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ARTICLE

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# Stapled versus robot-sewn ileo-ileal anastomosis during robot-assisted radical cystectomy: a review of outcomes in urinary bladder cancer patients

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**ABSTRACT**

**Background:** Whereas the literature has demonstrated an acceptable safety profile of stapled anastomoses when compared to the hand-sewn alternative in open surgery, the choice of intestinal anastomosis using sutures or staples remains inadequately investigated in robotic surgery. The purpose of this study was to compare the surgical outcomes of both anastomotic techniques in robotic-assisted radical cystectomy.

**Methods:** A retrospective analysis of patients with urinary bladder cancer undergoing cystectomy with urinary diversion and with ileo-ileal intestinal anastomosis at a single tertiary centre (2012–2018) was undertaken. The robotic operating time, hospital stay and GI complications were compared between the robotic-sewn (RS) and stapled anastomosis (SA) groups. The only difference between the groups was the anastomosis technique; the other technical steps during the operation were the same. Primary outcomes were GI complications; the secondary outcome was robotic operation time.

**Results:** There were 155 patients, of which 112 (73%) were male. The median age was 71 years old. A surgical stapling device was used to create 66 (43%) separate anastomoses, while a robot-sewn method was employed in 89 (57%) anastomoses. There were no statistically significant differences in primary and secondary outcomes between RS and SA.

**Conclusions:** Compared to stapled anastomosis, a robot-sewn ileo-ileal anastomosis may serve as an alternative and cost-saving approach.

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## Introduction

Cystectomy and urinary diversion is the standard treatment in high risk non-muscle invasive and muscle invasive urinary bladder cancer [1,2]. The use of robot-assisted techniques (RARC) has constantly increased since their introduction [3]. The use of intracorporeal urinary diversion has increased in the last decade [4]. After division of the proximal and distal ends of the ileum, the continuity of the bowel is usually restored by a stapled anastomosis [5].

The advanced technology of the da Vinci robotic system enables surgeons to perform sophisticated intracorporeal procedures in a precise and efficient way. One such procedure is intracorporeal urinary diversion, which is considered as one of the most critical points in reconfiguration as it includes manipulating the bowel, incising the mesentery, avoiding major injury to ileal vascularisation, as well as performing ileo-ileal anastamosis. An anastomotic leakage, especially that resulting from ileo-ileal anastomosis, is a dangerous and sometimes life-threating complication. Studies show that gastrointestinal complications including ileo-ileal anastomosis are reduced if an intracorporeal urinary diversion is constructed [4].

Robot-assisted radical cystectomy (RARC) is more expensive than open radical cystectomy [6]. One of the additional costs is due to the use of staples in ileo-ileal anastomoses. This is expensive and can be associated with technical mishaps in the operating room. No differences in outcome between hand-sewn and stapled anastomoses were found with open surgery [7]. Little is known regarding the impact of the anastomotic technique in patients with urinary bladder cancer undergoing cystectomy and intracorporeal urinary diversion using the da Vinci system. Few studies have focused on the overall incidence of complications associated with use of both techniques in patients with UBC undergoing cystectomy [8]. Thus, the present analysis had the aim of presenting our experience with both anastomotic techniques in regard to operation time, surgical complications, postoperative hospital stay, and cost.

## Materials and methods

### *Study design and patients*

All patients operated on with RARC with or without lymphadenectomy with entirely intracorporeal urinary diversion as

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treatment for UBC between December 2012 and December 2018 at the department of urology, University Hospital in Linköping, Sweden, were retrospectively included. Patients with previous major abdominal or bowel surgery were excluded from the study. Operations converted to open urinary diversion as well as those without urinary diversion were excluded from the study. All operations were performed with curative intent, and pre-, peri-, and post-operative data were collected and analysed. The data included patient characteristics (sex, age, BMI, ASA score) and information about the intra- and post-operative course. Two groups were formed based on the use of either staplers (ST) or robot-sewn (RS) reconstruction. Postoperative complications were defined as (1) anastomotic dehiscence (dehiscence/'leak' identified at reoperation or radiographic imaging), (2) ileus both paralytic and mechanical (identified at reoperation or with radiographic imaging), and (3) intractable nausea/vomiting (documented as a clinical finding in the medical record). The complications were classified according to the Clavien-Dindo classification [9].

The study was approved by the Regional Ethics Committee in south-eastern Sweden (Ref no: 2019-03464).

### Surgical technique

Robotic instruments included scissors, one cadiére forceps, a vessel sealer extend, and a large needle driver. After cystectomy, all diversion procedures were performed entirely intracorporeally. For the ileal conduit, an ileal segment about 15–20 cm in length was isolated, while for the neobladder a 50–60 cm ileal segment was used, both starting about 20 cm proximal to the ileocecal junction. If using staplers, the ileum was isolated using laparoscopic Endo-GIA with a 45-mm intestinal stapler. The stapler was inserted by the assisting surgeon, using the 12-mm port on the left side. The continuity of the small bowel was restored by using Endo-GIA with a 45-mm intestinal stapler, positioning the distal and proximal end of the ileum side-to-side with the anti-mesentery part facing each other. An additional transverse firing of the Endo-GIA stapler was used to close the open ends of the ileal limbs. The total number of stapler cartridges used was five or six per anastomosis (two for isolation and three or four for re-anastamosis).

If using the robot-sewn technique, the ileal segment was isolated using cold scissors. A da Vinci vessel sealer extend was used for the division of the ileal mesentery. Two semicircular single-layer 4-0 PDS running sutures starting on opposing sites were used for the ileo-ileal anastomosis.

Care was taken to ensure that the lumen of the completed intestinal anastomosis was sufficiently wide, with no traction on the suture.

### Statistical analysis

Statistical analyses were performed using SPSS statistics software, version 23 (IBM Corporation, USA). A Pearson's chi-square test was applied to evaluate the difference ST or RS anastomoses in relation to clinical data and GIT complications. A comparison of ST and RS anastomoses, operation time, hospital stay as well as time to first bowel motion was achieved by the use of a non-parametric test (Mann-Whitney test). $p < 0.05$ was considered statistically significant.

## Results

Out of a total of 155 patients, 66 (43%) had their small bowel anastomosed with ST and 89 (57%) with the RS technique.

### Patient characteristics (Table 1)

Patients with ST were more often male (79%), younger (median 68 years), had lower BMI (25.5), had lower ASA score, and a lower percentage had been treated with neoadjuvant treatment (27%), but had a similar pT stage distribution. Median robot operating time was 285 min for patients with RS compared to a median of 300 min for patients with ST ileo-ileal anastomosis. Median estimated blood loss was 150 ml for patients with RS anastomosis compared to a median of 300 ml for patients with ST ileo-ileal anastomosis ($p = 0.004$). Patients with RS anastomosis were more often operated with ileal conduit (93%) compared to patients with ST ileo-ileal anastomosis (76%).

### Postoperative GIT parameter and complications (Table 2)

There were no significant differences in 30-day Clavian-Dindo complication grade or in the overall 30-day GIT complications between the groups. Sub-group analysis of patients with a Clavian-Dindo complication grade more than 3b showed no difference between the two groups either. Sudden death (Clavian-Dindo 5) occurred for one patient 1 day before discharge in the RS group. Post-mortem revealed peritonitis due to an anastomotic leak. The overall 30-day readmission rate was significantly higher in the ST group ($p = 0.001$). The 30-day readmission rate due to GIT complications for patients with RS anastomosis was 3%, while for patients with ST anastomosis it was 9% ($p = 0.17$). A summary of GIT complications is shown in Table 2.

The median time to first bowel motion was 4 days (range = 2–9) for patients with robot-sewn anastomosis while for patients with a stapled anastomosis it was 4.5 (2–16) days (NS). The median time of hospital stay was 11 (7–29) days for patients with RS anastomosis, while for patients with ST it was 11 (4–71) (NS).

## Discussion

To our knowledge, RS is rarely used for the ileo-ileal anastomosis, whereas ST is used in most of the UBC cases undergoing cystectomy and urinary diversion [10]. The potential benefits and risks with the use of RS compared to ST anastomosis are not completely investigated. This study showed that, compared with ST anastomoses, RS was associated with

Table 1. Patient characteristics.

| | Total | Matched comparision | | |
|---|---|---|---|---|
| Patients *n* (%) | 155 | Stapled 66 (43) | Sutured 89 (57) | *p* |
| Median age (years) | 71 | 68 | 73 | 0.14 |
| Male, *n* (%) | 112 (73) | 52 (79) | 60 (68) | 0.08 |
| BMI median (Kg/m$^2$) | 25.8 | 25.5 | 26.7 | 0.48 |
| ASA | | | | |
| 1 | 29 (19) | 15 (22) | 14 (16) | |
| 2 | 78 (50) | 36 (55) | 42 (47) | |
| ≥3 | 48 (31) | 15 (22) | 33 (38) | 0.14 |
| Neoadjuvant chemotherapy, *n* (%) | 46 (29) | 18 (27) | 28 (31) | 0.35 |
| Pathologic stage, *n* (%) | | | | |
| ≤pT2 | 88 (57) | 36 (55) | 52 (58) | |
| >pT2 | 67 (43) | 30 (45) | 37 (42) | 0.37 |
| Median robot operative time, minutes | 295 | 300 | 285 | 0.57 |
| Median estimated blood loss, mL | 200 | 300 | 150 | 0.004 |
| Type of urinary diversion, *n* (%) | | | | |
| Orthotopic neobladder | 22 (14) | 16 (24) | 6 (7) | |
| Ileal conduit | 133 (86) | 50 (76) | 83 (93) | 0.002 |
| The median time to first bowel motion (days) | 4 | 4.5 | 4 | 0.39 |
| Median hospital stay (days) | 11 | 11 | 11 | 0.24 |

Table 2. Postoperative GIT parameter and complications.

| | Total | Stapled | Sutured | *p* |
|---|---|---|---|---|
| Low grade Clavien grade | | | | |
| Clavien grade 0 | 43 (28) | 17 (26) | 26 (29) | |
| Clavien grade 1 | 37 (24) | 16 (24) | 21(24) | |
| Clavien grade 2 | 47 (30) | 18 (27) | 29 (33) | |
| High grade Clavien grade | | | | |
| Clavien grade 3a | 13 (8) | 7 (11) | 6 (6) | |
| Clavien grade 3b | 12 (8) | 7 (10) | 5 (6) | |
| Clavien grade 4 | 2 (1) | 1 (2) | 1(1) | |
| Clavien grade 5 | 1 (1) | 0 (0) | 1 (1) | 0.67 |
| Overall 30-d GIT complications, *n* (%) | | | | |
| No | 101 (65) | 43 (65) | 58 (65) | |
| Yes | 54 (35) | 23 (35) | 31 (35) | 1.0 |
| 30-d readmission, *n* (%) | 30 | 22 | 8 | |
| No | 125 (81) | 45 (68) | 80 (90) | |
| Yes | 30 (19) | 21 (32) | 9(10) | 0.001 |
| 30-d readmission due to GI complication, *n* (%) | 30 | 22 | 8 | |
| No | 146 (94) | 60 (91) | 86 (97) | |
| Yes | 9 (6) | 6 (9) | 3 (3) | 0.17 |
| 30-d GI complication type | | | | |
| No complications, *n* (%) | 101 (66) | 42 (65) | 59 (66) | |
| Paralytic Ileus*, *n* (%) | 30 (20) | 12 (19) | 18 (20) | |
| Mechanical ileus, *n* (%) | 5 (3) | 4 (6) | 1 (1) | |
| Diarrhea, *n* (%) | 1 (1) | 1 (1) | 0 | |
| Intractable nausea/vomiting, *n* (%) | 16 (10) | 5 (8) | 11 (12) | 0.58 |
| Median time to first GI complication (d) | 4 | 4 | 4 | 0.38 |

*Ileus is defined as nausea or vomiting, together with abdominal distension requiring cessation of oral intake, possible nasogastric tube placement, and intravenous fluid therapy.

no increase in robotic operating time, overall complications, GIT complication, or readmissions due to GIT complications. The overall readmission rate was higher in the ST group compared to the RS group.

Intracorporeal urinary diversion is a technically challenging operation. Our study started with the use of ST in our first 66 patients and then shifted to the RS technique. The other technical steps during the operation remained the same. As a result, an improvement in operative parameters can be expected to affect our results, as shown in other studies [11]. Our robotic operative time is in line with other studies as regards both ileal conduit and ileal neobladder [12,13]. There was no difference in the robotic operation time in our study between the two techniques, which is in line with previous studies using robotic techniques [8] and with others using open surgery [7]. In comparison with published operating times from other centres of excellence, the choice of stapled anastomosis does not seem to be motivated by time saving reasons [14].

Length of hospital stay depends on many factors. The criteria required to send patients home varies from centre to centre. In our centre, the standard criteria for discharge include the optimising pain relief, oral feeding and ambulating patients, bowel motion, no indwelling catheters, no clinical or laboratory signs for postoperative complications, patients able to manage the stoma and having an optimal situation at home. Many patients are more than 70 years old and its seems necessary to keep them in hospital the required time to meet the discharge criteria as several studies show increased complications with early discharge [15]. Many studies reported shorter length of hospital stay and higher readmission rate. These studies did not state the

criteria for discharging the patients, which makes comparison difficult [16].

Postoperative complications are major factors in the evaluation of surgical techniques. A meta-analysis revealed no statistically significant difference in 30-day and 90-day complication rates between intracorporeal urinary diversion and extracorporeal urinary diversion [17]. In line with our results, three larger series in that analysis show a range of early, minor complications from 17% to 62.5% corresponding to Clavien-Dindo grades I–II, respectively, and a range of early, major complications 19% to 27% corresponding to Clavien-Dindo grades III–V, respectively. Gastrointestinal complications represented about 10% of all complications [4,18].

A recent study reported a 27% readmission rate after RARC despite the use of the early recovery after surgery protocol (ERAS) [16]. In our series, the early readmission rate was 19%, which is somewhat lower than reported in the literature. There was a higher readmission rate in the ST group. This might be due to improvement in our experience with time as the RS group started in the second half of the study. Furthermore, patients with substitute urinary diversion were usually readmitted for catheter removal and observation.

Cost-effectiveness is of great significance if RARC is to be widely adopted. The identification of the cost components that influence the total cost is crucial. The operative time, instruments used, length of hospital stay, and the numbers of annual cases were key drivers of costs. The results from the segmented costs indicated that RARC operating costs were higher and accounted for the largest proportion of total RARC costs [6]. The cost of endostapling devices makes RARC more expensive. A previous study shows that the cost for the stapling device was 222€ when using Covidien Endo GIA™ Ultra Universal Staplers. Depending on the number of stapling cartridges (257€ for 60 mm each), the total cost for a stapled anastomosis reached 1250€ using four 60 mm cartridges, two for the isolation of the ileal segment and another two for the ileo-ileal anastomosis [8]. In contrast, the cost for the two 4-0 PDS sutures is negligible.

### *Limitations of the study*

Single centre studies are limited by their small sample size and the possibility of a selection bias created by the practice of an individual institution. The analysis of retrospectively collected data is subject to limitations inherent to all retrospective studies. A larger sample size would allow better analysis and thus a deeper understanding of the variables independently influencing anastomotic healing.

## Conclusion

Robot-sewn ileo-ileal anastomosis was at least as good as the stapled alternative. Compared to the stapled alternative, a robot-sewn ileo-ileal anastomosis may serve as an alternative and cost-saving approach.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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