A preliminary study on the efficacy and safety of 3-hole VS 5-hole laparoscopic radical cystectomy

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Abstract

Objective

To investigate the efficacy and safety of three hole laparoscopic radical cystectomy (LRC) in comparison with five hole LRC.

Methods

The patients who underwent radical cystectomy from January 2019 to March 2021 in our hospital were retrospectively analyzed. Basic information and preoperative and postoperative data were collected (such as gender, age, hemoglobin, creatinine, operation time, blood loss, ventilation time, etc). Statistical analysis was used to determine whether there was statistical significance between the two groups (3-hole VS 5-hole).

Results

A total of 99 patients with radical cystectomy and urinary diversion were collected. Three hole laparoscopy included 33 cases and five hole laparoscopy included 66 cases. The basic characteristics of the two groups of data did not have significant statistical significance. The operation time and exsufflation time of 3-hole method were significantly shorter than that of 5-hole method in patients with ileal conduit. In patients with orthotopic neobladder, the exsufflation time and postoperative hospital stay of 3-hole method were significantly shorter than that of 5-hole method. Total laparoscopic surgery has shorter ventilation time than in vitro urinary diversion.

Conclusions

Compared with 5-hole LRC, 3-hole LRC can reduce the operation time, shorten the hospitalization time, reduce the hospitalization cost and save medical resources. However, due to the small sample size and short follow-up time, the long-term benefits need to be further observed.

Introduction

Bladder Cancer (BC) is the second most common malignancy of the genitourinary system and is a serious threat to life and health[1]. The incidence of bladder cancer is increasing in China men, but mortality decreases in China men and women. Both the incidence and mortality in China men have increased significantly with age and period, while the rates in women increased with period since 2007[2]. The most common clinical manifestation of bladder cancer is painless gross hematuria, and the diagnosis mainly depends on cystoscopy. Non-muscular invasive bladder cancer can be treated by
transurethral resection, combined with bladder perfusion chemotherapy. Radical cystectomy is usually performed for bladder cancer that recurs and invades the muscular invasive[3, 4].

Pelvic lymph node dissection improves survival and becomes a routine procedure for radical cystectomy[5]. For radical cystectomy, the choice of urinary diversion is particularly important. There are many types of urinary diversion, such as ureteral skin ostomy, Bricker ileal, orthotopic neobladder and so on[6]. Compared with the traditional open surgery, laparoscopic surgery has the advantages of less trauma, less bleeding and quick recovery, and has been widely used in the field of urology. Therefore, laparoscopic radical cystectomy, pelvic lymph node dissection and urinary diversion is a considered the standard treatment for muscular invasive bladder cancer.

For LRC, there are many ways to establish operation hole. In this paper, we collected the relevant information of patients with three or five hole radical cystectomy in our hospital. The relevant data are summarized and analyzed as follows.

Patients And Methods

Patients

This study retrospectively analyzed patients who were diagnosed with bladder malignant tumor in our hospital from January 2019 to April 2021 and underwent laparoscopic radical cystectomy and urinary diversion. Collect and analyze the basic information (gender, age, body mass index, HB, CR) and operation related data of patients (operation time, blood loss, exhaust time, postoperative hospital stay, postoperative pathology).

Inclusion criteria: 1) It is in accordance with the indication of radical cystectomy. 2) Patients underwent pelvic lymphadenectomy. Urinary diversion was either Bricker or neobladder. 3) There was no bowel disease. 4) There is no surgical contraindication caused by serious heart, lung and brain diseases.

LRC technique

3. hole: 10 mm Trocar was placed at the 2 cm above the umbilicus. 12 mm Trocar was placed at the 2 transverse fingers of the left rectus abdominis below the umbilicus, and 12 mm Trocar was placed at the 1 transverse fingers of the right rectus abdominis below the umbilicus. 5-hole: 10 mm observation hole was placed at 2 cm above umbilicus. 12 mm trocar was placed at the lateral edge of rectus abdominis 2 cm below umbilicus respectively. 5 mm trocar was placed in the medial 2 cm of the left and right the anterior superior iliac spine respectively.

Cystectomy: First, the posterior part of the bladder was dissociated (figA). Second of all, free anterior wall of bladder and suture of deep vein complex in the dorsal penile (figB). Finally, cut off the bladder lateral ligament, prostatic lateral ligament and urethra, and completely remove the bladder and prostate (figC).

Pelvic lymphadenectomy: The peritoneum was incised from the ureter across the iliac artery, and the lymph nodes in the external iliac region, the internal iliac region and the obturator region were
dissected (fig D/E). The upper boundary is ureter, the lower boundary is circumflex iliac artery, the inner boundary is internal iliac artery, and the outer boundary is genitofemoral nerve. Urinary diversion: 1) Ileal conduit: The distal end of the ureter is turned into a nipple and is implanted into the ileum entrance in vitro. 2) Construction of orthotopic neobladder in vivo: First of all, anastomose the intestine and urethra at an appropriate distance from the ileocecal region, cut the intestine longitudinally and suture the anterior and posterior walls of the neobladder. Secondly, the ureter was pulled out and everted to form a nipple and a ureteral stent was implanted. Finally, the ureter was implanted into the neobladder.

**Operation points:**
1) Both ends of the intestine were anastomosed with overlap (fig H). 2) The right peritoneum was sutured with continuous suture to reduce the friction between the intestine and pelvic cavity (fig I). 3) The orthotopic neobladder was constructed under laparoscopy (fig F/G). Reducing the time of intestinal tract in vitro is beneficial to the recovery of intestinal function. 4) Extraperitoneal total cystectomy can be performed for early localized bladder cancer (fig J/K/L).

**Statistical analysis**

The values of all data were expressed as mean ± SD. The data were analyzed by GraphPad Prism 8 software. The basic information and operation related data of the two groups were compared by Chi-square test and Student’s t test. When p < 0.05, it was considered that there was significant difference.

**Results**

**Baseline patient characteristics**

In this study, 99 patients who underwent LRC were included. Thirty three patients underwent 3-hole LRC, including 13 ileal conduit and 20 orthotopic neobladder. Sixty-six patients underwent 5-hole LRC, including 47 ileal conduit and 19 orthotopic neobladder. Among the patients with orthotopic neobladder, 15 patients underwent Total laparoscopic radical cystectomy and orthotopic neobladder. There was no significant difference in gender, age, HB, CR, lymph node number and pathological stage between the two groups (Table 1).

**Surgical-related Characteristics**

In patients with ileal conduit, the operation time of 3 hole LRC were shorter than those of 5 hole LRC, and the difference was statistically significant (p = 0.017). There was no significant difference in postoperative exhaust time due to the small sample size (p = 0.06, 3-hole VS 5-hole). There was no statistical significance in intraoperative blood loss, postoperative hospital stay and intestinal complications (Table 2). Ileal conduit was constructed in vitro in both 3 and 5 holes. In patients with orthotopic neobladder, the postoperative exhaust time and postoperative hospital stay time of 3-hole method were shorter than that of 5-hole method (p = 0.019 and p = 0.015). The operation time, intraoperative blood loss and intestinal complications were not statistically significant (Table 3). In comparison with total and
incomplete laparoscopy, total laparoscopic surgery has a faster ventilation time \( (p = 0.002) \). The postoperative hospitalization stay time needs to be measured by large sample size \( (p = 0.06) \). The operation time, intraoperative blood loss and intestinal complications were not statistically significant in the two groups (Table 4).

### Discussion

There are great differences in the treatment methods, treatment goals, survival rate and recurrence rate of BC. In non muscle invasive BC, the goal is to prevent progression and limit recurrence. About 75% of bladder cancers are non-invasive and usually have a good prognosis. In muscle invasive BC, our goal is to decide whether to retain or resect the bladder. About 25% of bladder cancer is muscle invasive \[7\]. With the development of laparoscopic technique, LRC has replaced the traditional open radical cystectomy. In addition, LRC has the advantages of less bleeding and rapid recovery \[8\]. Therefore, the patients with bladder tumor need radical cystectomy, that laparoscopic surgery is the first choice. There are many ways to establish the operation hole of laparoscopic surgery. Single incision laparoscopic surgery needs to overcome the difficulty of instrument collision and lack of triangular traction, and the learning curve of this technique is relatively long \[9\].

Traditional laparoscopic radical cystectomy, usually choose 5 operation holes. However, with the development of three port laparoscopy, its short-term and pathological results are the same as or even better than five port laparoscopy. Reducing the number of laparoscopic holes is a challenging technique \[10\]. This study collected the data of our hospital using 3 hole LRC for brief analysis.

Under the background of rapid economic growth, there are obvious differences in the allocation of health resources and the utilization and distribution of health services in China. Therefore, reasonable conservation of health resources, so that it is more needed in the area is a very meaningful thing \[11\]. The cost of trocar can be reduced by using 3-hole radical cystectomy. Reduce the cost of surgery, more reasonable allocation of medical resources. Due to the reduction of puncture holes and body surface trauma, psychological suggestion, it can be given to patients to accelerate their recovery.

It can be seen from the statistical results that 3 hole radical cystectomy can effectively save the operation time. The operation time was closely related to postoperative intestinal function recovery, surgical site infections and postoperative mortality. In the study of SM et al., it has been shown that prolonged abdominal surgery is a risk factor for increased intraoperative mortality \[12\]. The incidence of surgical site infection (SSI) varies from 0.1–50% according to the procedure, specialty and condition. The duration of surgery is often considered to be an independent and potentially modifiable risk factor for SSI \[13\]. The reduction of operation time can reduce the anesthesia time, which is conducive to postoperative intestinal recovery. Therefore, we recommend the three hole LRC.

Orthotopic neobladder is a common urinary diversion after RC for bladder cancer. It is also one of the most challenging operations for urologists. The advantages of neobladder include better quality of life and avoidance of psychological complications caused by ostomy \[14\]. In the comparison of urinary
diversion to orthotopic neobladder, the results showed that there was no significant difference in operation time between the two groups (294.5 ± 52.98 vs 303.47 ± 45.48), but the exhaust time and postoperative hospital stay were significantly reduced, the difference was statistically significant (3-hole vs 5-hole). The reason that there was no significant difference in operation time between the two groups may be that 75% of the patients in the three holes underwent total laparoscopic orthotopic neobladder, which prolonged the operation time. In the comparison of in vivo and in vitro in orthotopic neobladder, the postoperative ventilation time was significantly shorter in vivo, and the difference was statistically significant. The absence of intestinal exposure accelerated the postoperative ventilation time and prolonged the postoperative hospital stay. Early ventilation and early eating can stimulate faster peristalsis of gastrointestinal tract and promote faster recovery of physical strength and energy of patients. Shortening the length of hospital stay is beneficial to reducing the incidence of hospital infection, speeding up the turnover of hospital beds and reducing the consumption of medical resources. Therefore, we recommend the 3-hole total laparoscopic radical cystectomy and orthotopic neobladder.

Overlap anastomosis was first used for anastomosis at the end of gastrectomy [15]. It is a linear stapled reconstruction technique using an isoperistaltic side-to-side method [16]. This way of anastomosis is more in line with intestinal peristalsis and can restore the intestinal function earlier. Therefore, we recommend the overlap type anastomosis for end-to-end intestinal anastomosis.

The peritoneum is composed of mesothelial cells and basement membrane, and shows epithelial characteristics, which can effectively prevent adhesion between intestinal tract and platoon, and reduce the mechanical friction between them [17]. Pelvic peritoneal reconstruction is a separation technique that can separate the abdominal cavity from the pelvic cavity, thus preventing the small intestine from entering the pelvic dead space. Studies have shown that it can reduce the incidence of pelvic effusion and intestinal obstruction [18]. So, we recommend continuous suture to reconstruct the external peritoneum and restore its integrity and continuity.

Extraperitoneal radical cystectomy can reduce the inflammatory reaction between the intestine and pelvic wall, and reduce the incidence of small bowel paralysis, obstruction, intestinal obstruction or constipation [19]. Therefore, extraperitoneal resection can be performed for early bladder cancer.

In conclusion, in order to reduce the intestinal complications, we can use overlap anastomosis, reconstruction of the lateral peritoneum and extraperitoneal resection. Of course, in the process of three hole LRC, the use of these techniques can make the patients get the maximum benefit.

There are some limitations in this study. First, because this study is a retrospective study, there may be some selection bias. In order to avoid selection bias, strict inclusion criteria were established. Secondly, due to the lack of data analysis of operation skills, credibility may be insufficient. In order to avoid this shortcoming, we will make a comparative analysis of operation skills of each group in the future study. Finally, due to the short time of 3-hole LRC project, there is no long-term follow-up study with large samples. In future study, we will conduct multi-center long-term follow-up study.
Conclusion

We first analyzed the basic data of the two groups of data, and there was no statistical difference between the two groups. Secondly, we analyzed the data of ileal channel group, and the results showed that 3-hole LRC could reduce the operation time. Finally, in the comparison of the orthotopic neobladder, it can be concluded that three hole LRC can shorten the ventilation time. The advantage of total laproscopic is more obvious. Therefore, we can conclude that 3-hole LRC is feasible and has obvious advantages. But surgeons need to master the techniques of LRC and urinary diversion.

Declarations

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Authors’ contributions

LFP participated in the design of the study and analysis of data, and drafted the manuscript. LKB and DXY designed the study and drafted the manuscript. JYW were involved in analysis and interpretation of data.

Availability of data and materials

The authors declare The data used and analyzed in the study are authentic.

Competing interests statement

The authors declare that there are no competing interests.

Ethics approval

The study has been approved by the Second Affiliated Hospital of Anhui Medical University.

Informed consent

The information submitted in this study did not contain images to identify patients.

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**Tables**

Due to technical limitations, table 1, 2, 3, 4 is only available as a download in the Supplemental Files section.

**Figures**
Figure 1

A. Expose the rectal lacunae and free the posterior portion of the bladder and prostate. B. The anterior wall of bladder was dissociated and the dorsal deep vein complex of penis was sutured. C. Cut the urethra, remove the bladder and prostate. D/E. Right pelvic lymph node dissection. F. Anastomosis of intestine and urethra. G. Suture the anterior wall of the neobladder. H. Overlap anastomosis. I. Close the right peritoneum. J/K/L. Extraperitoneal radical cystectomy and pelvic lymphadenectomy.

Supplementary Files

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