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Fast-track surgery with three-port versus conventional perioperative management of bladder cancer associated laparoscopic radical cystectomy and ileal conduit diversion: Chinese experience

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Abstract

Objective This study seeks to explore the impact of fast track surgery (FTS) with three-port in patients treated with laparoscopic radical cystectomy and ileal conduit on postoperative recovery, hospital stay and the complications.

Methods This retrospective study analyzed 230 patients with invasive bladder cancer who underwent laparoscopic radical cystectomy at the Second Hospital of Anhui Medical University between December 2011 to January 2023. 50 patients received conventional surgery (CS) and 180 patients received FTS with three-port. Patients were assessed for time to normal diet consumption, time to passing first flatus, number of postoperative recovery days and complications. Trends of serum C-reactive protein levels were monitored preoperatively and on postoperative days 1, 3 and 7.

Results Patients who underwent FTS with three-port had a shorter duration to first flatus ($P < 0.05$). And number of postoperative hospital days and the length of hospital stay were notably shorter in contrast to the CS group ($P < 0.05$). Serum CRP levels on postoperative day 7 were markedly reduced in those of the FTS group compared to the CS group ($P < 0.05$). Those of the CS group experienced more frequent rates of complications compared to those of the FTS with three-port group ($P < 0.05$).

Conclusion Our findings demonstrate that the FTS with three-port program hastens postoperative recovery and reduces duration of hospital stay. It is safer and more effective than the CS program in the Chinese population undergoing laparoscopic radical cystectomy.

Keywords Fast-track surgery, Three-port, Conventional surgery, Laparoscopic radical cystectomy, Ileal conduit diversion

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Introduction

Bladder cancer was one of the most common urological malignancies worldwide in 2022 [1]. Radical cystectomy is the operation of choice in local muscle-invading as well as high-risk non-muscle invading bladder cancer [2]. However, the use of laparoscopic radical cystectomy and ileal conduit is more favored given its minimally invasive nature and decreased occurrences of complications compared to open surgery. The three-port three-layer laparoscopic radical cystectomy, which means the bladder must be removed by following the standard steps of freeing the external iliac vessels, the internal iliac vessels, and the ureter in order to complete the resection of the bladder, was conducted in our hospital [3]. This new method further reduces trauma and is more aesthetically pleasing. The complication rates for laparoscopic surgery is still high given its technical complexities. To further lower morbidity of this surgery, good perioperative management is imperative.

Fast-track surgery (FTS) was first conceptualized by Wilmore and Kehlet [4]. FTS combines multidisciplinary care strategies, including anesthetic, nursing, surgical, and perioperative management to accelerate recovery. Many studies have shown that FTS could reduce complications, improve patients prognosis and shorten hospitalization time of surgical patients [5]. FTS achieves this by reducing the physiological stress response thereby reducing the rate of postoperative complications. For example, the field of colorectal surgery has long implemented FTS with favorable results. ERAS guidelines tailored specifically for radical cystectomy specifically has since been published [6]. Existing papers studying FTS in Western populations receiving radical prostatectomy, partial nephrectomy and radical cystectomy have demonstrated its feasibility and effectiveness [7–10].

ERAS protocol was quite common in clinical practice, but we searched PubMed, EMBASE, and Web of Science databases for studies about ERAS and RC, we found patients in most studies published in the past were treated with open radical cystectomy or Da Vinci robotic-assisted laparoscopic radical cystectomy. Therefore, we want to share the experiences in the Chinese population undergoing laparoscopic and ileal conduit.

Aim

To bridge this knowledge gap, our department sought to prove the effectiveness of FTS with three-port laparoscopy in patients receiving radical cystectomy for bladder cancer in our hospital.

Material and method

This study was carried out on patients who received laparoscopic radical cystectomy and ileal conduit (including those who underwent five or three-port laparoscopic

cystectomy orthotopic ileal neobladder and laparoscopic radical cystectomy Bricker) for bladder cancer in the Department of Urology of the second hospital of Anhui Medical University between December 2011 to January 2023. The diagnosis of bladder cancer was established with a tissue biopsy taken during cystoscopy. All patients possessed muscle-infiltrating bladder cancer. The study was approved by the ethics committee of the second hospital of Anhui Medical University. All patients provided informed consent to allow the use of their data. The inclusion criteria were: (1) laparoscopic radical cystectomy and ileal conduit for bladder cancer; (2) no history of major surgery. The exclusion criteria were: (1) autoimmune diseases or severe cardiopulmonary diseases; (2) an American Society of Anesthesiologists (ASA) class IV; (3) conversion to an open procedure due to the objective existence of difficult dissection and large tumor size in some cases; (4) major concomitant surgical procedures, such as bile duct or bowel resection. Preoperative patient evaluation included a complete medical history, physical examination along with investigations such as a chest radiography, electrocardiogram and blood tests.

230 patients remained for the study after the exclusion criteria was applied. Figure 1 shows flow chart of patients selection section in the study. A total of 50 patients from November 2011 to December 2014 underwent conventional surgery (CS), which is a five-port laparoscopic radical cystectomy, the main surgical steps of which include the conventional steps of bladder freeing, vascular ligation dissections and urethral dissections. 180 patients from January 2015 to September 2023 underwent FTS with three-port (Fig. 1). The so-called three-port method means that the first puncture point is an observation hole, located 2 cm above the umbilicus, with an incision of about 1 cm, and a 10-mm observation trocar is inserted to observe the abdominopelvic cavity through the laparoscope. A 12-mm and a 5-mm trocar are placed bilaterally adjacent to the rectus abdominis muscle near the umbilicus, as described in our previous paper [3]. The same surgical team performed all surgical procedures. Standard pelvic lymph node dissection was done for all subjects. The Clavien-Dindo classification for postoperative complications was used to define complications [11]. In order for a patient to be discharged, the following criteria had to be met: (1) normal body temperature; (2) tolerance of regular diet; (3) satisfactory pain control; (4) out of bed ambulation; (5) patient keen to be discharged.

Vital characteristics of the FTS program is depicted in Table 1. FTS with three-port involved preoperative patient education, bowel preparation prior to surgery, restrictive transfusion protocols, strict intraoperative body temperature control, adequate postoperative analgesia, non-routine use of nasogastric tubes, early oral feeding and early ambulation.

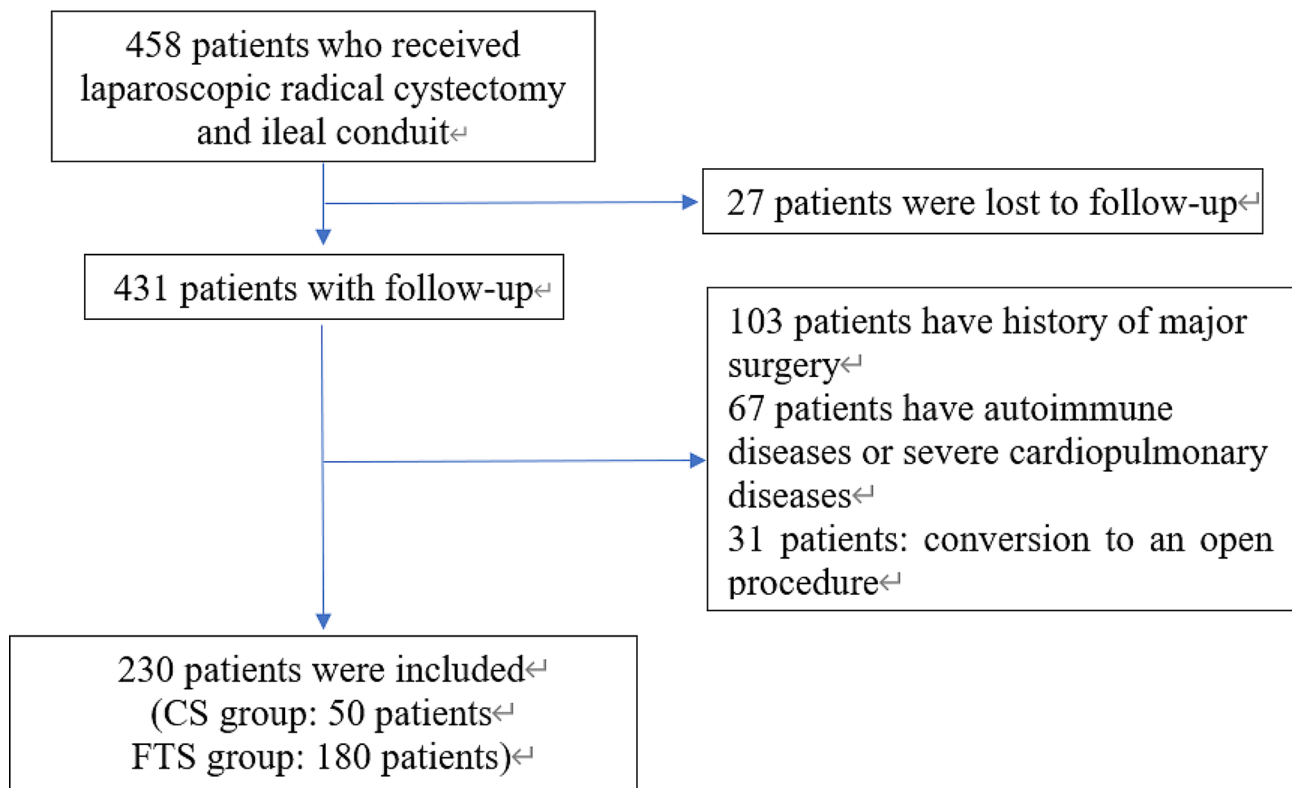


Fig. 1 Flow diagram showing patients selection section in the study

Table 1 Vital characteristics of the FTS and conservative program

Measure	Fast-track surgery group(n = 180)	Control group(n = 50)
Preoperative		
Education	Knowledge about the FTS and operative	Information about operation
Fasting	Fast for 8 h before operation	Fast for 24 h before operation
Bowel preparation	26.25 g polyethylene glycol preparation mixed with 1L of water in the afternoon prior to the operation No mechanical bowel preparation	Oral Metronidazole (oral 0.4 g tid 3 day) and gentamicin(oral 8wU tid 3 day) Semiliquid diets on the third day before operation Clear liquid diet on the second day before operation A mechanical bowel preparation in the night before operation
Gastric tube	No routine	Routine use of gastric tube
Intraoperative		
Transfusion and insulation	Intraoperative transfusion capacity is 1,500 mL or less; intraoperative insulation routinely	No routine intraoperative insulation; no control of intraoperative transfusion capacity
Incision processing	As small as possible	No special emphasis on creating a narrow incision
Postoperative		
Fluid infusion	Intravenous infusion of 1500 ml per day for 2–3 days	Intravenous infusion of 3000–5000 ml in 1 day after surgery. Intravenous infusion of 3000 ml fluid per day in the next 4–5 days after surgery.
Pain control	Celecoxib (oral 200 mg bid)	Opium analgesics were used for intolerable pain.
Ambulation	Off-bed activity were encouraged	Patients gets out of bed when they feel ready
Diet	Metoclopramide (10 mg IM q8h) for 48 h in order to prevent vomiting and nausea Oral feeding is initiated at 24 h after operation, according to steps: from warm clear water to a carbohydrate drink and then, to semi-fluid meals and normal food	Consume liquid after flatus passed and gradually to a normal diet

Table 2 Demographic data and clinical characteristics of the FTS group with three-port and CS group

	FTS group with three-port (n = 180)	CS group (n = 50)	P value
Male/female	152/28	41/9	0.677
Age(years)*	66(31–91)	68(45–89)	0.345
BMI(kg/m ²)*	22.31(17.14–32.27)	21.51(16.56–28.40)	0.065
TNM Classification			
T1	79(43.8%)	22(44.0%)	0.898
T2	68(37.7%)	20(40.0%)	
T3	24(13.3%)	5(10.0%)	
T4	9 (5.0%)	3(6.0%)	

*Mean (range); FTS: fast-track surgery; CS: conventional surgery; BMI: body mass index (calculated as Kg/m²)

Table 3 Operative details and outcomes

	FTS group with three-port(n = 180)	CS group(n = 50)	P value
EBL (ml)	280.78 ± 175.90	308.60 ± 184.46	0.344
Time of operation (min, mean ± SD)	312.48 ± 71.32	340.08 ± 82.66	0.143
Time to first postoperative flatus(day)	3.86 ± 1.79	4.78 ± 2.80	0.005
Length of hospital stay(day)	22.68 ± 7.87	26.78 ± 8.54	0.002
Postoperative hospital days(day)	13.66 ± 6.83	17.24 ± 7.17	0.001
Minor Complications(n)	32(17%)	18(36%)	0.002
Nausea and vomiting	12	5	
Ileus	9	6	
Pulmonary infection	5	2	
Icision infection	3	2	
DVT	2	1	
Urinary tract infection	6	1	0.000
Major Complications(n)	17(9%)	7(14%)	
Acute respiratory failure	1	0	
Mechanical bowel obstruction	8	4	
Acute renal failure	3	1	
Death	5	2	

FTS: fast-track surgery, CS: conventional surgery; EBL: estimated blood loss

Parameters recorded in this study included the duration of the operation, intraoperative bleeding, time to first flatus, time to normal diet consumption, number of postoperative days and the presence of postoperative complications. CRP levels were detected one day prior to surgery and on postoperative days 1, 3 and 7. Postoperative complications were recorded. Surgical-related data such as TNM staging were also recorded.

All statistical analysis were performed with the SPSS 26(SPSS, Inc., Chicago, IL, USA) program and data was depicted in terms of mean ± standard deviation. Inter-group differences between two groups were evaluated

Table 4 Perioperative C-reactive protein levels (mg/l)

Group	FTS group(n = 180)	CS group(n = 50)	P value
Preoperative	3.34 ± 7.45	3.59 ± 0.31	0.811
POD 1	92.82 ± 26.86	92.58 ± 33.27	0.344
POD 3	59.20 ± 23.13	70.04 ± 64.80	0.143
POD 7	23.93 ± 23.80	38.82 ± 23.93	0.000

Variables were expressed as the mean ± SD; POD postoperative day

using the Student's t test. Discrete variables were compared using the Chi-Square test or the Fisher's exact test. Statistical significance was conferred when the P value was less than 0.05.

Results

This study included patients with muscle-invasive bladder cancer who underwent radical cystectomy. 50 of these patients underwent conventional surgery while 180 underwent FTS with three-port laparoscopy. Table 2 depicts demographic data and clinical characteristics of the FTS with three-port group and CS group. There were no significant differences in terms of patient characteristics and tumor grade between the two groups ($P > 0.05$). 3 of the patients required reoperation and there were 7 perioperative deaths. There was no statistically significant difference of estimated blood loss between the two groups ($P > 0.05$). Patients in the CS group experienced complications compared to the FTS group (minor Complications rate, 36% vs. 17%, $P < 0.05$; Major Complications rate, 14% vs. 9%, $P < 0.05$). All complications occurred within 90 days after surgery.

Results related with operative outcomes are depicted in Table 3. Those in the FTS with three-port group had a significantly shorter time to first flatus and duration of hospital stay compared to those who underwent CS ($P < 0.05$).

Serum CRP levels, a marker of physiological stress, was also assessed in Table 4. We did not observe any significant differences in terms of preoperative and postoperative days 1 and 3 CRP levels between the two groups ($P > 0.05$). However, the average CRP levels were lower in the FTS with three-port group in contrast to the CS group on postoperative day 7 ($P < 0.05$).

Discussion

Perioperative management is critical in reducing length of hospital stay, cost of treatment and in improving patient quality of care. The implementation of FTS in surgery was based on evidence-based medicine and has shown great success in the fields of colorectal surgery, liver surgery, and thoracic surgery [5, 12, 13]. However, little is known about its efficacy in urological surgery, particularly with regards to radical cystectomy with urinary output reconstruction. Radical cystectomy with intestinal urinary reconstruction is considered to be a

major and complex operative procedure which holds the potential for significant complications and mortality [14–17]. Our study explores the benefits of FTS with three-port in comparison to CS in a cohort of Chinese patients planned for laparoscopic radical cystectomy and ileal conduit for bladder cancer.

Urinary diversion after radical cystectomy further increases its surgical complexity, especially when it involves bowel interception and reconstruction. The potential for bowel-related complications, including bowel obstruction and bowel perforation, occurs after both laparoscopic radical cystectomy+ileal conduit and in situ neobladder surgery. We analyzed that the bowel takes time to recover from normal peristalsis due to stress such as surgical reconstruction in a short period of time after surgery, and with time if its function does not recover in a short period of time, it may lead to the development of bowel obstruction. In severe cases of intestinal obstruction or perforation with acute peritonitis, timely surgical intervention is very important.

Relatively popular methods of trocar placement include the four-port and five-port methods. The four-port method is characterised by fewer surgical incisions, but it prolongs the duration of the procedure and is not conducive to postoperative recovery. The moderate exposure of the five-port approach is adequate to some extent, and the operative time is relatively short [18]. However, our original intention in using the three-port approach was to make the incision more favourable more favourable to improving the patient's aesthetics more in line with the minimally invasive concept. Philosophy. However, there is no doubt that this approach increases the difficulty of the procedure and demands a high level of laparoscopic surgical competence. Therefore, it is recommended that only surgeons with laparoscopic surgical competence are suitable for this new approach. But compared with the conventional five-port procedure, it is not restricted by the first assistant.

The concept of three-port surgery is based on the idea that “the left hand is the best assistant”. With the help of an assistant who hold the laparoscope, the assisting hand is used to fully expose the field of vision and to collaborate in the surgery, which facilitates a smooth and less traumatic operation. At the same time, the practice of fast track concept allows patients to ventilate and feed earlier, effectively reducing the incidence of gastrointestinal complications such as intestinal obstruction. Our experience shows that the combination of three-port and rapid recovery can reduce the hospitalization time of patients and effectively reduce the incidence of bowel obstruction and other complications, bringing higher benefits to patients.

Our study found that that patients who underwent FTS with three-port had better postoperative recovery,

shorter number of postoperative days and less complications. FTS with three-port can accelerate postoperative recovery while ensuring operative success. Key factors contributing towards the success of the FTS with three-port program may be attributed to thorough patient education and preoperative evaluation. Patient involvement in their treatment motivates them to cooperate with healthcare providers, thus ensuring better recovery outcomes.

Patients undergoing CS would typically be subjected to lengthy bowel preparation regimes and 3 days of prophylactic antibiotics. However, there is little evidence regarding the efficacy of this practice [19]. In contrast, a study reported a higher risk of anastomotic leakage and postoperative infections in patients who received preoperative bowel preparation [20]. Preoperative bowel preparation is thought to alter the delicate balance of intestinal flora while also damaging its protective barrier. Both of these processes accentuate the intestinal inflammatory response and induces intestinal edema. There is an increased risk of infection, which is deleterious to postoperative recovery. Furthermore, liquified bowel content increases the risk of gross contamination of the peritoneal cavity should the bowel inadvertently be perforated during the surgery.

A successful FTS program mandates a multidisciplinary team involving surgeons, anesthetists and nurses. Early enforced mobilization is a critical step in the FTS program. To achieve this successfully, patients should have adequate, portable pain control systems (such as transdermal fentanyl) and good nursing care. A carefully implemented FTS program significantly reduces physiological stress and decreases rates of postoperative complications. This in turn translates to improved patient comfort such as decreased postoperative nausea, allowing them to consume orally faster and experience a shorter overall duration of hospitalization. Early feeding, laxative use and antiemetics promote quicker return of normal gastrointestinal motility [21]. Furthermore, early postoperative oral nutrition also decreases the stress response, reduces catabolism, and combats postoperative complications such as abdominal distension or ileus [4]. The overall shorter duration of hospitalization also translates to lower healthcare costs.

This study is limited due to its retrospective design, small samples size and short follow-up time. Larger randomized controlled trials are required to furnish better quality evidence to support the widespread use of FTS with three-port in urological surgery. Furthermore, the use of FTS with three-port should also be investigated in 3D laparoscopy and robotic laparoscopy given the increasing use of these surgical modalities. Moreover, in addition to the above, studies based on the molecular mechanisms of bladder cancer will further advance the

progress of clinical research and will also be suggestive in terms of its development and surgical prognosis [22, 23].

Despite these limitations, the results of the current study have demonstrated that the FTS with three-port program can speed up recovery, lessen stress and shorten postoperative hospital stay. We conclude that the FTS with three-port program is safer and more effective than the CS program for Chinese patients undergoing laparoscopic radical cystectomy for bladder cancer.

Conclusion

The FTS with three-port program is safer and more effective than the CS program for Chinese patients undergoing laparoscopic radical cystectomy for bladder cancer.

Author contributions

LGZ designed and developed research directions, TL performed Relevant surgeries, WX and HCX analyzed the data and contributed in writing the manuscript, MJX followed most of the patients and collected and analyzed clinical data, SW Designed and completed forms, All authors reviewed the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Human ethics and consent to participate declarations

Our study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the Second Affiliated Hospital of Anhui Medical University. Each human participant volunteered for the study.

Competing interests

The authors declare no competing interests.

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