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Retrospective Study

Robotic natural orifice specimen extraction surgery I-type F method *vs* conventional robotic resection for lower rectal cancer

R-NOSES I-F for lower rectal cancer

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Abstract

BACKGROUND

Robotic resection using the natural orifice specimen extraction surgery I-type F method (R-NOSES I-F) is a novel minimally invasive surgical strategy for the treatment of lower rectal cancer. However, the current literature on this method is limited to case reports, and further investigation into its safety and feasibility is warranted.

AIM

To evaluate the safety and feasibility of R-NOSES I-F for the treatment of low rectal cancer.

METHODS

From September 2018 to February 2022, 206 patients diagnosed with low rectal cancer at First Affiliated Hospital of Nanchang University were included in this retrospective analysis. Of these patients, 22 underwent R-NOSES I-F surgery (R-NOSES I-F group) and 76 underwent conventional robotic-assisted low rectal cancer resection (RLRC group). Clinicopathological data of all patients were collected and analyzed. Postoperative outcomes and prognoses were compared between the two groups. Statistical analysis was performed using SPSS software.

RESULTS

Patients in the R-NOSES I-F group had a significantly lower visual analog score for pain on postoperative day 1 (1.7 ± 0.7 *vs* 2.2 ± 0.6, $p = 0.003$) and shorter postoperative anal venting time (2.7 ± 0.6 *vs* 3.5 ± 0.7, $p < 0.001$) than those in the RLRC group. There were no significant differences between the two groups in terms of sex, age, body mass index, tumor size, TNM stage, operative time, intraoperative bleeding, postoperative complications, or inflammatory response ($p > 0.05$). Postoperative anal and urinary functions, as assessed by Wexner, LARS, and IPSS scores, were similar in both groups (p

> 0.05). Long-term follow-up revealed no significant differences in the rates of local recurrence and distant metastasis between the two groups (p > 0.05).

CONCLUSION

R-NOSES I-F is a safe and effective minimally invasive procedure for the treatment of lower rectal cancer. It improves pain relief, promotes gastrointestinal function recovery, and helps avoid incision-related complications.

Key Words: Robotic surgery; Natural orifice specimen extraction surgery; Lower Rectal cancer

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Core Tip: This retrospective study examined the efficacy and safety of a novel surgical procedure called R-NOSES I-F for lower rectal cancer. Through a comparison with RLRC, the study demonstrates that R-NOSES I-F is a safe and effective minimally invasive surgical approach for low rectal cancer. It offers several benefits, including decreased postoperative pain, improved gastrointestinal function recovery, reduced abdominal wall dysfunction, and avoidance of complications associated with abdominal wall incisions. Furthermore, R-NOSES I-F does not negatively impact anal and urinary functions and does not increase the risk of local recurrence or distant metastasis.

INTRODUCTION

Colorectal cancer is a highly prevalent malignancy, ranking third in terms of incidence and second in terms of mortality worldwide in 2020 [1]. The most recent cancer statistics

in China indicate a significant increase in the incidence and mortality rates of colorectal cancer [2]; it ranks second in incidence and fifth in mortality rates in China [3, 4]. Therefore, enhancing surgical techniques to improve the postoperative quality of life for patients with rectal cancer is crucial, especially for those with lower rectal cancer. In recent years, the combination of robotic surgery and natural orifice specimen extraction surgery (NOSES) has gained attention in the management of colorectal cancer[5-8].

The robotic surgical platform has a magnified 3D high-definition field of view, a flexible robotic arm capable of 540° free rotation in seven directions, a stable camera platform, and enhanced depth perception, mitigating the challenges of hand-eye coordination. These features enable surgeons to operate with greater precision within the limited space of the pelvic cavity [9]. Robotic-assisted total rectal mesenteric resection has played a pivotal role in the minimally invasive treatment of lower rectal cancer [10, 11]. Therefore, robotic NOSES has garnered increasing attention as a surgical approach for the treatment of lower rectal cancer.

The introduction of the concept of NOSES has ushered in a new era of "no incision" in minimally invasive surgery [12]. Expert consensus on NOSES in colorectal neoplasms was initially published by the China NOSES Alliance in 2017 [13], and was later updated and improved in 2019 [14]. Additionally, an international consensus on NOSES for colorectal cancer has been published [15]. In 2022, China published the first expert consensus on robotic NOSES for colorectal neoplasm [16]. These guidelines have served to guide and standardize the development of robotic NOSES for lower rectal cancers.

Previous studies [5, 7, 8, 17] have confirmed the safety and feasibility of robotic NOSES surgery as a minimally invasive procedure, enhancing surgical quality and expediting postoperative recovery. Robotic resection of lower rectal cancer using the natural orifice specimen extraction surgery I-type F method (R-NOSES I-F) represents a novel approach characterized by intussusception to achieve transanal specimen eversion. This technique involves resecting the specimen and placing the anvil into the proximal bowel extra-abdominally [16]. However, existing studies related to this surgical approach are limited to case reports [18, 19], with a lack of long-term follow-up results. Therefore,

this study aimed to compare the postoperative outcomes of R-NOSES I-F with those of conventional robotic low rectal cancer resection (RLRC) through retrospective analysis, thereby evaluating the effectiveness and safety of R-NOSES I-F in the treatment of low rectal cancer.

MATERIALS AND METHODS

Patient information

In this retrospective analysis, we collected and analyzed clinicopathological data of patients diagnosed with rectal cancer at our hospital from September 2018 to February 2022. The following inclusion criteria were applied: (1) pathologically confirmed rectal malignancy through preoperative assessment; (2) tumor located 3–7 cm from the anal verge; (3) age between 18 and 80 years; (4) body mass index (BMI) ≤ 30 kg/m^2; and (5) absence of distant metastasis. The exclusion criteria were as follows: (1) patients who received preoperative neoadjuvant therapy; (2) TNM stage IV; (3) requirement for multiorgan resection; (4) presence of concomitant primary malignancies in other organs or multi-origin colorectal malignancies; (5) emergency surgery due to acute intestinal obstruction, perforation, or bleeding; and (6) major comorbidities such as coronary heart disease and cerebral infarction. According to the above criteria, patients who underwent R-NOSES I-F surgery were included in the R-NOSES I-F group, while patients who underwent RLRC surgery were included in the RLRC group. All patients provided informed consent before surgery. The study was approved by the Ethics Committee of the First Affiliated Hospital of Nanchang University and conducted following the principles outlined in the Declaration of Helsinki.

Perioperative management

All patients underwent a comprehensive preoperative evaluation, including physical examination, blood tests for tumor markers, colonoscopy, pathological biopsy, chest computed tomography or radiography, abdominal computed tomography, and rectal magnetic resonance imaging. Bowel preparation was performed using 2 L of polyethylene glycol solution 1 day before surgery, and postoperative self-administered

analgesia was employed. Postoperative pain was assessed using a visual analog scale (VAS) calibrated from 0 to 10, with 0 indicating no pain and 10 representing the most intense pain imaginable. Pain scores were recorded on postoperative days 1, 3, and 5. The postoperative inflammatory response was evaluated using global white blood cell and neutrophil counts (on postoperative days 1, 3, and 5), and body temperature (from postoperative days 1 to 5).

Surgical procedure

Following successful endotracheal intubation and general anesthesia, the patient was positioned in a lithotomy position with the head lowered and feet elevated between 15° and 30° and tilted to the right between 10° and 15°. The procedure was performed using a five-port approach with five trocar placements. The specific port locations were as follows: 1) Camera port C (12 mm), positioned 3–4 cm above the right side of the umbilicus; 2) robotic operating port R1 (ultrasonic knife; 8 mm), located at one-third of the distance between the umbilicus and the right anterior superior iliac spine; 3) robotic operating port R2 (bipolar electrocoagulation; 8 mm), placed 4–5 cm above the left side of the umbilicus; 4) robotic operating port R3 (noninvasive grasping clamp; 8 mm), positioned 2 cm below the left anterior axillary line rib margin; and 5) auxiliary port A (12 mm), medial to the right midclavicular line, corresponding to the position of the flat camera port (*Figure 1*). After establishing pneumoperitoneum, laparoscopic exploration was conducted to confirm the absence of tumor implantation and metastasis within the abdominal cavity and determine the precise location of the tumor.

The first incision was made below the sacral promontory, and dissection was carried out along Toldt's space. The inferior mesenteric arteries and veins were ligated at the level of the duodenum. The rectal mesentery was freed to expose the bilateral seminal vesicles (men) or the posterior vaginal wall (women). The left and right intestinal walls of the rectum were further exposed 2–3 cm below the lower edge of the tumor, and the pre-cut line was determined approximately 10 cm above the tumor. The sigmoid mesentery was dissected, and the intestinal canal was exposed.

For the R-NOSES I-F group, the specimen resection and digestive tract reconstruction were performed as follows (*Figure 2 and Supplementary Video 1*): The anus was fully dilated to accommodate the passage of six fingers, and a sterile plastic protective sleeve was inserted through the anus, extending 5 cm above the tumor. The oval forceps was introduced through the protective sleeve to the pre-excision site of the bowel lumen, approximately 10 cm from the upper edge of the tumor, and, under robotic view, it was secured to the bowel lumen with sutures (*Figure 2A*); then, the pre-excision bowel and mesentery were pulled out of the anus (*Figure 2B*). The tumor location was determined, and the tumor was flushed with iodophor water. The bowel was incised by the site of the oval forceps fixation, and the pre-exposed bowel was identified and disconnected (*Figure 2C*); after placing the anvil, it was secured at the sigmoid colon break and returned to the abdominal cavity (*Figure 2D*). The rectum was transected under direct vision, approximately 0.5–2 cm above the lower edge of the tumor, depending on the distance of the tumor from the anal edge (*Figure 2E*). The specimen was removed, and the distal rectal section was returned to the abdominal cavity. The anus was disinfected with iodophor water, and a circular stapler was used to perform a sigmoid-rectal end-to-end anastomosis (*Figure 2F*).

Specimen resection and digestive tract reconstruction in the RLRC group involved the following steps: The rectum was transected at a distance of 0.5–2 cm distal to the tumor, using a linear cutting closure device under the robotic system. Subsequently, a 6 cm incision was made adjacent to the rectus abdominis muscle in the left lower abdomen. The incision was protected with a protective sleeve. The proximal rectum and sigmoid colon containing the tumor were exteriorized from the abdominal cavity, and the affected intestinal segment was excised. An anvil was inserted into the proximal colon, pneumoperitoneum was re-established, and sigmoid-rectal end-to-end anastomosis was performed transanally using an anastomotic clutch while visualized through direct laparoscopy.

After thorough rinsing of the abdominopelvic cavity with iodophor water and injection of iodophor saline through the anus to ensure no anastomotic leakage, certain

postoperative measures were implemented. First, an anal tube was inserted through the anus. Second, a double-sleeve drainage tube was positioned on the left side of the anastomosis and drained through the presacral area. Finally, another drainage tube was placed on the right side of the anastomosis and drained through the trocar orifice on the right side of the abdomen. These steps were performed at the conclusion of the surgery.

Follow-up visits

Patients with postoperative pathological TNM stage I or II without risk factors did not receive chemotherapy, a few patients with stage II with risk factors underwent fluorouracil single-agent oral chemotherapy, and those with stage III underwent XELOX regimen chemotherapy. After the surgical procedure, patients were scheduled for outpatient clinic visits every 3 mo for a period of 2 years. Subsequently, the follow-up frequency was adjusted to every 6 mo. During each visit, patients underwent a comprehensive physical examination and tumor marker analysis. Additionally, chest and whole abdominal CT scans were performed to monitor their condition. Regular communication with patients *via* WeChat or telephone was also maintained to ensure continuous follow-up. At 6 mo after surgery, the postoperative anal function was evaluated using the low anterior resection syndrome (LARS) rating scale and Wexner Incontinence Score. The postoperative urinary function was assessed using the International Prostate Symptom Scale (IPSS). Owing to the impact of the novel coronavirus epidemic, some patients were followed up remotely through phone calls or WeChat. The final follow-up was conducted in June 2023.

Statistical analysis

All data analyses were performed using SPSS software (version 23.0; IBM, Armonk, NY, USA). Continuous variables were presented as mean ± standard deviation and compared using the Mann-Whitney U test. Categorical variables were expressed as percentages and compared using the $\chi 2$ test or Fisher's exact test, as appropriate. *P* values were two-tailed and differences were considered statistically significant at $p < 0.05$.

RESULTS

Clinical and pathological characteristics

A total of 22 patients were included in the R-NOSES I-F group and 76 in the RLRC group. The clinical and pathological characteristics of the patients are summarized in Table 1. No significant differences were observed between the two groups in terms of sex, age, BMI, tumor size, distance of the lower margin of the tumor from the anal verge, CEA level, or TNM stage of the tumor ($p > 0.05$).

Perioperative results

Perioperative results are summarized in Table 2. All procedures were performed using the da Vinci Surgical System (Da Vinci ® Si System, Intuitive Surgical, Sunnyvale, CA, USA) and were performed by the same surgeon following the principles of total rectal mesenteric resection. None of the patients in the R-NOSES I-F or RLRC groups underwent open surgery. The operative time (173.0 ± 39.5 min vs. 187.3 ± 50.9 min, $p = 0.389$) and intraoperative blood loss were comparable between the two groups (89.6 ± 47.9 mL vs. 74.5 ± 62.8 mL, $p = 0.068$). No significant difference in the proportion of patients with a prophylactic stoma was observed between the two groups (31.8% vs. 47.4%, $p = 0.196$). Regarding postoperative recovery, VAS scores on postoperative day 1 were significantly lower for patients in the R-NOSES I-F than for those in the RLRC group (1.7 ± 0.7 vs. 2.2 ± 0.6, $p = 0.003$), and no significant difference in VAS scores on postoperative days 3 and 5 was observed ($p > 0.05$). The postoperative venting time was significantly shorter in the R-NOSES I-F group than in the RLRC group (2.7 ± 0.6 d vs. 3.5 ± 0.7 d, $p < 0.001$). Regarding postoperative complications, three complications in the R-NOSES I-F group and 12 in the RLRC group occurred, with no significant difference between the two groups (13.6% vs. 15.8%, $p = 0.632$). Regarding postoperative inflammation, no significant differences in global white blood cell and neutrophil counts were observed between the two groups on postoperative days 1, 3, and 5 ($p > 0.05$). Furthermore, no significant difference in the body temperature of the patients between postoperative days 1 and 5 was observed ($p > 0.05$).

Postoperative chemotherapy and follow-up results

As shown in Table 3, no significant difference in the proportion of patients receiving postoperative chemotherapy between the R-NOSES I-F and RLRC groups (p = 0.995) was observed. The Wexner, LARS, and IPSS scores in both groups were not significantly different (p > 0.05), indicating a similar degree of damage to the anal and urinary systems for both surgical procedures. Until the last follow-up in June 2023, the median follow-up time was 26 and 36 mo (range 16–57 mo) in the R-NOSES I-F and RLRC groups, respectively. No deaths were reported for the R-NOSES I-F group, while two were reported for the RLRC group. One local anastomotic recurrence occurred in the R-NOSES I-F group, while nine distant metastases occurred in the RLRC group (four liver metastases, three lung metastases, and two pelvic metastases). However, no significant difference between the two groups (p = 0.291) was observed.

DISCUSSION

Robotic technology combined with the NOSES concept has revolutionized minimally invasive surgeries by offering new possibilities. This retrospective cohort study represents the first published comparison between R-NOSES I-F and conventional laparoscopic RLRC. The study findings indicate that R-NOSES I-F is a safe and effective minimally invasive surgical technique for the treatment of lower rectal cancer.

In 2010, our center performed an improved laparoscopic transanal pull-through (ILTPT) technique for lower rectal cancer, which eliminated the need for auxiliary incisions in four patients with rectal cancer. This technique was the first of its kind on an international scale and the study represented the first investigation of laparoscopic R-NOSES I-F for lower rectal cancer. The results of this study demonstrated favorable short-term outcomes, with no instances of surgical site infections or complications in any of the cases. These findings provide substantial evidence that ILTPT is a safe and feasible approach for anus-preserving surgery in the treatment of lower rectal cancer [20]. Expert consensus[13] supports the notion that the anus serves as an ideal natural passage for extracting colorectal specimens, aligning with the requirements of minimally invasive surgery. Leveraging the clinical use of the Da Vinci robot, our center

has also published a case report on R-NOSES I-F for low rectal cancer [18, 19]. Although the above studies have shown good short-term results, they had the limitations of small sample sizes, lack of controlled trials, and lack of long-term follow-up results.

In this study, the R-NOSES I-F and RLRC groups had similar operative time (p = 0.389) and intraoperative blood loss (p = 0.068). However, the R-NOSES I-F group demonstrated significantly lower VAS scores on the first postoperative day (p = 0.003) and a significantly shorter postoperative anal venting time (p < 0.001) compared to those of the RLRC group. These findings are consistent with previous studies on laparoscopic NOSES [21, 22]. Severe acute postoperative pain is reported as a risk factor for poor long-term prognosis [23]. Therefore, effective postoperative analgesia is crucial. By avoiding a long abdominal incision, patients in the R-NOSES I-F group experienced reduced postoperative abdominal pain, earlier mobilization, and faster recovery of gastrointestinal function, leading to a shorter postoperative anal venting time.

Regarding postoperative complications, our results revealed no significant difference in the incidence of complications between the R-NOSES I-F and RLRC groups (p = 0.632). The R-NOSES I-F group exhibited a 9.1% incidence of anastomotic leak, which is comparable to previous studies on robot-assisted rectal cancer resection (4.5%–12.1% incidence) [24-26]. Notably, the RLRC group experienced two cases of incisional infections and four incisional hernias, whereas no incisional complications occurred in the R-NOSES I-F group. A retrospective study conducted in China [27], involving 79 hospitals and including 718 patients treated with NOSES for colorectal tumors, has reported no complications associated with abdominal wall incisions. The R-NOSES I-F approach, which avoids abdominal wall incisions during transanal specimen retrieval, offers unique and minimally invasive advantages. It maximizes preservation of abdominal wall function, reduces postoperative pain, minimizes complications related to abdominal wall incisions, provides favorable cosmetic outcomes, and alleviates the psychological stress associated with surgical scars.

Inflammation is closely associated with the development, progression, and prognosis of cancer [28, 29]. A growing array of evidence suggests that local and systemic

inflammatory responses are important predictors of prognosis and recurrence in patients with colorectal cancer [30-32]. Previous animal experiments and clinical studies [22, 33, 34] have shown that transanal NOSES for colorectal cancer elicits a stronger systemic inflammatory response compared to conventional laparoscopic surgery. However, unlike previous studies, our study found that postoperative global white blood cell and neutrophil counts, and body temperature did not differ significantly between the patients in the two groups ($p > 0.05$). We conclude that the R-NOSES I-F group avoided the abdominal incision used to obtain the surgical specimen, thereby reducing surgical stress and decreasing the release of inflammatory mediators. Most importantly, the dissection and resection of specimens in the R-NOSES I-F group were performed entirely under direct *in vitro* vision, which shortens the time of intra-abdominal surgeries, avoids the potential risk of infection caused by dissecting the intestinal canal in the abdomen, minimizes the risk of contamination of the surgical area, and reduces the probability of intestinal bacteria entering the circulation. Additionally, the iodophor water used for irrigation before intestinal cutting and during the placement of the transanal circular stapler for digestive tract reconstruction ensured distal cleanliness. Consequently, in line with Efetov's findings [35], we believe that the R-NOSES I-F surgical approach does not exacerbate the postoperative inflammatory response.

The attainment of sterile and tumor-free standards in NOSES remains a substantial concern among surgeons. A recent multicenter study has shown that robotic NOSES had no adverse impact on the radical outcome of tumors [17]. Expert consensus [16] provides the following indications for R-NOSES I-F: (1) appropriateness for low rectal cancer with the lower margin of the tumor located 2–5 cm from the dentate line; (2) suitability for tumor invasion depth within T3; and (3) applicability to tumors with a circumference of less than 5 cm. In our study, the R-NOSES I-F group included 81.8% of patients with a tumor infiltration depth within T3 and 86.4% of patients with a tumor circumference of < 5 cm. Adequate tumor size and proper bowel preparation facilitate conducive transanal specimen eversion. Moreover, the entire procedure was conducted

following high standards. Before the specimen removal, a sterile protective sleeve was positioned, and the specimen underwent repeated rinsing with iodophor water before resection and reconstruction of the digestive tract. Additionally, resection of the specimen in the R-NOSES I-F group was performed entirely under direct extracorporeal vision with sufficient operating space, which provided favorable conditions for a more precise judgment of the surgical margins and allowed us to preserve more of the distal rectum while ensuring complete resection of the tumor. Finally, the perirectal circumferential resection margins were negative in both groups. The mean number of lymph nodes cleared in the R-NOSES I-F group was no less than that in the RLRC group (14.2 ± 7.3 vs. 13.7 ± 6.0, p = 0.759) and exceeded the recommended threshold of at least 12 Lymph nodes cleared, as outlined by the College of American Pathologists. Thus, we conclude that the R-NOSES I-F surgical approach adheres to aseptic and tumor-free principles.

The development and promotion of new approaches should prioritize the patient postoperative quality of life and long-term survival rates. Performing TME in the lower rectum is challenging owing to pelvic limitations, which can result in nerve injury. However, the magnified high-definition 3D view provided by robotic technology, along with the flexible and stable robotic arm, can help prevent permanent nerve injury during surgery [36]. In our study, we did not observe statistically significant differences in LARS and Wexner scores between patients in the R-NOSES I-F and RLRC groups (p > 0.05). This result is consistent with the findings of Tang [37]. No significant difference in the IPSS between the two groups (p = 0.207) was observed. Therefore, we believe that the R-NOSES I-F procedure does not cause more damage to the anal sphincter or urinary system during transanal specimen retrieval than the RLRC procedure. Furthermore, we did not find any difference in the incidence of local recurrence or distant metastasis between the two groups over the long follow-up period (p = 0.291).

However, it is important to acknowledge the limitations and disadvantages of R-NOSES I-F: (1) The method involves using intussusception to remove the required intestinal segments externally, which requires moving the descending colon upward

during the surgery, increasing the operational complexity; (2) In our study, we utilized single-point suture fixation to secure the oval forceps to the intestinal wall in the proximal pre-excision section. This approach places considerable tension on the intestinal wall amount of and carries a risk of intestinal tears. In future endeavors, we plan to improve this technique by employing a metal rod with a large head end and a small tail end (resembling the shape of a mushroom) as a replacement for the oval forceps. This modified approach involves binding the neck of the metal rod to the colon wall under robotic vision and then extracting the specimen, substantially reducing tension during specimen retrieval, and thereby mitigating surgical complexity and associated complications.

Furthermore, our study had several limitations. First, it was a single-center retrospective study, potentially introducing selection bias in patient enrollment. Second, the sample size was small, and the follow-up period was insufficient for some patients. A prospective multicenter randomized trial with a larger sample size and longer follow-up period is necessary to evaluate the advantages of R-NOSES I-F in the treatment of lower rectal cancer.

CONCLUSION

In conclusion, our findings support that R-NOSES I-F is a safe and effective, minimally invasive surgical approach for the treatment of lower rectal cancers. This procedure to did not lead to an increased postoperative inflammatory response compared to RLRC. It offers several advantages, including reduced postoperative pain, enhanced recovery of gastrointestinal function, minimized abdominal wall dysfunction, avoidance of complications associated with abdominal wall incisions, favorable cosmetic outcomes, and comparable rates of local recurrence and distant metastasis over a long follow-up period.

ARTICLE HIGHLIGHTS

Research background

R-NOSES I-F is a novel minimally invasive surgical strategy for the treatment of lower rectal cancer with robotic resection of rectal cancer and natural oral specimen extraction surgery. But its safety and feasibility are still worth exploring.

Research motivation

To evaluate the safety and feasibility of R-NOSES I-F for the treatment of lower rectal cancer by comparing R-NOSES I-F with traditional robotic lower rectal cancer resection. To provide a new minimally invasive surgical method for the treatment of lower rectal cancer.

Research objectives

To investigate the safety and feasibility of R-NOSES I-F surgery in the treatment of low rectal cancer.

Research methods

We used retrospective analysis to include 22 patients who underwent R-NOSES I-F surgery into the R-NOSES I-F group and 76 patients who underwent RLRC surgery into the RLRC group. The clinicopathological data of all enrolled patients were analyzed to compare the postoperative outcomes and prognosis of the two groups.

Research results

Compared with the RLRC group, the R-NOSES I-F group had a lower VAS of pain on day 1 after surgery (1.7 ± 0.7 *vs* 2.2 ± 0.6, $P = 0.003$) and a shorter postoperative ventilation time (2.7 ± 0.6 *vs* 3.5 ± 0.7, $p < 0.001$). After long-term follow-up, there was no significant difference in local recurrence rate and distant metastasis rate between the two groups ($p > 0.05$).

Research conclusions

R-NOSES I-F is a safe and effective minimally invasive procedure for the treatment of lower rectal cancer, which has the advantages of relieving pain, promoting gastrointestinal function recovery, and avoiding incision complications.

Research perspectives

The incidence and mortality of rectal cancer are increasing significantly, and it is particularly important to improve the postoperative quality of life of rectal cancer patients, especially those with low-grade rectal cancer, through improved surgical methods. In recent years, the combination of robotic surgery and NOSES has become one of the hot spots in rectal cancer surgery. R-NOSES I.-F has the advantages of reducing postoperative pain, promoting gastrointestinal function recovery, reducing abdominal wall dysfunction, and avoiding complications of abdominal wall incision, and has certain cosmetic effects. It is a safe and effective minimally invasive surgical modality for the treatment of low-lying rectal cancer.

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