

Original Research

Comparison of stapler and handsewn anastomosis techniques in creating an ileal conduit following radical cystectomy

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Abstract

Background and objective: Ileal conduit for urinary diversion can be completed using either end-to-end handsewn or stapled anastomosis. This study aimed to compare stapled and handsewn anastomosis methods in terms of complications, hospitalization and cost.

Materials and methods: Forty-three patients were included in the hand-sewn and 44 patients in the stapler group. After creating an ileal conduit, continuity of the loop was achieved either with handsewn or stapler method. Patients' demographic data, time to onset of bowel movement, time to transit to oral intake, time to removal of the drain, perioperative and postoperative complications, mortality and total costs were retrospectively recorded and compared between the two groups.

Results: There was no statistically significant difference between the groups in terms of the mean to the onset of bowel movements ($p = 0.51$) and the mean time to transit to oral intake ($p = 0.23$). The mean time to removal of the drain was significantly lower in the stapler group ($p = 0.023$). Perioperative complications were seen in eight patients in the handsewn group, while none of the patients in the stapler group developed perioperative complication ($p = 0.003$). Postoperative complications were similar between both groups ($p = 0.75$). The duration of hospitalization was statistically significantly lower in the stapler group ($p = 0.004$) and the mean total cost was statistically significantly more advantageous ($p < 0.001$).

Conclusion: No significant difference was found between stapler and handsewn anastomosis techniques in terms of postoperative complications. On the other hand, hospitalization and total cost were in favour of stapler technique, showing that this technique can be used safely.

Keywords

Bladder cancer; Ileal loop; Ileal conduit; Handsewn; Stapler

1. Introduction

Bladder cancer is a complex disease associated with high rates of morbidity and mortality, if left untreated. Bladder cancer is the second most common cancer in men and ninth cancer in women in Western countries with an increasing global incidence [1, 2]. Despite recent striking advancement in

radiotherapy and chemotherapy techniques, radical cystectomy (RC) remains the preferred elective treatment option in bladder cancer [3]. Several retrospective studies have reported that RC provides excellent oncological results and improves postoperative quality of life at long-term follow-up [4]. However, clear margins are mandatory as well for all other type of tumors [5, 6].

Ileal conduit (IC) has been considered a standard urinary diversion method for most patients undergoing RC for more than forty years. Although RC is associated with significant morbidity, IC has minimal metabolic changes and this has made IC the preferred diversion method in many patients and in those with decreased renal functions [7]. IC is accepted as the clinically most suitable and reliable, cost effective solution [8]. Ileal loop was described for the first time by Seiffert in 1935 and has increasingly gained popularity in parallel with the developments in surgical techniques [9]. First applications of ileal loop have been classically performed by handsewn in an end-to-end fashion. The main disadvantage of this technique is not being a standard practice and showing variability dependent on the surgeon. In addition, perioperative complications are also variable with the handsewn method, which may affect length of hospital stay and costs. This technique is still performed as a routine method in numerous centers.

Loop ileostomies are closed with secondary operations and postoperative results differ according to the preferred technique [10]. Among the relatively new loop techniques, stapled ileal conduit has been used in various studies with promising results [11, 12]. This technique has advantages of excellent tissue adaptation and water-tight closure. However, the probability of calculi formation on the staples over time makes long-term follow-up necessary [13].

The objective of this study was to compare stapled and handsewn anastomosis methods used for providing continuity of ileal conduit in terms of peri- and postoperative complications, hospitalization and costs in patients undergoing radical cystectomy due to bladder cancer.

2. Material and methods

A total of 87 patients who underwent ileal conduit with loop ileostomy following radical cystectomy in our urology clinics between 2012 and 2020 were enrolled in the study. Patients with pathologic findings that do not allow a safe ileostomy closure in the preoperative tests and those with active urinary infection were excluded from the study.

Patients were divided into two groups based on the technique used for anastomosis. Patients underwent side-to-side anastomosis using linear stapler technique were assigned into the Stapler group and those undergone handsewn end-to-end anastomosis into the Handsewn group.

2.1 Surgical technique

All interventions were performed with open surgery. According to the method described by Bricker, first the ileal loop was isolated and an ileal segment of approximately 15 cm was identified at a 15 cm distance from the ileocecal junction [14]. This segment was then separated with a mesenteric pedicle from the gastrointestinal tract for use as a conduit. This ileal segment was then used for ureteroileal anastomosis. After the 15 cm ileal segment was removed, the ileo-ileal anastomosis was achieved by two different methods for the continuity of the remaining intestinal canal.

Handsewn method: Ureteric anastomosis was applied with Bricker technique [14] to the removed ileum segment in 43 patients (handsewn group). In these patients, end-to-end ileal anastomosis was performed with the classical handsewn method with two folds.

Stapler method: After separating the 15 cm ileum segment from the intestinal tract to be used as a conduit, the continuity of the tract was provided by the same general surgeon using two linear staplers (blue thin tissue cartridge).

2.2 Data collection

Data used in this study were obtained from the patient files and hospital archives. Manual anastomoses were performed by the same urology team and stapler anastomosis by the same general surgeon. All patients' demographic data such as age and gender, previous abdominal surgery, TNM stages, time to onset of bowel movement, time to transit to oral intake, time to removal of the drain, perioperative and postoperative complications, mortality and total costs were retrospectively recorded and compared between the two groups. Postoperative complications within the 90-day follow-up were evaluated according to the Clavien Dindo classification, which is based on the number of complications seen within a certain period of time [15].

2.3 Ethics approval

Before the beginning, the necessary approval was received from the local committee of our hospital with the 27/04/2021 dated and 26397 numbered decision. The study followed ethical principles of the Declaration of Helsinki.

2.4 Statistical analysis

Data obtained in this study were evaluated and statistically analyzed using SPSS (SPSS version 25.0, IBM, Armonk, NY, USA) package software. Normality of the variables was analyzed with the Kolmogorov-Smirnov test. General features of the study population were expressed using descriptive statistics. Parametric quantitative variables were expressed as mean \pm standard deviation, while nonparametric quantitative variables were given as median, minimum, maximum and qualitative variables as number and percentage. Parametric quantitative variables were analyzed with independent samples *t* test, nonparametric quantitative variables with mann-Whitney U test and categorical variables with Fisher's Exact test and Pearson Chi-square test. $p < 0.05$ values were considered statistically significant.

3. Results

A total of 87 patients who underwent IC following RC in the urology clinics of our hospital were included in the study. Of all patients, 78 (89.7%) were male and 9 (10.3%) were female. 43 (49.4%) patients were in the handsewn group and 44 (50.6%) patients in the stapler group. The mean age was found as 67.4 ± 10.03 years in the handsewn group and 68.4 ± 10.1 years in the stapler group. Of the patients in the

handsewn group, 40 (93%) were male and 3 (7%) were female, while 38 patients (86.4%) were male and 6 patients (13.6%) were female in the stapler group. No statistically significant difference was found between the two groups in terms of age and gender ($p = 0.63$, $p = 0.484$; respectively).

Six (14%) of the patients in the handsewn group and 2 (4.5%) of the patients in the stapler group had a history of previous abdominal surgery. There was no statistically significant difference between the groups in terms of having a history of previous abdominal surgery ($p = 0.157$). In addition, no significant difference was found between both groups in terms of TNM staging ($p = 0.48$). Distribution of the patients in both groups according to tumor stages is shown in Table 1.

TABLE 1. TNM stages of the patients in both groups.

TNM stage	Handsewn		Stapled	
	n	%	n	%
0	6	14.0	10	22.7
I	11	25.6	13	29.5
II	14	32.6	15	34.1
III	11	25.6	5	11.4
IV	1	2.3	1	2.3

Pathological T group was further divided into subgroups as T0, T1, T2 (T2a + T2b), T3 (T3a + T3b), T4 (T4a + T4b). No statistically significant difference was found between the two groups in terms of T stage subgroups ($p = 0.608$). Distribution of T stages between handsewn and stapler groups is given in Table 2.

TABLE 2. T stage subgroups of the patients in both groups.

Pathological T stage	Handsewn		Stapled	
	n	%	n	%
T0	6	14.0	6	13.6
T1	1	2.3	3	6.8
T2 (T2a + T2b)	12	27.9	15	34.1
T3 (T3a + T3b)	13	30.2	14	31.8
T4 (T4a + T4b)	11	25.6	16	13.6

Two patients in the handsewn group who died before the onset times of bowel movements, four patients in the same group who died before transition to oral nutrition and removal of the drains were excluded from the statistical analysis.

The mean time to the onset of bowel movements was found as 4 (min-max: 0–6) days in the handsewn group (n:41) and 3 (min-max: 1–7) in the stapler group (n: 44), and there was no statistically significant difference between the groups ($p = 0.230$). Similarly, the mean time to transit to oral intake was found as 4 (min-max: 0–7) days in the handsewn group (n: 39) and 4 (min-max: 1–8) days in the stapler group (n: 44) with no statistically significant difference between the groups ($p = 0.732$). The mean time to removal of the drain was found as 8 (min-max: 0–44) days in the handsewn group (n: 39) and 9 (min-max: 3–20) in the stapler group (n: 44) and the difference between the two groups was statistically

significant ($p = 0.139$).

Perioperative complications were seen in 8 (18.6%) patients in the handsewn group, while none of the patients in the stapler group developed perioperative complication ($p = 0.002$). The patients were followed-up for 90 days and 22 (51.2%) patients in the handsewn group and 22 (50.0%) in the stapler group developed complications in this period, and the difference was not statistically significant ($p = 0.914$). Perioperative and postoperative complications of the groups are seen in Fig. 1.

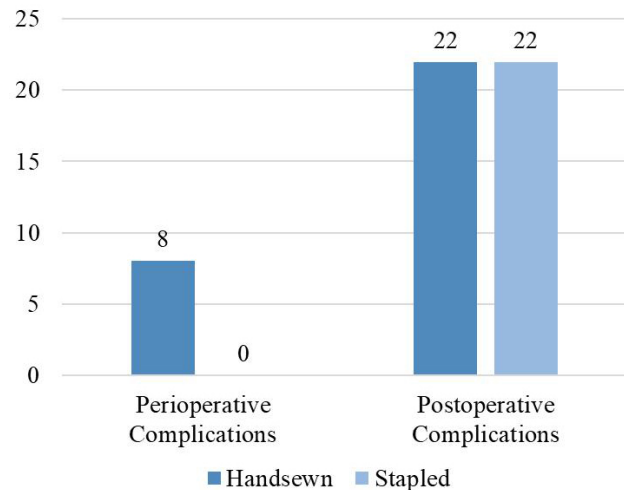


FIG. 1. Perioperative and postoperative complications of the groups.

Severity of the postoperative complications were graded according to the Clavien Dindo classification system. There was no statistically significant difference between the groups in terms of the Clavien Dindo scores ($p = 0.216$) (Table 3).

Based on the Clavien Dindo scoring, grade 1 and 2 complications were defined as minor and grade ≥ 3 complications as major. No statistically significant difference was found between the groups in terms of severity of the complications ($p = 0.093$) (Table 4).

During the 90-day follow-up period, 9 (20.9%) patients in the handsewn group, and 2 (4.5%) patients in the stapled group died. The mortality rate was statistically significantly lower in the stapled group ($p = 0.021$).

The median duration of hospitalization was found as 12 (min-max: 6–32) days in the stapled group and 9 (min-max: 0–49) days in the handsewn group. The duration of hospitalization was statistically significantly lower in the handsewn group ($p = 0.023$). Total operational cost was calculated as 9614 (min-max: 4608–68,051) ₺ in the handsewn group and 7457 (min-max: 3983–16,347) ₺ in the stapler group. The mean total cost was statistically significantly more advantageous ($p < 0.001$).

4. Discussion

Urinary diversion is the diverting of urinary drainage out of the body either temporarily or permanently. Ileal conduit, the most common form of urinary diversion, is a passive loop that provides urine to drain an appliance. It was first de-

TABLE 3. Distribution of the Clavien Dindo scores between the patient groups.

Clavien Dindo score	Number of complications seen in the handsewn group within 90-day follow-up (n (%))	Number of complications seen in the stapler group within 90-day follow-up (n (%))
0	20 (46.51%)	23 (52.27%)
1	5 (11.63%)	6 (13.64%)
2	3 (6.98%)	8 (18.18%)
3	4 (9.30%)	3 (6.81%)
4	2 (4.65%)	2 (4.55%)
5	9 (20.93%)	2 (4.55%)
Total	43 (100%)	44 (100%)

TABLE 4. Severity of the postoperative complications according to the groups.

Clavien Dindo severity groups	Handsewn		Stapled	
	n	%	n	%
No complication	20	46.5	23	52.3
Minor complications	8	18.6	14	31.8
Major complications	15	34.9	7	15.9
Total	43	100	44	100

scribed in the 19th century and further developed by Bricker in the 1950s [14]. Over time, several techniques have been developed to construct ileal conduit in parallel with the advancements in oncologic and surgical techniques [16]. When constructing an ileal conduit, intestinal continuity is achieved through the anastomosis of the ileum using either staplers or hand suturing. In addition to urinary diversion, stapler technique has been used in the laparoscopic and robotic cystectomy with low rate of complications [17, 18]. Each technique has unique advantages and disadvantages. In the present study, we compared ileal loop procedures performed with conventional end-to-end handsewn and side-to-side stapler anastomoses.

In our study, time to transition to oral intake was similar between both groups (4 days). In a study by Sato *et al.* [19] comparing stapled and manual intestinal anastomoses, the mean time to transition to oral intake was found as 5 days in both groups. On the other hand, time to removal of the drain was significantly shorter in the stapler group.

Symptomatic infection, ureteral stenosis and intestinal complications may be seen following ileal conduit operation depending on the technique [20]. In a study by Li *et al.* [21], ileal conduit operations performed with conventional and modified techniques were compared in terms of the complications. Postoperative early and late complications were reported to be lower in ileal conduit diversion with the modified surgical technique [21]. In our study, no significant difference was found between the handsewn and stapler groups in terms of the postoperative complications, while perioperative complications were observed in eight patients in the handsewn conduit group. Whereas, none of the patients in the stapler group developed perioperative complications.

Following gastrointestinal anastomoses, anastomotic leakage, bleeding and stenosis may be seen and the incidence of these complications has been reported as nearly 10% [22, 23].

The most common complication of ileal conduits is anastomotic leakage followed by anastomosis stenosis [24]. Anastomoses performed using stapler technique were reported to be more effective than those completed with hand suturing [25]. In our study, postoperative anastomosis leak was found in 4.7% in the handsewn group and 2.3% in the stapler group. This finding suggests that a better tightness was achieved using the stapler technique. However, the difference between both groups was not statistically significant. On the other hand, in a study by Liu *et al.* [26] comparing stapler and manual anastomosis techniques in terms of anastomotic leakage, no significant difference was found between the two groups in terms of anastomotic leakage. In our study, lower rate of anastomotic leakage in both groups may be attributed to a low tension provided at anastomoses with proper techniques and meticulous suturing techniques. In addition, anastomosis stenosis is more common in the early period with handsewn technique [24]. In our study, none of the patients developed anastomosis stenosis.

The other common complications associated with ileal conduit diversion include pyelonephriti (5–23%), urinary calculi (3–16%) and stomal complications [27]. In a study by Kavarić *et al.* [28] using modified Wallece technique, the most common postoperative complication following ileal conduit was pyelonephritis followed by pneumonia, paralytic ileus and anastomotic leakage. In our study, pyelonephritis was found in three patients and stomal complications in three patients and ileus in nine patients. In addition, we classified the postoperative complications seen during 90-day follow-up according to the Clavien Dindo system, and again no significant difference was found between the groups in terms of the grades and severity of the complications.

The duration of hospitalization is the time from the first admission to the discharge and may vary depending on the type of the operation and different techniques used at the same operation. In our study, different durations of hospitalization were obtained in the creating ileal loop following radical cystectomy due to bladder cancer with two different techniques. The median duration of hospitalization was found as 12 days in the stapled group, while this duration was calculated as 9 days in the handsewn group. Previous studies reported different durations of hospitalization with stapler and hand-made anastomosis in various operations. In a meta-analysis performed by Lustosa *et al.* [29], no significant difference was reported between the two techniques by the studies included. Again, in a study by Olmez *et al.*

[30], comparing stapler and handsewn methods in ileocolic anastomosis, no significant difference was found with both techniques in terms of hospitalization. We attributed the shorter duration of hospitalization found in our study with the handsewn technique compared to the previous studies to the different techniques used in various operations. In fact, there were differences among studies in terms of the duration of hospitalization.

Total cost of an operation depends on the operational time, hospitalization, cost of the equipment and other factors. One of the most important factors affecting total cost in the stapler technique is the isolation of the ileal segment and the cost of cartridges used for ileo-ileal anastomosis [31]. In our study, total cost was significantly lower in the stapler group. The most important reason for this may be that none of the patients developed perioperative complications and shorter duration of hospitalization was lower in this group. When both methods are evaluated in terms of postoperative complications, it seems that the stapler method can be used safely and effectively.

5. Study limitations

This study has several limitations. First, the study was designed as retrospective and conducted in a single center. Second, operational times could not be compared between the two groups, because we could not reach information of operational time in all patient records. Finally, since the studies comparing handsewn and stapler techniques specifically in urinary diversion procedures is very limited, we had to compare our data mostly with different operation types. Because of the limited studies on these techniques in the literature, we believe that our findings will shed light to the further studies that will investigate superiority of end-to-end and side-to-side ileo-ileal anastomosis in urinary diversion procedures.

6. Conclusions

Findings of this study indicate that no significant difference was found between stapler and handsewn anastomosis techniques used in ileal conduit procedures performed after radical cystectomy due to bladder cancer in terms of postoperative complications. On the other hand, total cost were in favour of stapler technique, showing that this technique can be used safely. Future prospective and multi-center studies to be performed on this subject will further clarify advantages and disadvantages of these two techniques.

Author contributions

GC and FH conceived and designed the study. GC, FH, EG, HIC, AI and KO developed the study protocol. GC, FH, EG, and KO designed and tested the study instruments. GC, FH, EG, HIC, AI and KO supervised data collection. FH, EG, HIC, and KO analysed the data. GC, FH, EG, HIC, AI and KO prepared and approved the manuscript.

Ethics approval and consent to participate

Before the beginning, the necessary approval was received from the local committee of our hospital with the 27/04/2021 dated and 26397 numbered decision. The study followed ethical principles of the Declaration of Helsinki.

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Conflict of interest

The authors declare no conflict of interest.

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