



Natural orifice specimen extraction (NOSE) surgery with rectal eversion and total extra-abdominal resection

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Abstract

Background Natural orifice specimen extraction (NOSE) surgery is gaining popularity among colorectal surgeons. The technical aspects of this new procedure are still debated and many variations have been presented in the last decade.

Methods We propose a new variation of transanal NOSE after robotic and laparoscopic LAR consisting of rectal eversion by using a special rod after laparoscopic TME. Eversion makes it possible to perform resection and placement of the anvil extracorporeally. We included a video demonstration of the technique. Clinical Patient Grading Assessment Scale was calculated 1 month after stoma closure and the Low Anterior Resection Syndrome (LARS) score was calculated preoperatively and 1 month after stoma closure.

Results Seven female patients with rectal cancer, all with normal BMI, underwent laparoscopic ($n = 5$) or robotic ($n = 2$) TME with rectal eversion. No intraoperative and postoperative complications were reported. One month after stoma closure, the median Clinical Patient Grading Assessment Scale was 5 (range 3–7), which means “a good deal better”. The median LARS score was 14 (IQR 14–19,5) preoperatively and 19 (IQR 19–21,5) 1 month after stoma closure.

Conclusions This variation of NOSE surgery was safe and effective in our patient population.

Keywords Natural orifice surgery · Rectal neoplasms · Robotic surgical procedures · Laparoscopic surgical procedures

Introduction

Both laparoscopic and robotic low anterior resection (LAR) for rectal cancer have been shown as effective techniques with good oncological outcomes [1], reduction of postoperative pain and length of hospital stay [2].

However, both these procedures require a mini-laparotomy for specimen extraction which can be a main cause of postoperative pain, wound infection, and incisional hernia. Several attempts to overcome postoperative pain,

wound infection, and incisional hernia have led surgeons to develop less invasive methods such as natural orifice specimen extraction (NOSE) surgery [3].

We propose a variation of NOSE surgery with eversion of rectum and extra-abdominal rectal and colon resection. Furthermore, we present short-term outcomes of seven patients who were treated with this new technique.

Patients and Methods

Between September 2018 and January 2019, seven patients with rectal adenocarcinoma had LAR. Informed consent was obtained after approval from the hospital ethics committee.

NOSE surgery with eversion of rectum and extra-abdominal rectal and colon resection was performed. Six of the seven patients had a loop colostomy formed. Low Anterior Resection Syndrome (LARS) [4] score was calculated preoperatively and 1 month after stoma closure. Patients were then asked to quantify their response to surgery using the Clinical Patient Grading Assessment Scale (CPGAS) [5] one month after stoma closure. Patients could pick a number

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over a range (+7 = completely better; 0 = no change; -7 = very much worse) that best answered the question. A score of 4 indicated the patient being "moderately better" and a score of 5 indicated the patient being a "good deal better" etc. Follow-up with colonoscopy, computed tomography scan, magnetic resonance imaging and testing for tumour markers were planned.

Technique

The patient is positioned in lithotomy position.

Trocar position

Laparoscopic approach Optical trocar A: periumbilical region. Trocar B (10 mm): iliac fossa 2 cm above the iliac spine. Trocar C (5 mm): in right flank. Trocars D and E (5 mm): left flank.

Robotic approach Optical trocar A: periumbilical region. Trocar B (8 mm): epigastric region, 4 cm under xiphoid process and 2 cm on the right side. Trocar C (8 mm): iliac fossa 2 cm above the iliac spine. Trocars D (12 mm) and E (8 mm), respectively, in right and left flank.

After D3 lymph node dissection and low ligation of inferior mesenteric artery with its skeletonization (preserving left colon artery), total mesorectal excision (TME) is performed. The rectum is mobilized to the down to the level of the levators. In no case the splenic flexure was mobilized.

NOSE procedure

A metal rod is inserted through the anus until its broadest part is located 10 cm above the tumour. An umbilical tape or wire is used to secure the colon around the rod.

Then the rod is extracted through the anus with an invagination of the colon allowing eversion of the colon and rectum through the anus (Fig. 1a, b). The tumour is identified and the rectal incision is performed 1–2 cm above the everted tumour (therefore ab anum in the rectum and represents the distal line of resection) preserving the wall of the sigmoid colon below (Fig. 2). The colon is disinfected after rectal resection to prevent abdominal contamination.

The level of proximal colonic resection is decided and the colon is transected using a linear stapler and the resected specimen sent for histological analysis (Fig. 3). The proximal colon is prepared for a side-to-end anastomosis, securing the anvil through a side colotomy and replaced in the abdominal cavity.

The rectal stump is closed with a purse-string suture or linear stapler. A circular stapler with a plastic guide is inserted through the suture (Fig. 4). A side-to-end

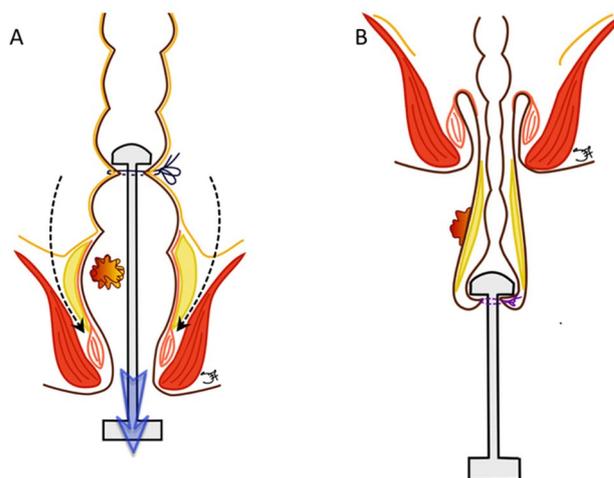


Fig. 1 a Scheme of metal rod introduction. b Scheme of the extraction



Fig. 2 Incision performed 2 cm above the tumour (distal line of resection)

anastomosis is performed. Bubble test is carried out (Video 1). Loop colostomy is performed in the upper left quadrant. An abdominal drain is positioned in the pelvis. Access sites are closed with intradermal sutures.

Results

Baseline and intraoperative characteristics of patients are reported in Table 1. Mean follow-up was 9 months (IQR 5–13). Two patients underwent neoadjuvant therapy consisting in a single tumor dose 2 Gray and total radiation dose 50 Gray + capecitabine and were operated 12 weeks after completion of radiation. No postoperative complications occurred. One patient complained of mucus discharge from the anus for the



Fig. 3 Resection of colon using a linear stapler (proximal line of resection)



Fig. 4 Using a plastic guide, the circular stapler is inserted through the distal line of resection

first 3 days after surgery. Median length of hospital stay was 9 days (IQR 7, 5–11). Postoperative histopathological data are provided in Table 2. None of the specimens had signs of mesorectal fascia damage and no positive margins were

detected. The median number of harvested lymph nodes was 22 (range 13–57). Closure of loop colostomy was performed at a median of 45 days after the first operation. One month after stoma closure the median Clinical Patient Grading Assessment Scale was 5 (range 3–7), which means “a good deal better”. The median LARS score was 14 (IQR 14–19,5) preoperatively and 19 (IQR 19–21,5) 1 month after stoma closure.

Discussion

Since the concept of TME has become a standard of care for low rectal cancer surgery [6], there has been an increasing interest in new minimally invasive techniques, reducing the size of abdominal incisions to the minimum required for abdominal specimen extraction, although extraction specimen site infections and hernia are described in the literature [3, 7, 8]. NOSE has aroused a great interest among colorectal surgeons as a way to reduce abdominal incision still further.

Indications for NOSE procedures are strict and include T2–T3 tumours, with a maximum circumferential diameter (CD) of 3 cm and a body mass index (BMI) less than 30 kg/m² for transanal extraction and a CD of 3–5 cm and a BMI less than 35 kg/m² for transvaginal extraction. We strictly adhered to these indications, moreover, all of our patients were females who present the advantage of a wider pelvic outlet.

In this article, we proposed a variation of NOSE surgery with eversion of the rectum not included among techniques already described in the literature [9–11].

In our technique, we proposed the eversion of the rectum and sigmoid colon to have complete extra-abdominal control of the tumour. Furthermore, this variation of NOSE surgery makes it possible to control the blood supply of the anastomosis and to identify accurately where to perform the rectal resection. In our case series, no intraoperative or postoperative complications occurred in the short term and

Table 1 Baseline and intraoperative data

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Age (years)	29	60	44	40	31	57	58
Sex, M/F	F	F	F	F	F	F	F
BMI (kg/m ²)	22	23,8	20,5	20,5	21	21	25
ASA class	I	II	I	I	I	II	II
Distance of the tumour by dentate line (cm)	6	7	7	4	7	6	9
Laparoscopic (L) or robotic (R) approach	R	L	L	R	L	L	L
Operation time (min)	300	220	120	270	340	240	270
Intraoperative blood loss (ml)	20	30	50	50	150	50	30

BMI body mass index, ASA American Society of Anesthesiologists

Table 2 Histopathological findings and postoperative outcomes

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Length of hospital stay (days)	7	8	11	9	15	11	7
Tumour size (maximum diameter)	3 cm	4 cm	4 cm	4 cm	2 cm	3 cm	3 cm
pTNM	T2N2M0	T3N0M0	T2N0M0	T2N1M0	T3N2M0	T2N0M0	T3N0M0
Clavien–Dindo grade	1	1	1	1	1	1	1
Anastomotic leak	NO						
CPGAS	7	5	5	4	5	5	3
Preoperative LARS score	14	14	9	19	20	20	14
LARS score 1 month after surgery	19	14	19	21	22	31	19

CPGAS Clinical Patient Grading Assessment Scale, LARS low anterior resection syndrome

patient satisfaction was very high according to CPGAS score results. As regards postoperative bowel dysfunction, only one patient had “major LARS” 1 month after stoma closure. However, follow-up was too short and the sample size too small for us to evaluate this technique better in terms of functional results when compared to other approaches.

The main risk of this procedure could be the damage of colon mucosa during the complete eversion and the difficulty of controlling the rectal stump that tends to be retract after the first transection.

Conclusions

Our variation of the procedure could be considered as a valid alternative to classic transanal NOSE surgery with the advantage of reducing the risk of intra-abdominal contamination and identifying accurately the line of rectal resection.

Author contributions SKE: conceptualization; data curation; investigation; supervision; writing—original draft. IAT: conceptualization; data curation; formal analysis; investigation; methodology; supervision; validation; writing—original draft. VDK: data curation; investigation; writing—original draft; writing—review and editing. KY: figure curation, conceptualization. AP: conceptualization; data curation; formal analysis; investigation; methodology; supervision; writing—original draft; writing—review and editing. PVT: first surgeon performing all operation; conceptualization; data curation; investigation; methodology; supervision; validation; writing—original draft.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All human studies have been reviewed by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in an appropriate version of the 1965 Declaration of Helsinki.

Informed consent Informed consent was obtained from all individual participants included in the study.

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