sided colorectal resections*. Surgical Endoscopy Other Interventional Techniques, 2012; 26:1495–500.

12. Leroy J, Costantino F, Cahill RA, D'Agostino J,Morales A, Mutter D, Marescaux J: *Laparoscopic resection with transanal specimen extraction for sigmoid diverticulitis*. Br J Surg 2011; 98:1327-334.

13. 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.

14. Cai JC, Hong XY: *Laparoscopic-assisted natural orifice specimen extraction radical descending colectomy using a Cai tube*. World J Surg, 2016; 40:2803–807.

15. Zhou S, Wang X, Zhao C, PeiW, Zhou H: *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 Management and Research, 2019;:11.

16. Park JS, Kang H, Park SY: *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.

17. 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.