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Research Article

Orthotopic Ileal Neobladder Construction Using Non-Absorbable Staples: Is It Safe?

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Abstract

Objective: Approximately 30% of bladder cancer patients present with muscle-invasive disease at the time of diagnosis and the standard treatment is radical cystectomy. The challenge for surgeons has been selecting an ideal urinary diversion technique for these patients. The main objective of this paper is to evaluate the post-surgical complications, resulting from the use of non-absorbable titanium staples in Orthotopic Ileal Neobladder (OIN) construction.

Materials and Methods: We performed a retrospective analysis of all patients subjected to radical cystectomy with OIN construction at a single institution between 2006 and 2012. During this period, 18 patients underwent this surgery; imaging analyses and kidney function tests were performed as part of the follow-up to identify disease recurrence or the presence of complications.

Results: The patients were followed for an average period of 20.8 months (range, 1–68 months) and had a mean 6-year overall survival rate of 75%. Two patients developed deep vein thrombosis (DVT) and 1 patient developed a urinary fistula (uretero-neobladder anastomosis). These complications developed early and were resolved after treatment. We observed 3 late complications, including a rupture of the OIN (6.2%) in 1 patient and reservoir calculus formation in 2 patients (12.5%). These complications developed late and were not related to the use of non-absorbable staples.

Conclusions: The long follow-up period in patients subjected to OIN with the use of titanium staples demonstrated the safety and simple reproducibility of this technique. Prospective, comparative, and randomized studies should be performed to confirm these findings.

Keywords: Bladder Cancer; Cystectomy; Urinary Diversion; Orthotopic Neobladder; Non-Absorbable Staplers

Abbreviations

OIN: Orthotopic Ileal Neobladder;
DVT: Deep Vein Thrombosis;
TCC: Transitional Cell Carcinoma;
T-T: Terminal-Terminal;
CIC: Clean Intermittent Catheterization

Introduction

Bladder cancer is the ninth most frequent cause of cancer worldwide and is the fourth most frequent cause of cancer in men in the United States, where it is responsible for 130,000 deaths per year [1]. According to the Ministry of Health, the incidence of bladder cancer in Brazil is estimated to be 3.7 cases per 100,000 individuals [2]. Approximately 30% of bladder cancer patients present with muscle-invasive disease at the time of diagnosis [3]. The standard treatment for these patients comprises radical cystectomy combined with pelvic lymphadenectomy; this combination provides disease-free survival rates of approximately 70% and 66% after 5 and 10 years, respectively [3].

One challenge for surgeons has been selecting an ideal urinary diversion technique that simultaneously provides low morbidity, effective upper urinary tract protection, and a good quality of life for the patient by preserving his/her body image [4-6]. Throughout the years, several techniques that included diverse intestinal segments and various morphologies have been used to perform urinary diversions [7-9]. In 2004, an Italian group reported an "easy, fast, and reliable" orthotopic ileal neobladder (OIN) technique in which non-absorbable titanium staples were used [10].

This study was aimed to evaluate the post-surgical complications, particularly reservoir calculus formation, resulting from the use of non-absorbable titanium staples in OIN construction.

Materials and Methods

A retrospective analysis of all patients subjected to radical cystectomy performed by a single surgeon at the Santa Marcelina Hospital in São Paulo between June 2006 and July 2012 was conducted. All the clinical data were obtained from the patients' medical records and the Ethics Committee of our institution approved this study. During this period, 78 cystectomies were performed, among which 59 (75.6%) patients were subjected to Bricker's ileal conduit method of incontinent cutaneous diversion and 19 (24.3%) were subjected to OIN construction.

Among the OIN construction surgeries, 18 (94.7%) incorporated titanium staples. However, early death occurred in 2 of these patients, 1 of whom died from acute myocardial infarction and the other from sepsis. These patients were excluded from the study (Diagram 1). The indications for cystectomy in the remaining 16 patients included the presence of muscle-invasive bladder transitional cell carcinoma (TCC) (\geq pT2 according to the Union for International Cancer Control 2002 TNM staging criteria) in 8 patients (50%) and recurrent non-invasive high-grade TCC (T1G3) in the other 8 patients (50%). The inclusion

criteria for neobladder construction were as follows: absence of metastatic disease during the pre-operative assessment, good performance status, absence of intestinal inflammatory diseases, proper physical and mental skills for self-catheterization, serum creatinine level <2.5 mg/dL or a creatinine clearance rate ≥ 50 mL/min, and consent for surgical treatment. Pre-surgical assessments were performed via chest radiography and abdominal and pelvic tomography and demonstrated that the disease was clinically localized (cN0M0) in all patients.

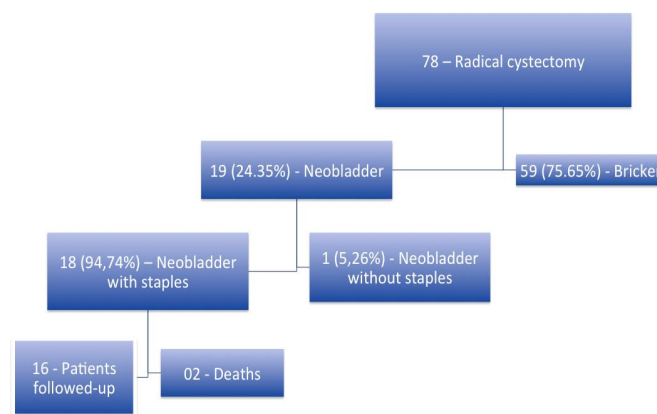


Diagram 1. Patients submitted a radical cystectomy and stratified by the kind of urinary diversion

Surgical Technique

In all patients, a standard procedure was applied for the OIN surgery. Neobladder construction occurred after the radical cystectomy and pelvic lymphadenectomy. The first step involved a 40cm ileal resection at a 20cm distance from the ileocecal valve (we preserved the terminal ileum). The intestinal transit was then systematically reconstructed via a side-side anastomosis by using a titanium stapler. Subsequently, the mesenteric opening was closed to avoid the formation of internal hernias. The resected segment was then folded in a Y-shape configuration with two 15cm parallel central portions and 2-5cm chimneys (Figure 1). A 1cm hole was created in the most caudal extremities of the central portions to insert the linear stapler (titanium stapler, 75 mm), and the intestinal segment was closed by using 2 sequential loads to create a 15cm pouch.

After the bilateral insertion of an 8Fr ureteral catheter, a termino-terminal (T-T) ureteral-neobladder spatula-shaped anastomosis was performed in each neobladder chimney. The distal ureteral catheter extremities were then externalized through 2 small separated openings in the sidewalls of the pouch and were finally externalized through an opening in the abdominal wall to prevent the constructed pouch from filling. Finally, the caudal opening of the neobladder, through which the stapler had been inserted, was used to construct the urethral-neobladder anastomosis. This anastomosis was performed by placing

8 separated 3-0 polyglactin sutures over a 22Fr urethral catheter.

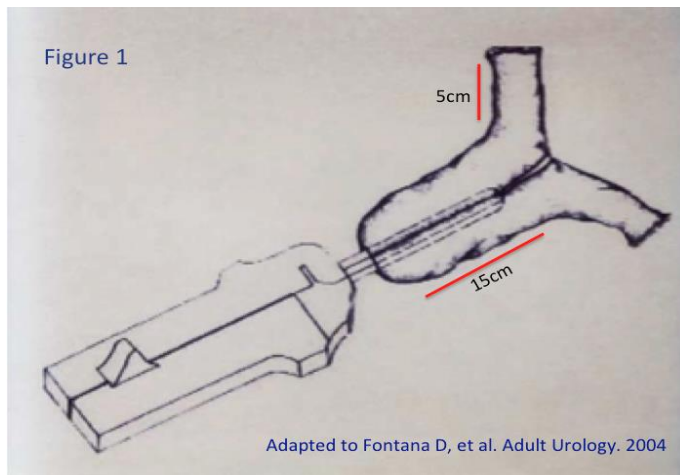


Figure 1. Two central segments of resected tract of ileum brought together and detubularized with mechanical stapler inserted through orifice made at lowest point of neobladder.

Follow-up

The patients remained catheterized for 14 days. The ureteral catheters were removed on day 10 post-surgery and the abdominal drains were removed when the output was less than 150 mL/24 hours. The neobladder was irrigated every 8 hours with 50 mL of saline solution to remove clumps. The patients were followed routinely after surgery with imaging tests (ultrasonography or pelvic and abdominal tomography) and kidney function tests (serum levels of urea, creatinine, sodium, and potassium). The patients were evaluated for disease recurrence and the presence of complications every 3 months for the first 2 years and every 6 months thereafter.

Results

Between 16 patients included in this study 14 (87.5%) were men and 2 (12.5%) women with a mean age of 57.2 years (range, 48–74 years), an average follow-up period of 20.8 months (range, 1–68 months), and a mean 6 year overall survival rate of 75%. All patients had TCC with the following pathological staging: pT1G3 in 8 patients (50%), pT2 in 7 (43.7%), and pT4 in 1 (6.2%). Of the patients with muscular-invasive disease, 2 (12.5%) had lymph node involvement (pN+). One patient had an incidental finding of prostate adenocarcinoma (Gleason score 3+3). All pathological and demographic findings are summarized in Table 1.

There were 3 early complications. Two patients (12.5%) developed deep vein thrombosis (DVT), which was resolved with drug treatment (Clavien II), and 1 patient (6.2%) developed a

urinary fistula of the uretero-neobladder anastomosis, which was surgically treated with good results (Clavien IIIb).

Pathological and demographic data	
Gender	
Male	14 (87.5%)
Female	2 (12.5%)
ECOG*	0-1 (100%)
Age (Years)	57,21 (48-74)
Pathological staging	
Urothelial Carcinoma	16 (100%)
pT1G3	8 (50%)
pT2	7 (43,7%)
pT4	1 (6,2%)
N+	2 (12,5%)
Concomitant prostate Adenocarcinoma Gleason (3+3)	1 (6,2%)

Table 1. Pathological and demographic data.

*ECOG - Eastern cooperative oncology group performance status

There were 3 late complications. One (6.2%) involved a neobladder rupture at 36 months post-surgery in a patient who avoided performing clean intermittent catheterization (CIC) for 15 days. This patient underwent surgery and had his OIN converted to an incontinent urinary diversion. During the surgery, we noted that the rupture did not take occur in the stapler line, which was found to be intact. The patient progressed well after the surgical intervention (Clavien IVa).

Two additional patients developed calculus in the OIN and were diagnosed through imaging tests performed during outpatient follow-up. The first patient developed a 2cm calculus at 68 months post-surgery. This patient had been performing twice-daily CIC despite receiving instructions to perform CIC 4–5 times per day. This low bladder-emptying frequency led to long periods of urinary stasis in this patient.

Table 2	Results (n=16)
Early complications	3 (18,7%)
DVT* (Clavien II)	2
Urinary fistula (Clavien IIIb)	1
Late complications	3 (18,7%)
Rupture of the neobladder (Clavien IVa)	1
Lithiasis in the neobladder (Clavien IIIa)	2
Kidney function deterioration	0
Overall survival (OS)	12 (75%)
Average follow-up (months)	20,88 (1-68)

Table 2. The complications founded and the overall survival rate (OS).

*DVT - deep vein thrombosis

The other patient developed two calculi (1,5cm each one) at 55 months post-surgery. Both patients were treated endoscopically (Clavien IIIa); during the procedures, mobile calculi that were unattached to the bladder wall were observed, and the stapler lines were covered by the bladder mucosa and were therefore not visible via cystoscopy. The calculi were subjected

to a laboratory analysis and were not found to contain metallic fragments. None of the patients developed urethral stenosis or renal function deterioration during the follow-up period. These results are summarized in Table 2.

Discussion

The primary contribution of this study was an evaluation of the safety of non-absorbable staples in patients subjected to OIN construction after radical cystectomy consequent to bladder carcinoma. The OIN is a urinary diversion technique that closely approximates an ideal treatment because it provides a better quality of life for the patient, maintains urinary continence, preserves the patient's body image, and does not cause damage to the upper urinary tract [5,11-13]. The scientific literature had already established that the OIN does not compromise oncological results and provides good functional results [14]. According to Fontana et al. [10], stapler use would simultaneously render this procedure simpler, more rapid, more reproducible, and more reliable.

Only a few literature reports have described the use of non-absorbable staples during OIN construction, and only 2 studies have analyzed the long-term results and complications associated with this technique [15,16]. In 1993, Kerbl et al. initially reported the use of titanium staples to close the bladders of patients subjected to laparoscopic radical nephroureterectomy. No complications resulted from this method and none of the patients developed lithiasis during a 5-month follow-up period [17]. In 2004, Fontana et al. expanded upon this concept and developed a new technique to construct a Y-shaped OIN by using non-absorbable staples. Using this technique, the authors demonstrated a reduced surgical duration, low complication rate, and good functional results along with a lithiasis incidence of only 6%, which is the same as the calculus formation rate associated with OIN without stapler use [10]. Subsequently, in 2004 and 2005, Abreu et al. reproduced the technique proposed by Fontana in 2 cases and obtained similar surgical results. In those studies, the authors observed that the stapler lines were no longer visible during cystoscopic evaluations performed 2 months post-surgery and demonstrated that the staple lines were soon covered by epithelium, thus preventing direct contact between the staples and urine [18,19].

Only the studies by Castillo et al. and Kravchick et al. [15,16] evaluated late complications in patients with OIN constructed by using non-absorbable staples. The first study, published in 2011, reported the presence of uretero-neobladder stenosis in 3 ureteral unities (10% of the 30 uretero-neobladder unities performed) and the absence of lithiasis during the 24 months follow-up period. In 2013, Kravchick et al. observed calculus formation in 4 (23.5%) of 17 patients and 4 cases of uretero-neobladder stenosis (8.8%) during the 41-month follow-up period. In our study, the calculus formation rate was 12.5% (2

patients), lower than that obtained by Kravchick et al. Additionally, none of our patients developed ureteral stenosis or renal function deterioration.

Our findings suggest that the use of non-absorbable stapler to construct the OIN is safe and does not predispose patients to calculus formation. Besides the low urinary lithiasis rate, we found that all calculi were mobile with no adhesions to the staple line and all appeared late in the follow-up period (after 55 and 68 months) in the 2 patients. Furthermore, a laboratory analysis of the calculi did not identify the inclusion of metallic fragments, thus confirming the hypothesis that the lithiasis etiology in these cases was unrelated to stapler use [10,15,18].

According to Pantuck et al., a higher incidence of uretero-neobladder stenosis was observed with the use of an anti-reflux technique. The authors also observed that the presence of ureteral reflux in a neobladder with low pressure did not increase the incidence of pyelonephritis and renal function deterioration [20]. In our study, no renal function deterioration or uretero-neobladder anastomosis was observed. It is likely that the use of a Y-shaped neobladder as described by Fontana requires little ureteral mobilization, thus maintaining good vascularization as well as the anastomosis of each ureter in its original location immediately above the iliac vessels [10]. In addition, the use of an ample spatula-shaped uretero-neobladder anastomosis without anti-reflux mechanisms contributed to the absence of these complications [15,16,21].

Our study included some limitations. First, the study was retrospective and was performed at a single center. Second, some clinical information was missing that limited the analysis of other variables such as the decrease in surgical time. The number of patients included in the study was small ($n = 16$) but was greater than that used in two of the three related studies [15,16]. Prospective, multicenter, and controlled studies should be performed to definitively confirm these findings.

Conclusions

The safety of OIN construction with non-absorbable titanium staples was demonstrated by the long patient follow-up period. The staple lines were soon covered with epithelium preventing direct contact between the staples and urine. We believe that the use of a Y-shaped neobladder without an anti-reflux mechanism decreased the incidence of ureteral stenosis because it permitted an ample anastomosis without the requirement of extensive ureteral mobilization. Additionally, this technique is rapid, reliable, and reproducible.

Conflict of Interest Statement

We certify that there is no conflict of interest and no financial support with any organization regarding the material dis-

cussed in this manuscript.

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