

Effects of Laparoscopic Pelvic Autonomic Nerve-Preserving Radical Resection of Rectal Cancer on Urinary and Sexual Function

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Abstract: *Objective:* To investigate and analyze the effect of laparoscopic pelvic autonomic nerve-preserving radical resection of rectal cancer on urinary and sexual function. *Methods:* Cases of laparoscopic radical resection of rectal cancer in our hospital from April 2018 to April 2023 were selected, and 60 patients who met the requirements were included as research subjects. The patients were divided into an experimental group and a reference group by a double-blind mechanism, with 30 cases in each group. The experimental group underwent laparoscopic pelvic autonomic radical resection, while the reference group underwent ordinary radical resection. The voiding function, urodynamics, sexual function, and blood indexes of the patients of both groups were compared. *Results:* The total incidence of voiding dysfunction in the experimental group was significantly lower than in the reference group ($P < 0.05$). Urodynamics such as abdominal leak point pressure (ALPP), maximum urethral pressure (MUP), maximum urethral closure pressure (MUCP), and functional urethral length (FUL) in the experimental group were significantly better than those in the reference group ($P < 0.05$). The incidences of erectile dysfunction and ejaculatory dysfunction in the experimental group were significantly lower than those in the reference group ($P < 0.05$). Before the surgery, there were no significant differences in the blood indexes such as C-reactive protein (CRP), cortisol (Cor), and pre-albumin (PA) between the two groups ($P > 0.05$); after the operation, the blood indexes of the patients in the experimental group were significantly better than those in the reference group ($P < 0.05$). *Conclusion:* Laparoscopic pelvic autonomic nerve-preserving radical resection of rectal cancer has lesser effects on urinary and sexual functions.

Keywords: Laparoscopy; Pelvic autonomic nerve preservation; Radical resection of rectal cancer; Urinary and sexual function

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1. Introduction

Radical resection is a common surgical treatment for rectal cancer. The rectum is near the urinary and reproductive systems. Therefore, it is easy to damage these two systems during the surgery, leading to

postoperative urinary and sexual dysfunction^[1,2]. Therefore, it is important to protect the surrounding nerves during the surgical procedure. Studies have found that completely removing the mesentery while preserving the pelvic autonomic nerves during radical resection of rectal cancer can minimize the adverse effects on urination, sexual function, and various physiological processes in the human body^[3,4]. Therefore, this study aimed to analyze the impact of laparoscopic pelvic autonomic nerve-preserving radical resection of rectal cancer on urinary and sexual functions.

2. General information and methods

2.1. General information

Cases of laparoscopic radical resection of rectal cancer in our hospital from April 2018 to April 2023 were selected, and 60 patients who met the requirements were included as research subjects. The patients were divided into an experimental group and a reference group by a double-blind mechanism, with 30 cases in each group. The ages of the patients in the experimental group ranged from 35 to 55 years old, with an average age of 45.27 ± 0.68 years. The ages of the patients in the reference group ranged from 34 to 55 years old, with an average age of 45.15 ± 0.71 years. There was no statistically significant difference in general data between the two groups ($P > 0.05$).

Inclusion criteria: (1) male, (2) signed an informed consent, (3) had normal urinary and sexual functions before surgery.

Exclusion criteria: (1) presence of mental illness, (2) presences of cognitive disabilities, (3) presence of liver and kidney failure, (4) presence of severe underlying diseases.

2.2. Methods

The reference group underwent ordinary radical resection, where the surgery was performed according to the procedure of total mesangial resection.

The experimental group received laparoscopic pelvic autonomic nerve-preserving radical resection. This procedure involved tracheal intubation for anesthesia, creating pneumoperitoneum, conducting thorough abdominal exploration, using an ultrasonic knife to separate tissues while protecting primary structures, cutting the anorectal ligament and sacral fascia, freeing the anterior rectal wall, safeguarding the seminal vesicle's capsule structure, preserving the autonomic nerve, releasing the rectum, retaining the bladder branch and associated tissues, placing a protective sleeve, and excising the tumor tissue.

2.3. Observation indicators

- (1) Voiding function: Grade 1 (normal urination), Grade 2 (bladder irritation, mild dysfunction, residual urine volume within 50 mL), Grade 3 (moderate voiding dysfunction, might require catheterization), Grade 4 (severe voiding dysfunction, urinary retention, requires catheterization).
- (2) Urodynamics: abdominal leak point pressure (ALPP), maximum urinary pressure (MUP), maximum urethral closure pressure (MUCP), and functional urethral length (FUL).
- (3) Sexual function: Grade 1 (normal erectile function within a month), Grade 2 (normal erectile function within 15 days), grade 3 (persisting erectile dysfunction)
- (4) Blood indicators: C-reactive protein (CRP), cortisol (Cor), and pre-albumin (PA).

2.4. Statistical analysis

The data were processed and analyzed using SPSS 21.0. The count data were expressed as the number of cases (n)

and percentage (%), and the χ^2 test was employed. The measurement data were described as mean \pm standard deviation, and the t -test was conducted. $P < 0.05$ indicates statistical significance.

3. Results

3.1. Voiding function

The total incidence of voiding dysfunction in the experimental group was significantly lower than in the reference group ($P < 0.05$), as shown in **Table 1**.

Table 1. The comparison of the voiding function between the two groups (n [%])

| Group | Number of cases | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Incidence of voiding dysfunction |
|--------------------|-----------------|------------|----------|-----------|-----------|----------------------------------|
| Experimental group | 30 | 29 (96.67) | 0 (0.00) | 1 (3.33) | 0 (0.00) | 1 (3.33) |
| Reference group | 30 | 23 (76.67) | 1 (3.33) | 3 (10.00) | 3 (10.00) | 7 (23.33) |
| χ^2 | - | - | - | - | - | 5.1923 |
| P | - | - | - | - | - | 0.0226 |

3.2. Urodynamics

The ALPP, MUP, MUCP, and FUL of the patients in the experimental group were significantly better than those in the reference group ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of the urodynamics between the two groups (mean \pm standard deviation)

| Group | Number of cases | ALPP (cmH ₂ O) | MUP (cmH ₂ O) | MUCP (kPa) | FUL (cm) |
|--------------------|-----------------|---------------------------|--------------------------|-------------------|-----------------|
| Experimental group | 30 | 160.27 \pm 25.54 | 67.24 \pm 5.91 | 50.37 \pm 10.63 | 4.25 \pm 0.53 |
| Reference group | 30 | 80.24 \pm 15.23 | 40.28 \pm 6.89 | 33.21 \pm 8.56 | 3.01 \pm 0.43 |
| t | - | 14.7410 | 16.2673 | 6.8866 | 9.9513 |
| P | - | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

3.3. Sexual function

The incidences of erectile dysfunction and ejaculatory dysfunction in the experimental group were significantly lower than those in the reference group ($P < 0.05$), as shown in **Table 3**.

Table 3. The comparison of sexual function between groups is as follows (n [%])

| Group | Number of cases | Erectile function | | | Obstacle incidence | Ejaculation function | | | Obstacle incidence |
|-----------------|-----------------|-------------------|-----------|-----------|--------------------|----------------------|-----------|-----------|--------------------|
| | | Grade 1 | Grade 2 | Grade 3 | | Level 1 | level 2 | Level 3 | |
| Reserved group | 30 | 28 (93.33) | 1 (3.33) | 1 (3.33) | 2 (6.67) | 28 (93.33) | 0 (0.00) | 2 (6.67) | 2 (6.67) |
| Reference group | 30 | 22 (6.67) | 5 (16.67) | 3 (10.00) | 8 (26.67) | 23 (76.67) | 4 (13.33) | 3 (10.00) | 7 (23.33) |
| χ^2 | - | - | - | - | 4.3200 | - | - | - | 4.8904 |
| P | - | - | - | - | 0.0376 | - | - | - | 0.0270 |

3.4. Blood indicators

Before the surgery, there were no significant differences in the blood indexes such as CRP, Cor, and PA between the two groups ($P > 0.05$); after the surgery, the blood indexes of the patients in the experimental group were significantly better than those in the reference group ($P < 0.05$), as shown in **Table 4**.

Table 4. The comparison of blood indicators between groups is as follows (mean \pm standard deviation)

| Group | Number of cases | CRP (mg/L) | | Cor (mmol/L) | | PA (mg/L) | |
|-----------------|-----------------|-----------------|------------------|----------------------|----------------------|--------------------|--------------------|
| | | Before surgery | After surgery | Before surgery | After surgery | Before surgery | After surgery |
| Reserved group | 30 | 1.84 \pm 0.64 | 58.42 \pm 5.12 | 3385.59 \pm 102.56 | 3685.12 \pm 112.54 | 221.57 \pm 10.35 | 245.56 \pm 15.24 |
| Reference group | 30 | 1.86 \pm 0.57 | 81.57 \pm 4.66 | 3385.12 \pm 102.75 | 4159.57 \pm 120.69 | 221.69 \pm 10.57 | 200.58 \pm 12.57 |
| <i>t</i> | - | 0.1278 | 18.3150 | 0.0177 | 15.7476 | 0.0444 | 12.4710 |
| <i>P</i> | - | 0.8987 | 0.0000 | 0.9859 | 0.0000 | 0.9647 | 0.0000 |

4. Discussion

In recent years, the eating habits of many have become increasingly concerning. Long-term unhealthy lifestyles will severely impact human health and increase the incidence of diseases^[5,6]. For example, the incidence of rectal cancer has been increasing sharply^[7,8]. Laparoscopic radical resection of rectal cancer offers the advantage of reduced surgical trauma compared to traditional methods. However, it doesn't completely eliminate the risk of unintentional damage to other organs or tissues during the procedure. In male patients, there is a relatively high likelihood of experiencing postoperative dysuria and sexual dysfunction, which poses new challenges to the practice of laparoscopic radical resection for rectal cancer^[9]. During radical resection of rectal cancer, a partial resection of the rectum can result in a loss of support for the bladder. This can lead to a shift in the position of the bladder or cause obstructions, which may subsequently result in postoperative voiding dysfunction^[10,11]. Damage to the bladder nerve plexus during the operation can disrupt the voiding reflex, leading to impaired bladder function^[12]. In this surgery, the pelvic autonomic nerve needs to be removed, which may affect sexual function, lead to erectile and ejaculation dysfunction, and even cause irreversible damages^[13]. Therefore, the pelvic autonomic nerves should be preserved during laparoscopic radical resection for rectal cancer. During the operation, the ligaments should be treated with care to avoid damaging the ligaments, and the pelvic plexus should be protected to minimize nerve damage and to preserve the integrity of the nerve^[14,15].

Laparoscopic pelvic autonomic nerve-preserving radical resection of rectal cancer has a protective effect over urinary and sexual functions and causes lesser damage to the bladder and seminal vesicles. However, this surgery requires a comprehensive understanding of the location of rectal tumors and lymphoid tissues, proper handling of them, proficiency in laparoscopic techniques, and thorough nerve exploration. Besides, it is important to pay attention to protecting the surrounding nerves.

5. Conclusion

In conclusion, laparoscopic pelvic autonomic nerve-preserving radical resection of rectal cancer can ensure normal urinary and sexual function after surgery. Therefore, this procedure should be popularized.

Disclosure statement

The authors declare no conflict of interest.

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