



# Laparoscopic vs. Open Surgical Access Radical Cystectomy with Subsequent Orthotopic Reconstruction in the Treatment of Invasive Urothelial Carcinoma of the Bladder

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## Abstract

**Introduction:** Radical cystectomy combined with extended lymph node dissection is the treatment of choice for muscle-invasive bladder cancer and can be performed using open, laparoscopic, or robot-assisted surgical access.

**Aim:** To compare the outcomes of laparoscopic (LRC) and open-access (ORC) radical cystectomy in terms of surgery, oncology, functional outcomes, and complications.

**Materials and methods:** We conducted a retrospective study of 200 patients who had all undergone cystectomy for muscle-invasive bladder cancer within the last 4 years. All patients were divided into groups according to the surgical access: LRC in 30 patients and ORC in 170 patients. Oncologic outcomes, expressed as perioperative complications and postoperative results, were analyzed.

**Results:** Overall survival rates were most significantly associated with the histological type, as well as the 'positive' lymph nodes and positive resection margin. The average duration of the procedure was shorter in ORC than in LRC (245.5 min and 345.3 min, respectively). Hospital stay was on average 9.18 days in LRC and 12.63 days in ORC, and this duration could vary depending on the type of diversion. The average blood loss in LRC (250-320 ml) was lower than that in ORC (200-720 ml). The complications rate was lower with LRC than with ORC; however, with subsequent orthotopic reconstruction, the functional results were better in ORC.

**Conclusions:** LRC is an alternative option to ORC, considering the fewer complications, less amount of blood loss, and greater surgical precision, as well as shorter hospital stay. Orthotopic diversion has better functional outcomes in ORC.

## Keywords

bladder cancer, cystectomy, laparoscopy, orthotopic neobladder, urine diversion

## INTRODUCTION

Radical cystectomy combined with extended lymph node dissection, with or without subsequent orthotopic neobladder reconstruction, has been established as the gold standard in the treatment of muscle-invasive and non-muscle-in-

vasive bladder cancers that are unresponsive to intravesical therapy. The procedure is accompanied by significant perioperative mortality due to the oncologic risk factors, the complexity of the operative skills required, and the relatively high incidence of postoperative complications.<sup>[1]</sup> For this reason, it is imperative to attempt to improve the

quality of radical cystectomy procedures, focusing on the improvement of the surgical approaches, by improving the skills of the surgeon, the technological advances in medical equipment, and by optimizing the anesthesia. Developing a curative approach in the surgical treatment of bladder carcinoma is a medical as well as a medico-social issue, and as such, it is critical to reintegrate radical cystectomy patients into society as soon as possible while also improving their quality of life. With the improvement of the laparoscopic technique, more and more urologists around the world are preferring the laparoscopic/robot-assisted approach, which in many cases gives better results than the open-access surgical approach.<sup>[2]</sup>

## AIM

The current study aimed to compare the surgical and oncologic outcomes, as well as the complication rate, of laparoscopic radical cystectomy (LRC) versus open-access radical cystectomy (ORC) in patients with muscle-invasive bladder carcinoma.

## MATERIALS AND METHODS

We conducted a retrospective monocentric study of 200 patients (28 women and 172 men) who had undergone radical cystectomy and subsequent urinary diversion for muscle-invasive bladder cancer between 2016 and 2020. All patients were staged as T2-T3 muscle-invasive urothelial carcinoma of the bladder without any distant metastases. We analyzed the oncologic outcomes, such as the pre- and postoperative clinical staging, as well as the postoperative outcomes associated with the type of urine derivation chosen. The primary endpoints of this study were overall survival and relapse-free survival rates. Two types of derivation were performed – ureterocutaneostomy and orthotopic neobladder reconstruction.

For morphological staging (typing, depth of infiltration, histological grading, vascular and perineural invasion), biopsies from the primary tumor in the transurethral resection of the bladder (TURB), as well as surgical tissue from the primary tumor were fixed in 10% formaldehyde and analyzed (selection of sections at the discretion of the pathologist). It is obligatory to also thoroughly analyze the resection margins tissue. Lymph node dissection tissues (minimum 9 lymph nodes) were examined on a permanent paraffin preparations.<sup>[3]</sup>

The surgical approach chosen is determined by the set criteria for the chosen intestinal segment, ureteral implantation technique, and continence mechanism. Different forms of urinary diversion use different-sized intestinal segments, which can have an effect on the digestive system after surgery. In principle, the length of the ileum used determines the degree of postoperative malabsorption syndrome and the functional results.

Patients were divided into groups according to the type of surgical access: laparoscopic radical cystectomy in 30 patients (12 women and 18 men) and open radical cystectomy in 170 patients (16 women and 154 men). The urine diversion was grouped as follows: Studer (Bern Neobladder), Hautmann (Ulm Neobladder), Vesica Ileale Padova – V.I.P., and ureterocutaneostomy.

Clinical local staging, resp. baseline histology: T1G3 – tumor penetrating the subepithelial space: 21 patients; T2aG2 – tumor penetrating superficially tunica muscularis (inner half): 51 patients; T2aG3: 69 patients; T2bG2 – tumor penetrating deep into the tunica muscularis (outer half): 24 patients; T2bG3: 11 patients; T3G2: 16 patients; and T3G3: 8 patients (Fig. 1)

Our first LRC was performed in March 2010. The open surgical approach is well known and we followed already established procedures (Figs 2, 3, 4, 5). The LRC procedure begins by establishing a pneumoperitoneum and placing two 5-mm, two 10-mm trocars, and one 12-mm trocar. We use an ultrasonic scalpel, bipolar scissors, metal clips for tissue dissection and vessel ligation. After initial anatomy identification, we begin by dissecting the seminal vesicles and the posterior surface of the prostate in men. After dissection of the space of Retzius, we incise the pelvic fascia, dissect the apex of the prostate and the urethra.

For pathological analysis, the lymph node dissection is performed along the obturator, external, internal, common iliac, presacral, para-aortic and paracaval lymph nodes. Specimens are removed through the incision for the subsequent orthotopic reconstruction. In women, the procedure begins by dissection of the uterine ligaments and peritoneum in the cavity of Douglas. The bladder and lymph node are removed externally through the hypogastric port (in men) or transvaginal in women. A cruciate incision is made through the fascia of the anterior rectus abdominis muscle and the muscle is divided. For security, 4 supporting sutures are made in the fascia to fix the segment that has already been separated. Under video control, a vascular clamp is introduced through the stoma to grasp the Marionette suture and the ends of the ureteral stents. The latter are pulled through the stoma, avoiding the twisting of the segment.<sup>[4]</sup>

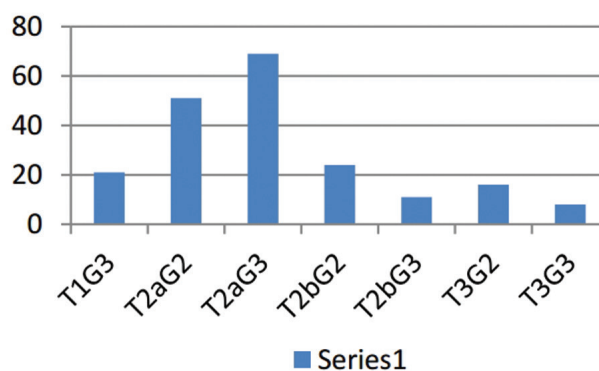
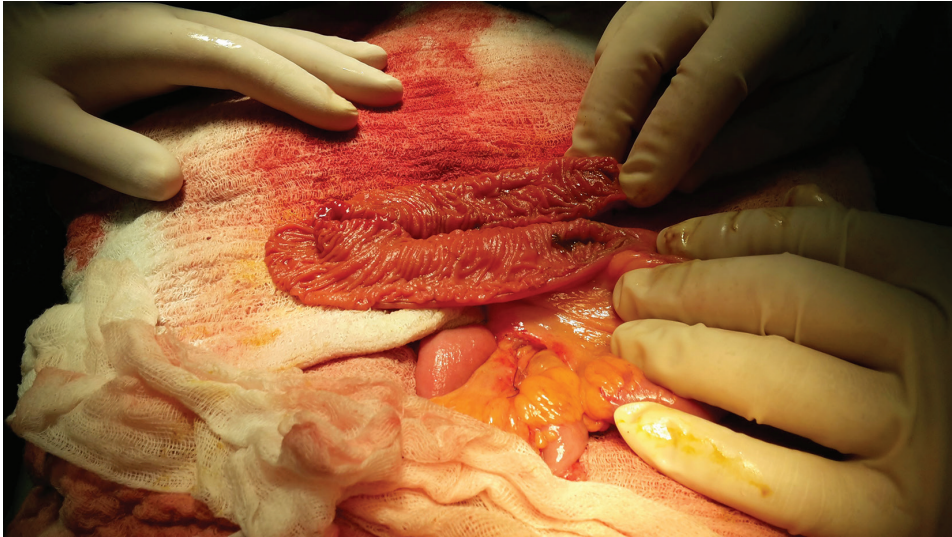
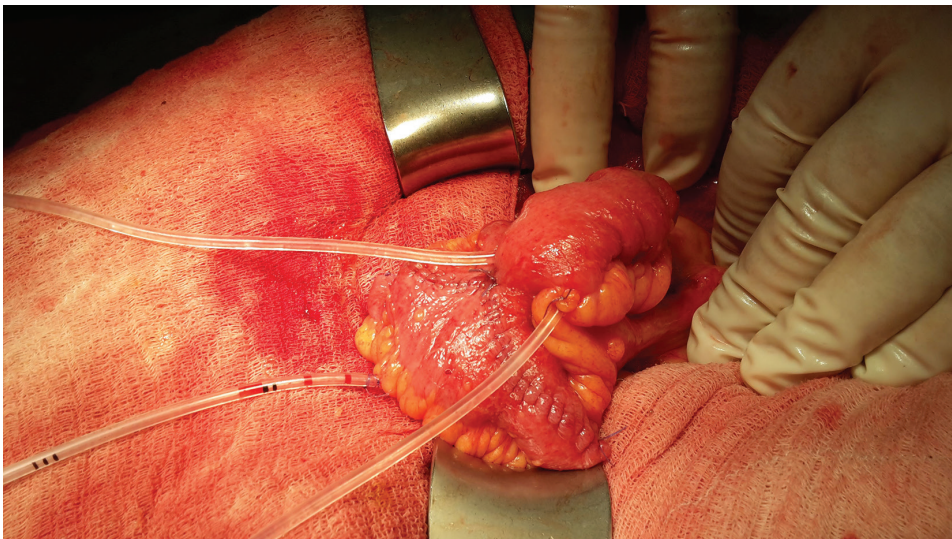


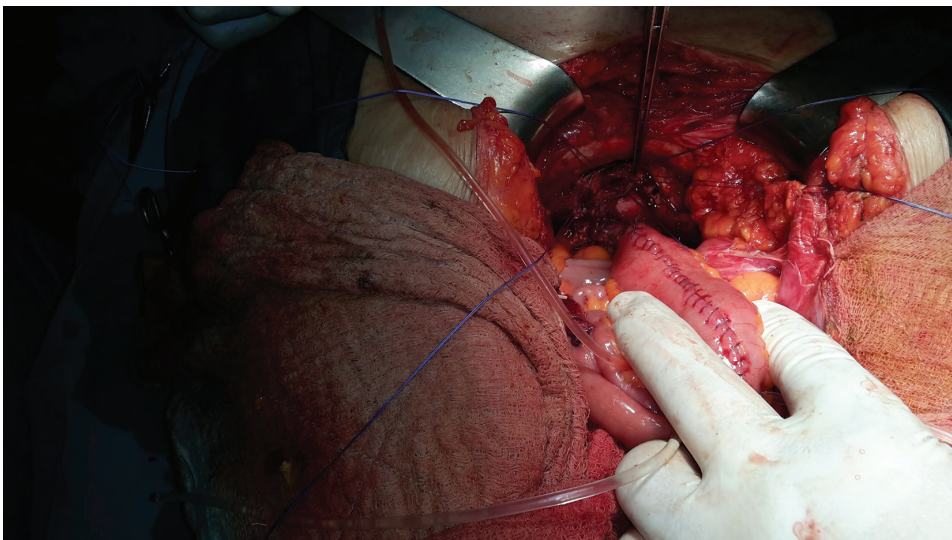
Figure 1. Clinical local staging.



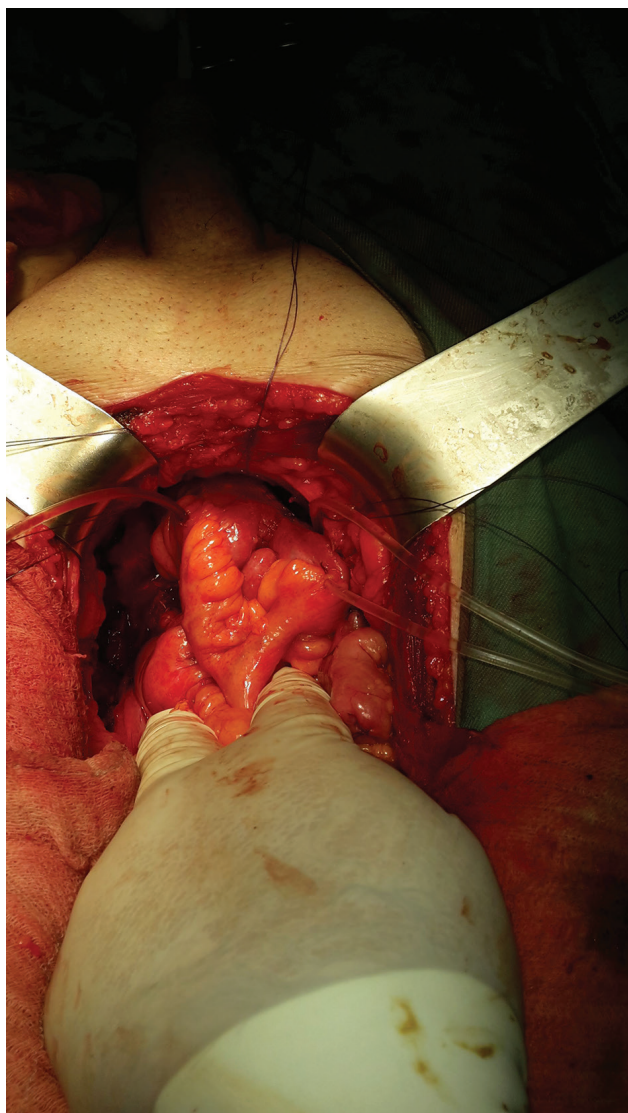
**Figure 2.** Detubularization of loop segment.



**Figure 3.** Drawing of the ureteral tubes through the neobladder.



**Figure 4.** Placement of the anastomosis sutures.



**Figure 5.** Descent of the neobladder towards the urethra.

The bladder with urethra, uterus, anterior vaginal wall, and lymph nodes are removed with a transvaginal access in women when the derivation is completed with a ureterocutaneostomy. Urine drainage is performed using a lower mini-laparotomy technique, with the left ureter transferred from the right side under the mesenterium of the sigmoid

colon. Most of our experience is with the Hautmann type, as well as the technique described by Studer et al.<sup>[5]</sup> (Figs 6, 7). Before the closure of the abdominal cavity, two lateral drains (16-18F) are placed.

Outcomes were assessed by patient demographics, pathology grading at the time of the cystectomy, comorbidity, operative time, conversion rate, blood loss, need for transfusion of bioproducts, method of urinary diversion, analgesic requirements, length of hospital stay, and rate of complications.

The patients were monitored at the clinic for one month postoperatively, every three months in the first year, every six months for the following year, then annually. Follow-up examinations consisted of transabdominal ultrasound, CT, and laboratory tests.

Patients reported that the most important factor for their quality of life is continence. The postoperative functional bladder volume and continence were assessed. Immediately after operation, the functional bladder capacity of the studied patients was between 300 and 540 ml. The mean volume value was  $456.54 \pm 9.36$  ml ( $\bar{x} \pm S_x$ ). This is a result of the relatively short intestinal segment applied to the tank construction. Using a longer segment seems intriguing; however, bladder emptying problems are very likely to occur when creating a larger tank. After 3 months with gradually increasing micturition intervals, a mean functional capacity of  $474.00 \pm 10.02$  ml was reached; at 1 year, it increased to  $537.38 \pm 13.44$  ml (Table 1).

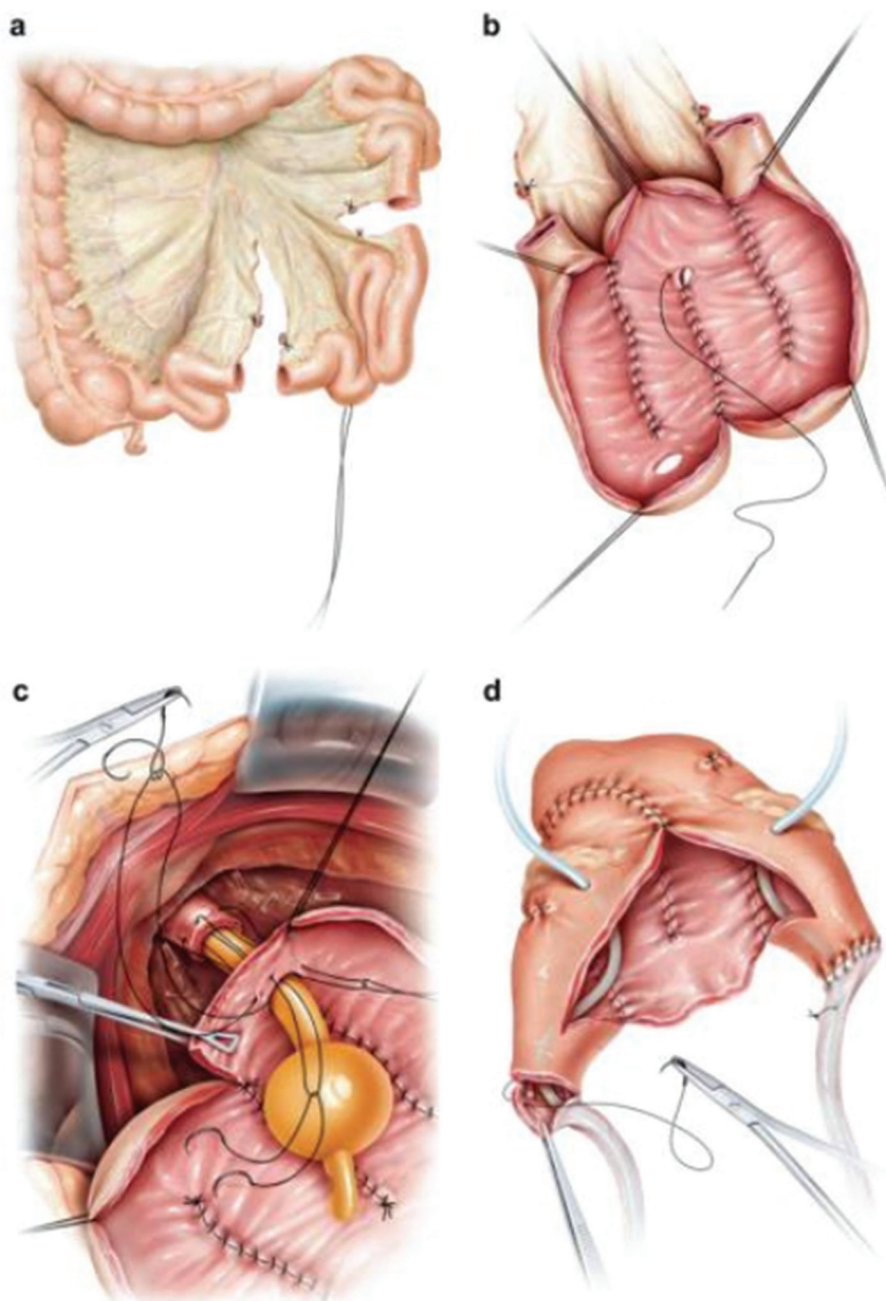
Patient survival was also analyzed depending on the tumor stage regardless of the surgical technique. Two groups of patients were distinguished: group 1 with stages T1, T2, and T3a (stages in which tumor process does not 'leave' the bladder) and group 2 – in stages T3bi and T3bii. Data analysis showed that the probability of survival of patients in group 1 was statistically significantly higher than that in group 2 (log rank=6.44,  $p=0.01$ ) (Fig. 8). The median survival time of group 1 was 58 months (95% CI [50.66]), while for group 2 it was 34 months (95% CI [22.46]).

## DISCUSSION

The advantages of robotic cystectomy and orthotopic reconstruction include faster postoperative recovery, earlier

**Table 1.** Changes in functional bladder volume over the follow-up period in 39 patients

Follow-up period	Patient count	Min volume (ml)	Max volume (ml)	Mean volume $\pm$ standard error (ml)
Postoperative (p.o.)	39	300	540	$456.54 \pm 9.39$
3 months p.o.	30	340	550	$474.00 \pm 10.02$
6 months p.o.	23	340	600	$496.30 \pm 12.87$
12 months p.o.	21	380	650	$537.38 \pm 13.44$
24 months p.o.	14	520	750	$606.43 \pm 16.66$



**Figure 6.** Hautmann neobladder (Hautmann, 2010).

recovery of peristalsis, and reduced need for analgesics, which also have an impact on the length of hospital stay, although there are no randomized trials comparing open versus laparoscopic/robotic-assisted intracorporeal derivation. Studies comparing different types of derivation undoubtedly have some limitations such as: lack of standardized reports of early and late complications; they are rather retrospective with non-uniform patient selection and follow-up.

Worldwide, there has been a significant increase in robotic-assisted radical cystectomy cases. Robotic-assisted radical cystectomy and subsequent intracorporeal derivation have been demonstrated to be technically feasible and

have excellent results. Despite the potential benefits of early restoration of intestinal peristalsis and improved postoperative outcomes (pain), intracorporeal neobladders are less applicable and limited to large academic institutes worldwide.<sup>[6]</sup> They are technically more difficult, challenging, and with a longer surgery duration. Careful patient selection, detailed postoperative follow-ups and counseling with the patient, the patient's relatives, and the oncology team are key factors for a good outcome regardless of the type of urinary diversion chosen.

The most common problem in laparoscopic or robotic intracorporeal orthotopic replacement is the functional volume and continence of the neobladder, because the

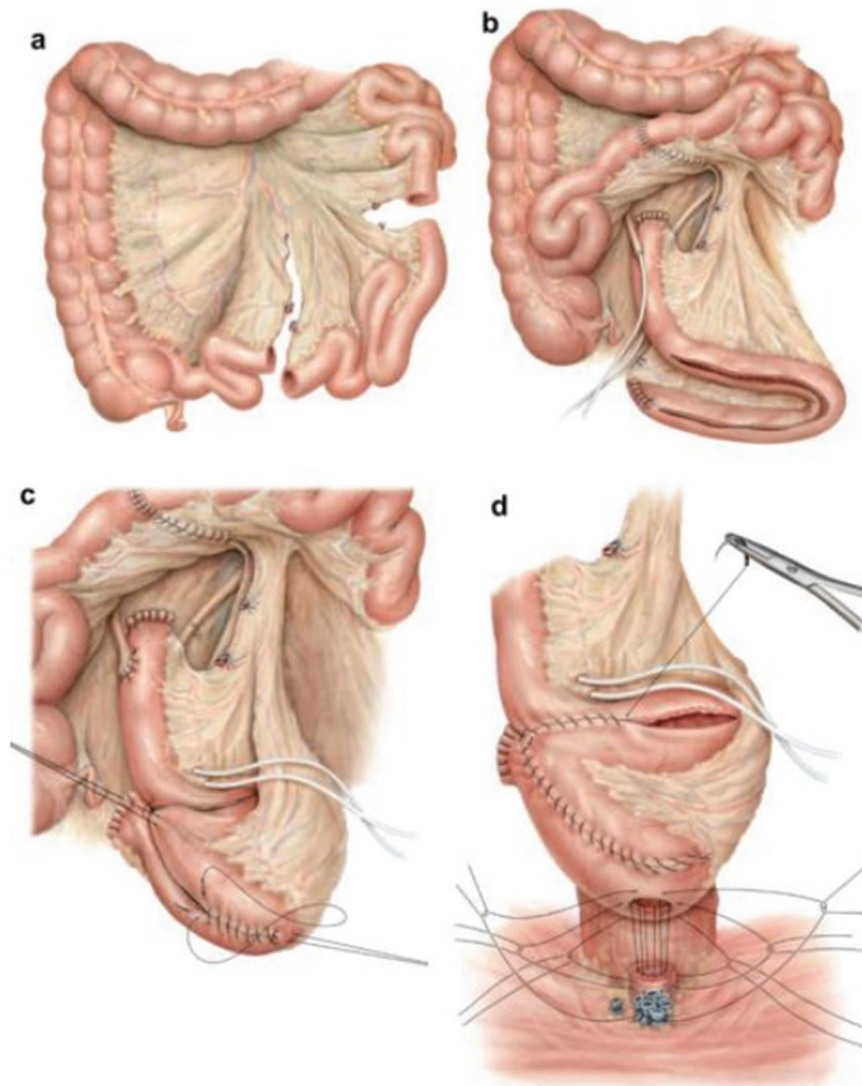


Figure 7. Studer neobladder (Studer et al., 2004).

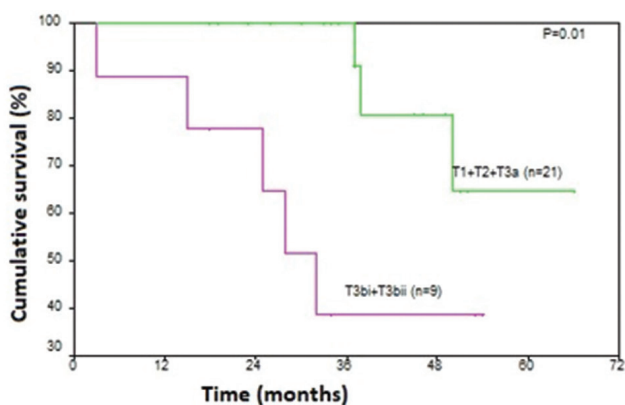


Figure 8. Survival of patients depending on tumor stage (Kaplan-Meier curve).

most common operative technique is the two-loop variant, which has a smaller volume and, as a result, more patients are incontinent.

## CONCLUSIONS

For decades, radical cystectomy has been the gold standard in the treatment of invasive bladder cancer, and it is still the standard against which outcomes are evaluated. Despite patient selection, improvements in technique and perioperative care, the development of effective perioperative preparation, urinary diversion, and the expansion of the limits of pelvic lymphadenectomy, approximately 35%–50% of patients with stage T3-4 and positive lymph nodes die of progressive cancer. Likewise, the impact of radical cystectomy on the patient in terms of treatment-related morbidity and quality of life is significant. Laparoscopic radical cystectomy offers patients the potential for reduced intra- and postoperative complications and faster recovery while maintaining oncological efficacy compared to the open technique. We prefer the urinary diversion approach (when orthotopic) to proceed via the open route. Preliminary comparative data show that laparoscopic rad-

ical cystectomy has reduced blood loss and the need for hemotransfusion, and recovery is faster compared to open operative techniques. Patient selection remains leading in both laparoscopic and open procedures. The leading factor in radical cystectomy is not the size of the tumor, but its degree of malignancy.<sup>[7]</sup>

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## Competing Interests

The authors have declared that no competing interests exist.

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# Лапароскопическая или радикальная цистэктомия открытым хирургическим доступом с последующей ортотопической реконструкцией в лечении инвазивного уротелиального рака мочевого пузыря

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## Резюме

**Введение:** Радикальная цистэктомия в сочетании с расширенной лимфаденэктомией является методом выбора при лечении мышечно-инвазивного рака мочевого пузыря и может выполняться с использованием открытого, лапароскопического или роботизированного хирургического доступа.

**Цель:** Сравнить результаты лапароскопической (ЛРЦ) и радикальной цистэктомии открытого доступа (РЦОД) с точки зрения хирургии, онкологии, функциональных исходов и осложнений.

**Материалы и методы:** Мы провели ретроспективное исследование 200 пациентов, перенёвших цистэктомию по поводу мышечно-инвазивного рака мочевого пузыря в течение последних 4 лет. Все пациенты были разделены на группы в зависимости от хирургического доступа: ЛРЦ – у 30 пациентов и РЦОД – у 170 пациентов. Анализировались онкологические исходы, выраженные в виде периоперационных осложнений и послеоперационных результатов.

**Результаты:** Общая выживаемость была наиболее значимо связана с гистологическим типом, а также с «положительными» лимфатическими узлами и положительным краем резекции. Средняя продолжительность процедуры была короче при РЦОД, чем при ЛРЦ (245.5 мин. и 345.3 мин. соответственно). Пребывание в больнице в среднем составляло 9.18 дней при ЛРЦ и 12.63 дня при РЦОД, и эта продолжительность могла варьироваться в зависимости от типа утечки. Средняя кровопотеря при ЛРЦ (250-320 ml) была ниже, чем при РЦОД (200-720 ml). Частота осложнений была ниже при использовании ЛРЦ, чем при использовании РЦОД; однако при последующей ортотопической реконструкции функциональные результаты были лучше при РЦОД.

**Заключение:** ЛРЦ является альтернативой РЦОД, учитывая меньшее количество осложнений, меньшую кровопотерю и большую хирургическую точность, а также более короткое пребывание в больнице. Ортотопическая диверсия даёт лучшие функциональные результаты при РЦОД.

## Ключевые слова

рак мочевого пузыря, цистэктомия, лапароскопия, ортотопический неопузырь, отведение мочи