Clinical Feasibility and Safety of Trans-anal Specimen Extraction of High Rectal and Sigmoid Cancers

Abou-Ashour H., MD, MRCS; El Kased A., MD, MRCS; Shahin M, MD
Department of General Surgery, Faculty of Medicine, Menoufia University Hospital, Egypt

Introduction: There has been a growing interest in innovative minimally invasive procedures that reduce the size of abdominal incisions to the smallest size necessary for abdominal specimen extraction. Mini-laparotomies, which are used to retrieve specimens, have been linked to post-operative pain, wound site infections, and hernias.

Patient and methods: This prospective observational study was conducted in Menoufia University Hospital, General Surgery Department from Jan.2018 to October 2021. A total of 20 patients were included in the study. We aimed to evaluate the clinical feasibility and safety of trans anal specimen extraction of high rectal and sigmoid cancers.

Results: The mean operative time was (154± 10) minutes, mean blood loss was (75 ± 10) ml, the mean time to return to anal tone (Anal exhaustion time) was (58± 6) hours, and mean postoperative hospital stay was (5.4 ± 1.3) days. The severity of the patients' pain was determined using the Visual Analogue Scale (VAS). The patients had a mean VAS pain score of (2.8± 0.8) after surgery. The average number of lymph nodes extracted was 16.2. (Ranging from 12 to 18). One female patient in the trial required conversion to open laparotomy due to extensive pelvic adhesions due PID.

Conclusion: Trans anal specimen extraction appeared to have a number of advantages, including less blood loss, scar avoidance, and a shorter post-operative hospital stay. Trans anal specimen extraction is safe and possible in laparoscopic anterior rectal resection for upper rectal or lower sigmoid colon cancer with certain limitations.

Key words: Trans anal specimen extraction, Natural orifices specimen extraction, NOSE, Colorectal cancers.

Introduction

Colorectal cancer is one of the most common types of cancer in the globe. Rectal cancer accounts for almost one third of all colorectal malignancies. It is linked to a high rate of morbidity and mortality, putting millions of people's quality of life and health at risk.[1,2] There has been a growing interest in innovative minimally invasive procedures that reduce the size of abdominal incisions to the smallest size necessary for abdominal specimen extraction. Mini-laparotomies, which are used to retrieve specimens, have been linked to post-operative pain, wound site infections, and hernias.[3-6] Several studies evaluated the psychological results of various colorectal procedures and concluded that patients who underwent laparoscopic surgery were happier than those who underwent open surgeries.[7]

The specimen is extracted trans anally under the acronym NOSE (natural orifice specimen extraction). NOSE is the surgical evacuation of a specimen through an aperture of a hollow viscus that already communicates with the outside, such as the gastrointestinal tract or the vaginal canal. Instead of retrieving the specimen through an abdominal incision, a viscerotomy is employed, which allows patients to fully avoid the difficulties associated with bigger abdominal incisions. In 1991 and 1992, Stewert et al,[8] Nezhat.[9] reported retrieving the colectomy specimen within the vagina. Nine colectomies with transvaginal specimen extraction were performed in Woldhuis et al[10] series for the treatment of endometriosis, though this method is now being used to treat diverticulitis, inflammatory bowel disease, and cancer.

Franklin et al. disclosed partial colectomy using NOSE via the anus for the first time in 1993.[11] Malignant and benign pathologies from the cecum to the distal rectum have been removed through the anus or vagina in a number of publications recently. 10 NOSE has also been used to accomplish successful complete mesorectal excision, as initially documented by Person et al 12 in 2006. Trans anal NOSE's clinical efficacy for colorectal cancer is similarly underreported, and there are inconsistent outcomes in terms of its oncological safety and infection risk.[11]

The primary endpoint of the present study is to assess the feasibility and safety of trans-anal specimen extraction of high rectal and low sigmoid tumours. The second study endpoint is the occurance of complications of the procedure.

Patients and methods

This prospective observational study was conducted in Menoufia university hospital, general surgery department from Jan.2018 to October 2021. A total of 20 patients were included in the study. We aimed to evaluate the clinical feasibility and safety of trans

anal specimen extraction of high rectal and sigmoid cancers.

We included patients who were ASA III or less, patients with high rectal or sigmoid cancer where the size of tumour is 5 cm or less. We excluded obese patients with BMI over 30 kg/m2 and patients with anal stenosis. Patients were followed up for 60 days after the procedure.

All patients had a colonoscopy prior to surgery to establish a pathology diagnosis. CT, MRI, and colonoscopy were used to determine the tumor's location. CT or MRI were used to identify the tumours' maximum transverse diameter.

Before the operation, all patients gave their informed written consent. The surgical procedures were approved by the institution's review board and were carried out by the same surgical team.

Surgical procedures

Under general anaesthesia, a urinary catheter was placed in the patient's bladder. The lithotomy posture was adjusted for each patient, with the feet elevated 15°–20° above the head and a 10°–15° rightward lean. The umbilical port was used for the telescope, and the five-port approach was applied. The primary operating port was put at McBurney's point on the right side of the abdomen; a primary auxiliary operative port of 5 mm was introduced on the right side of the umbilical port; and two other auxiliary operative ports were placed in the left lower quadrant. We explored the abdominal cavity and determined whether trans anal specimen extraction was feasible. The inferior mesenteric artery was severed from the root using a medial approach. A long the inferior edge of the pancreas, the inferior mesenteric vein was also dissected. The Toldt's gap separated the rectum from the left hemi-colon. The left ureter and the reproductive vascular system were spared. The rectum was "bared" five cm distally from the tumour, and a linear stapler (Echelon 60®, Ethicon Endo-Surgery, Cincinnati, USA) was used to cut and seal it. We also used linear stapling 5 cm proximal to the tumour. The distal rectum was thoroughly irrigated with a diluted povidone-iodine solution after perineal re-disinfection. The feasibility of collecting the specimen through trans anal injection was re-evaluated. Under laparoscopic vision, the stump of the distal rectum was incised. The upper end of the specimen collecting sterile bag - was inserted into the pelvic space throughout the anus with the other end still outside the anus using a tape and oval forceps. The bag was filled with the mobilised tumor-containing proximal colon segment **(Figure 1)** sometimes we insert Nelaton catheter through a small opening of the retrieved specimen (After it came outside the anus) to deflate the accumulated gases in the blind upper end of the specimen and to facilitate its retrieval **(Figure 2).**

The colon was dissected 5 cm from the tumour. The anvil is inserted transanally through a sterile bag then a small incision was made laparoscopically at the lower end of the left colon to enter the anvil, **(Figure 3)** which was subsequently secured with a burse string **(Figure 4).** The rectum stump was then closed with a linear stapler Finally, the colorectal anastomosis was finished by inserting a circular stapler through the anus and fixing it to the anvil **(Figure 5)**.

Fig 1: Putting the specimen an collecting plastic bag.

Fig 2: Deflating the specimen to facilitate its extrusion.

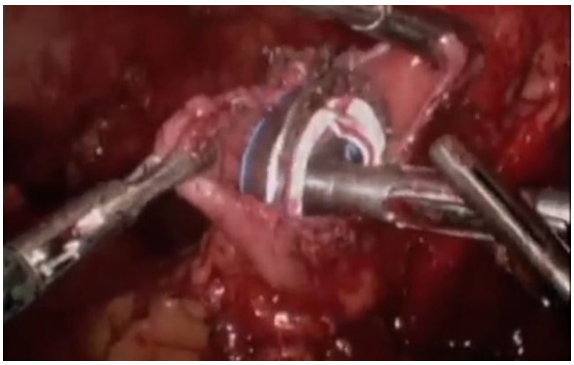

Fig 3: Putting the anvil in the distal end of the colon.

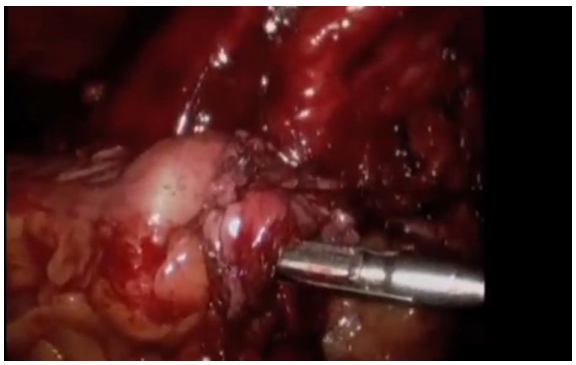

Fig 4: Burse string around the anvil.

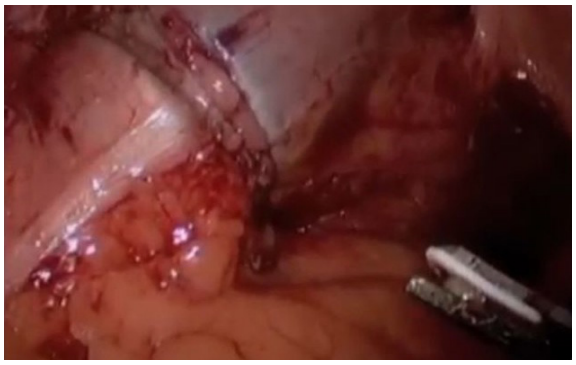

Fig 5: Establishing colorectal anastomosis by fixing the stapler to the anvil.

Results

The study included 20 patients, 12 males and 8 females, ranging in age from 37 to 67 years (Mean 56±4 years). Age, sex, BMI, tumor site, tumour differentiation, American anesthesiologist categorization (ASA), and colon-tumour diameter are listed in **(Table 1).**

In the present study, the mean operative time was (154± 10) minutes, mean blood loss was (75 ± 10) ml, the mean time to return to anal tone (Anal exhaustion time) was (58± 6) hours, and mean postoperative hospital stay was (5.4 ± 1.3) days. The severity of the patients' pain was determined using the Visual Analogue Scale (VAS). The patients had a mean VAS pain score of (2.8± 0.8) after surgery. The average number of lymph nodes extracted was 16.2. (Ranging from 12 to 18). **(Table 3).**

Eight patients were classified as stage I, nine as stage II, and three as stage III, according to the 8th edition of the UICC TNM Classification of Malignant Tumors.[13]

One female patient in the trial required conversion to open laparotomy due to extensive pelvic adhesions due PID, we also reported failure to deliver the specimen in one male patient and mini laparotomy was required. There were no anastomotic leak, no anal incontinence, no anal fissure or mortality **(Table 2)** . Results are clarified in **(Figures 6-9).**

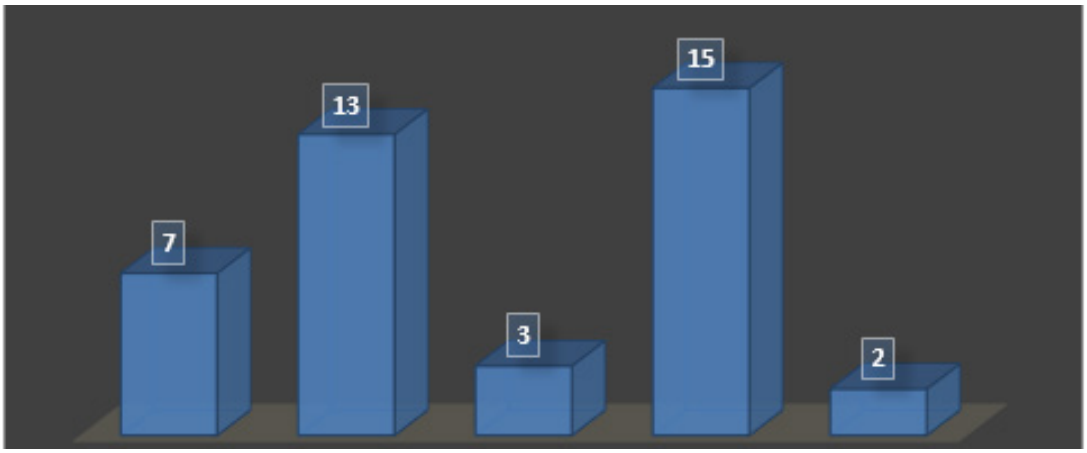

Fig 6: Shows tumour characters.

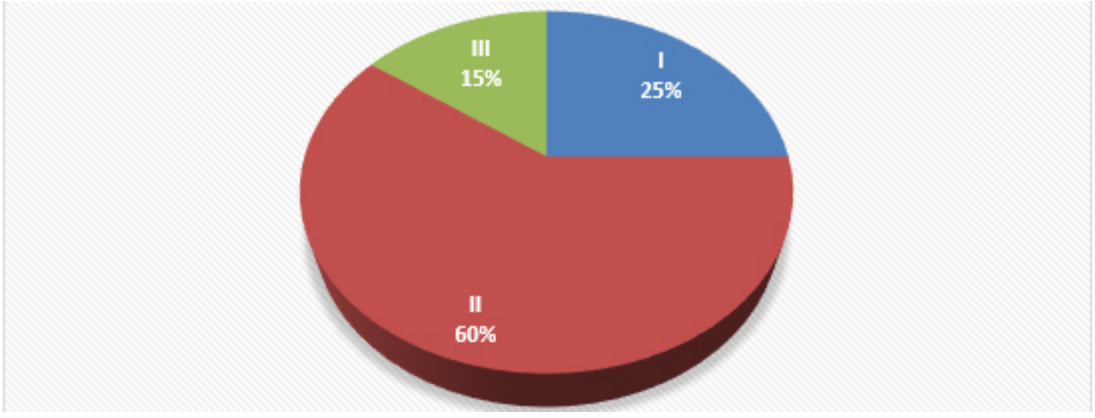

Fig 7: Shows ASA classification.

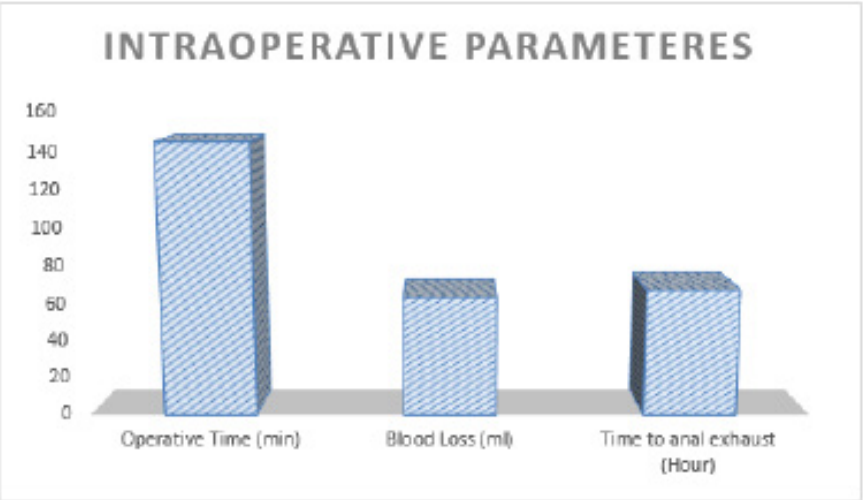

Fig 8: Shows intraoperative conditions and early postoperative efficacy.

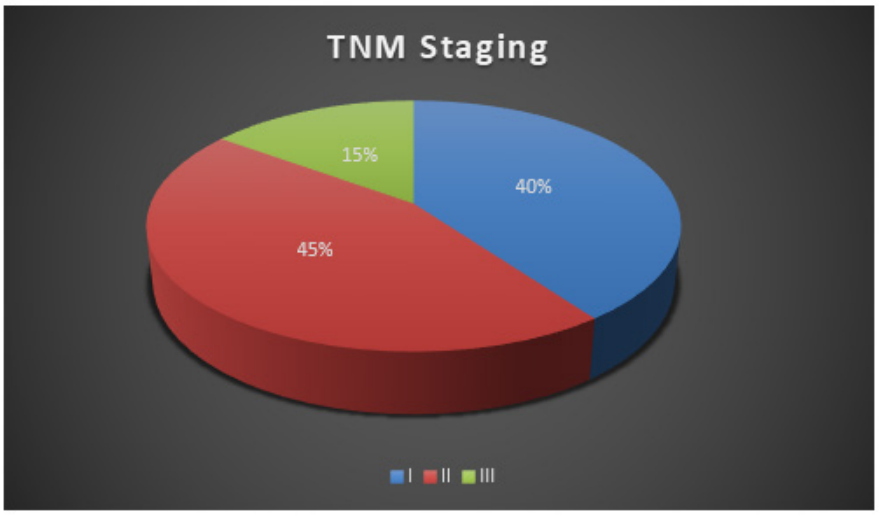

Fig 9: Shows postoperative staging.

Table 1: Shows age, sex, BMI, tumor charteristics and ASA classification

	Mean / Number
Number of Patients	20
Age (years)	52 ± 7
sex	
Male	12
Female	8
BMI (kg/m^2)	23.0 ± 1.7
Tumour Position	
Lower sigmoid	7
Upper Rectum	13
Tumour Differentiation	
High	3
Moderate	15
Low	2
Tumour Diameter (CM)	4.2 ± 0.5
ASA Classification	
I	5
II	12
III	3

Table 2: Shows intraoperative conditions and early postoperative efficacy

	Mean / Number
Operative time (min)	154± 10
Blood loss (ml)	63 ± 6
Time or anal exhaustion (Hour)	67 ± 7
Postoperative VAS score	3.4 ± 1.1
Postoperative Complication	
Port site wound infection	Two patients (10%)
Failure to extract the specimen	One patient (5%)
Mini-laparotomy	One patient (5%)
Port site infection	Two patients (10%)
Postoperative Hospital Stay (days)	6.0 ± 1.1

Table 3: Shows postoperative oncological outcomes

Harvested Lymph nodes	17.5 ± 4.5
TNM staging	
I	8
II	9
III	3

Discussion

Since its introduction in the early 1990s, laparoscopic surgery has become recommended for minimally invasive colorectal surgery, changing surgical paradigms.[14–18] To extract the specimen, the laparoscopic technique for colorectal cancer still requires a 5-cm long incision. In other studies,[12,19,20] successful outcomes in laparoscopy in terms of specimen extraction, such as current study, have been observed without the need for an abdominal incision. The abdominal incision raises the risk of postoperative wound infection, incisional hernia, and intestinal adhesions, as well as reducing the benefits of minimally invasive laparoscopic surgery.[15,16,17]

In the present study we found that it was suitable for specimen extraction when the colonic diameter including the lesion was 5 cm or less; tumours of 5 cm or more could be difficult for trans anal extraction. We were obliged to make mini laparotomy in one male patients where the colonic diameter including the lesion was more than 5 cm (6 cm) due to imaging miscalculation. Post operative pain was mild and we reported a VAS of pain of 3.4 ± 1.1 which is considered low. Other non-serious complications had occurred in this study as 2 patients had port site infection 5%. **(Table 2).**

We smoothly handled the retrieval process with avoidance of forcible traction of the specimen, there was no recorded anal fissures or rectal injuries. The BMI of two patient was 30 Kg and there was difficulty during specimen retrieval and these difficulties were not found in BMI <30kg/m^2. The mesocolon of obese patients was bulky that's is why patients with BMI more than 30kg won't gain the advantage of this technique.

Some authors advocated less invasive technique, the natural orifice transluminal endoscopic surgery (NOTES) which has just emerged as a new era of minimally invasive surgery, but it is still employed in simple procedures.[18] Its application in colorectal cancer radical surgery still requires more data and evidence-based medical confirmation before it can be widely used in clinical practice.

Yagi et al,[21] and Torres et al,[22] believed that the vagina could be considered as an ideal route to remove large colorectal neoplasm if compared with anus, due to its good elasticity, good blood supply, ability of rapid healing and easy access. However, transvaginal specimen extraction addresses some limitations: First, this technique is restricted to female cases only; again opening the wall of the vaginal could cause postoperative complications and dyspareunia moreover it may be associated with ethics limitations in our region.

In the present study we used aseptic technique during the procedure. The proximal portion was stapled in the peritoneal cavity; we irrigated the distal rectum extensively with saline then povidone-iodine solution to prevent infection before opening the distal segment. Moreover, we used a specimen bag to retrieve the specimen to avoid bacterial and tumour contamination in the rectal stump during specimen withdrawal. The anal sphincter is relaxed during general anesthesia due to administration of muscle relaxant. When a tumour is retrieved through a rectal stump, there must be some resistance. But

forceful pulling should be avoided to avoid injury to the rectal stump, specimen extraction was aided by finger dilatation and laparoscopic assistance.

We agreed with Jiajing et al[23] in a recent meta-analysis in 2021, where they concluded that that natural orifices specimen extraction was superior to conventional laparoscopic surgery and mini-laparotomy in terms of postoperative morbidity, postoperative pain, hospital stay, the time to first flatus, cosmetic results, and wound infections; however, it was associated with a longer operative time. Again He et al[24] in 2020 concluded that the trans anal specimen extraction after -laparoscopic anterior resection was safe, and it could be an alternative to conventional laparoscopic anterior resection for rectal and sigmoid tumours.

Patients with high rectal and low sigmoid cancer can benefit from trans-anal specimen extraction. The procedure has various limits, such as the tumor's diameter in the colonic segment should be 5 cm or less, and the tumor's invasion level should not exceed T3 - it does not reach the visceral peritoneum or surrounding organs. This approach necessitates two distal segment resections, middle and low rectal cancers are not candidates for this procedure. As a result, lower anastomosis and related difficulties occur in low and middle rectal cancer. More studies are required from colleagues to build solid evidence of this technique.

Conclusion

Natural orifice specimen extraction, which was used to remove tumours and extract specimens, appeared to have a number of advantages, including less blood loss, scar avoidance, and a shorter post-operative hospital stay. Trans anal specimen extraction is safe and possible in laparoscopic anterior rectal resection for upper rectal or lower sigmoid colon cancer. The procedure demonstrated speedy recovery, minimum trauma, low postoperative pain, and a low complication rate, providing the benefits of minimally invasive surgery. We agree that minimally invasive surgery is progressing and will play an important role in the future of treatment of most surgical disorders.

References

1. Yin J, Bai Z, Zhang J, et al: Burden of colorectal cancer in China, 288; 1990 - 2017: Findings from the Global Burden of Disease Study. 2017. Chin J Cancer. 2019; 31(3): 489-498.
2. Siegel RL, Miller KD, Jemal A: Cancer statistics, 2019. CA ***Cancer J Clin.*** 2019; 69: 7-34.
3. Ihedioha U, Mackay G, Leung E, et al: Laparoscopic colorectal resection does not reduce incisional hernia rates when compared with open colorectal resection. ***Surg Endosc.*** 2008; 22: 689–692.
4. Han FH, Hua LX, Zhao Z, et al: Transanal natural orifice specimen extraction for laparoscopic anterior resection in rectal cancer. ***World J Gastroenterol.*** 2013; 19: 7751-7757.
5. Winslow ER, Fleshman JW, Birnbaum EH, et al: Wound complications of laparoscopic vs open colectomy. ***Surg Endosc.*** 2002; 16: 1420–1425.
6. Kaminski JP, Pai A, Ailabouni L, et al: Role of epidural and patient-controlled analgesia in site-specific laparoscopic colorectal surgery. ***JSLS.*** 2014; 18(4): e2014.00207.
7. Hobson JA, Slade P, Wrench IJ, et al: Preoperative anxiety and postoperative satisfaction in women undergoing elective caesarean section. ***Int J Obstet Anesth.*** 335; 2006; 15: 18–23. 336.
8. Stewert EA, Liau AS, Friedman AJ: Operative laparoscopy followed by colpotomy for resecting a colonic leiomyosarcoma: A case report. ***J Reprod Med.*** 1991; 36(12): 883–884.
9. Nezhat F: Laparoscopic segmental resection for infiltrating endometriosis of rectosigmoid colon: A preliminary report. ***Surg Laparosc Endosc Percutan Tech.*** 2001; 11(1): 67–68.
10. Woldhuis AM, de Buck van Overstraeten A, D'Hoore A: Laparoscopic natural orifice specimen extraction-colectomy: A systematic review. ***World J Gastroenterol.*** 2014; 20(36): 12981–12992.
11. Franklin ME Jr, Ramos R, Rosenthal D, et al: Laparoscopic colonic procedures. ***World J Surg.*** 1993; 17(1): 51–56.
12. Person B, Vivas DA, Wexner SD: Totally laparoscopic low anterior resection with transperineal handsewn colonic J-pouch anal anastomosis for low rectal cancer. ***Surg Endosc.*** 2006; 20(4): 700–702.
13. Bertero, Luca, et al: Of the UICC Classification of Malignant Tumours: An overview of the changes in the pathological TNM classification criteria—What has changed and why?. ***Virchows Archiv.*** 2018; 472.4: 519-531.
14. Zhuo C, Liang L, Ying M, et al: Laparoscopic low anterior resection and eversion technique combined with a nondog ear anastomosis for mid- and distal rectal neoplasms: A preliminary and feasibility study. ***Medcine.*** 2015; 94(50): e2285.
15. Kong SK, Onsiong SM, Chiu WK, et al: Use of intrathecal morphine for postoperative pain relief after elective laparoscopic colorectal surgery. ***Anaesthesia.*** 2002; 57(12): 1168–73.

16. Zeng WG, Zhou ZX: Mini-invasive surgery for colorectal cancer. ***Chin J Cancer.*** 2014; 33(6): 277–84.

17. Cai Y, Zhou Y, Li Z, et al: Surgical outcome of laparoscopic coletomy for colorectal cancer in obese patients: A comparative study with open colcetomy. ***Oncol Lettl.*** 2013; 6(4): 1057–62.

18. Chapman AE, Levitt MD, Hewett P, et al: Laparoscopic-assisted resection of colorectal malignancies. A systematic review Ann Surg. 2001;234(5):590–606. Whang SH, Thaler K. Natural orifice transluminal endoscopic surgery: where are we going? ***World J Gastroenterol.*** 2010; 16(35): 4371–3.

19. Han FH, Hua LX, Zhao Z, Wu JH, Zhan WH: Transanal natural orifice specimen extraction for laparoscopic anterior resection in rectal cancer. ***World J Gastroenterol.*** 2013; 19(43): 7751–7.

20. Kvasha A, Khalifa M, Biswas S, et al: Unlimited-length proctocolectomy utilizing sequential intussusception and pull-through: Novel clean endolumenal note-assisted technique with transanal natural orifice specimen extraction without rectal stump opening in a porcine model. ***Surg Innov.*** 2016; 23: 456–62.

21. Yagi MA, Kayaalp C, Novruzov NH: Intracorporeal mesenteric division of the colon can make the specimen more suitable for natural orifice extraction. ***J Laparoendosc Adv Surg Tech A.*** 2014; 24: 484-6.

22. Torres RA Orban RD Tocaimaza L et al: Transvaginal specimen extraction after laparoscopic colectomy. ***World J Surg.*** 2012; 36: 1699-702.

23. Jiajing Lin, Suyong Lin, Zhihua Chen, et al: Meta-analysis of natural orifice specimen extraction versus conventional laparoscopy for colorectal cancer. ***Langenbecks Arch Surg.*** 2021; 406(2): 283-299.

24. He J, Yao HB, Wang CJ, et al: Meta-analysis of laparoscopic anterior resection with natural orifice specimen extraction (NOSE-LAR) versus abdominal incision specimen extraction (AISE-LAR) for sigmoid or rectal tumors. ***World J Surg Oncol.*** 2020;18(1):215. doi:10.1186/s12957-020-01982-w.