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**Studer orthotopic neobladder: a modified surgical technique**

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## ABSTRACT

**OBJECTIVE** A modified technique for orthotopic ileal neobladder preparation is described. The Studer technique is the method most frequently used worldwide and seems to be an ideal reconstructive solution after radical cystectomy.

**METHODS** After radical cystectomy, urinary diversion is attained by means of a detubulized ileal segment. About 40 cm are used to create the reservoir and 15 cm for a tubular afferent limb. A spheroidal-shaped reservoir is then obtained with a conic distal part that will be anastomized to the urethral stump. After the reconstructive part, the neobladder and the afferent limb are attached to the levator ani and psoas muscles respectively. Post-operative results on a series of 36 patients are reported.

**RESULTS** The final shape of the reservoir was roughly spherical. A small amount of anastomotic strictures was registered. Renal function was not impaired after surgery, even at late follow-up.

**CONCLUSION** Even if the Studer technique is already well described, we believe that our technical changes may improve urinary tract restoration, and potentially decrease complications typical of urinary orthotopic diversion. Further cases are required to confirm possible advantages of the modified technique.

## INTRODUCTION

Radical cystectomy is the gold standard of treatment of muscle invasive bladder cancer [1,2]. Since 1980, a number of orthotopic reservoirs has been described and gradually improved: these diversions have to meet both oncological criteria and the patient's expectations from a functional point of view [3]. Cystectomy, which is regarded as an ablative step, is in itself a procedure subject to high risk of intra- and post-operative complications [4,5]. Furthermore, potential symptoms connected to urinary storage/voiding phases and erectile failure may worsen the quality of life.

Long-term renal function can also be impaired by post-surgical urinary tract obstruction due to uretero-ileal or neobladder-urethral strictures as well as ureteral reflux [6].

Among different reconstructive modalities, ileal neobladder with Studer technique is a frequent orthotopic diversion [1,7]. Even if this is regarded as a well-defined procedure, we report our experience with a modified technique, in order to improve the morphological features of the diversion and its location within the pelvis.

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## METHODS

### *Surgical procedure*

#### a) Common steps with traditional Studer's technique:

After radical cystectomy and pelvic lymphadenectomy, orthotopic diversion is made through the isolation of an ileal segment 50-60 cm long (25 cm proximal to the ileocaecal valve, in order to avoid risk of vitamin B12 malabsorption or diarrhoea due to bile acid). The distal end of the ileal segment, 40-44 cm long, is opened along its antimesenteric border whereas the proximal 15 cm maintain their tubularization (so called "afferent limb"). Ureters are then separately anastomosed to that afferent tubular ileal segment in an end-to-side fashion. Up to the realization of the posterior face of the bladder substitute, which is shown in Figure 1, the procedure is identical to the traditional Studer technique. Small bowel continuity is achieved in a latero-lateral fashion with the aid of mechanical staplers and with a running 3-0 Vycril seromuscular suture. The reconstruction of the reservoir is completed manually, realized by a series of continuous 3-0 Monocryl sutures on the luminal side and 3-0 Vycril on the serosal side.

#### b) Modified surgical steps:

Ureters are firstly spatulated on their distal side for about 2 cm and cannulated with 6 Ch ureteral catheters, then the left ureter is mobilized and carried retroperitoneally beside the right ureter. Next they are anastomosed together and with the most proximal side of the afferent limb in an end-to-end fashion, using the Wallace technique. The opened part of the ileal segment is then folded in order to configure the anterior plate of the neobladder. As clearly shown in Figure 2, the main difference in our technique from the original Studer depiction is that reconstruction of the anterior plane begins with the first stitch, which passes between the middle of the left side and that of the right side, then we proceed with a continuous suture downwards ending at the bottom, configuring a conic neobladder neck. This passage facilitates the anastomosis between the urethral stump and neobladder.

The superior hemi-suture is then performed transversally, to give the reservoir a "heart-like" shape (Figure 3). Urethra-neobladder anastomosis is usually performed with 9 singular stitches and by means of magnification loops. After the reconstructive step, the neobladder and its afferent limb are fixed to the levator ani muscle and parietal peritoneum respectively, in order to give the reservoir a correct placement and to assure its morphological stability.

## RESULTS

We report partial outcomes on 36 patients, with regard to the configuration of the diversion and its implications at early and mid-term follow up.

The post-operative course was uneventful in 86.1% (31/36) of the patients, without leakage at the neobladder-urethral anastomosis in 77.7% (28/36). Mean follow up is 3.21 +/- 1.4 years. Overall renal function resulted unaffected by the diversion (creatinine values before surgery: 1.07 +/- 0.26 mg/dl; creatinine values at follow up: 1.19 +/- 0.47;  $p=0.138$ ). Imaging was assessed with multidetector CT scan or Magnetic Resonance Imaging. As late occurrences, 2 uretero-neobladder strictures and 1 case of ureteral reflux were recorded. The stricture at the neobladder-urethral anastomosis was detected in a single patient (2.7%).

No complications directly related to the modified folding were observed.

The final shape of the reservoir was roughly spherical, with a slight (but clinically irrelevant) lateralization toward the right side in 6 patients. A single case of cystocele was recorded. The morphology and location of the afferent ileal limb seemed to be regular in all cases.

## COMMENT

Although radical cystectomy represents a standard surgical technique for the definite management of muscle invasive bladder cancer, this procedure is still affected by a number of complications, most of them serious [4].

Peri-operative mortality is currently set at 3%, and the incidence of complications within 3 months of surgery is described in up to 28% of patients [4, 5]. A salvage procedure, an ASA score more than 3, significant intra-operative bleeding, patient's age and extra-vesical disease have been regarded as variables impairing outcomes. In more recent years, the introduction of definite scales evaluating pre-operative comorbidities has been addressed, and such indexes have been regarded as better indicators of life expectancy than the patient's age [4.8].

Beyond pre-existing patient comorbidities, complications may also be related to the surgical procedure itself as well as bowel anastomosis or urinary diversion [4].

An orthotopic bladder substitution anastomosed to the urethra is now commonly used both in men and women with well-defined safety and long-term reliability. However, early and late morbidity is reported in up to 22% of patients [4.9]. Long-term complications include diurnal (8-10%) and nocturnal incontinence (20-30%), ureteral anastomotic stenosis (1.4-18%), urinary retention (4-12%) both in male and female patients [4, 9, 10, 11, 12, 13]. Stricture of neobladder-urethral anastomosis, a complication that might threaten bladder shape and voiding as well as renal function, has been described in up to 16.9% of patients [14].

Studer orthotopic bladder substitution is a well-established surgical procedure with certain functional and oncological outcomes [15]. However, modifications to surgical technique might contribute to the decrease of surgical related side effects.

In such a setting, the described modified approach relies on four differences from traditional Studer diversion: 1) Folding of the anterior plate; 2) Reconfiguration of the bladder neck; 3) Final shape; 4) Fixation to levator ani muscle and psoas muscle.

The modified folding (from left to right side in the inferior hemi-suture, transversally in the superior one) gives an original shape to the whole diversion and a conic figure to the new bladder neck, that can be easily anastomosed to the urethral stump, decreasing tension on the anastomosis. In fact, traction or continuous tension at this site may induce ischemic and fibrotic effects that can be regarded as a possible explanation of post-surgical strictures. In our series, the low occurrence of strictures at the vesico-urethral anastomosis (2.7) could be due to this modified technique, especially if compared to the incidence reported in literature (16.9%) [14].

The suture of the reconfigured reservoir to the levator ani muscle and psoas muscle allows the reservoir to gain correct placement, reducing cystoceles and abnormal displacement of the afferent limb (i.e. rotation). For uretero-neobladder suture, we adopted the Wallace technique to reduce overall stenosis rate [16] and to avoid risk of urinary reflux due to possible ureteral kinking following incorrect ureteral anastomosis with the Bricker technique. The decreased rate of



obstructive events and/or voiding disorders may support preserved renal function, which is often affected by the reservoir [6].

Regarding our clinical records, no case was observed needing re-intervention. Some late complications reported (2 uretero-neobladder strictures and 1 case of ureteral reflux) were detected by CT scan but patients were asymptomatic and close surveillance was adopted for early detection of undesirable events (impairment of renal function, urinary tract infections) possibly linked to those situations. The single case of cystocele was observed three years after surgery in a 73 year-old woman and consisted of a grade II in Baden-Walker classification, causing stress urinary incontinence in the patient. Due to the patient's age and comorbidities, in agreement with the patient, no kind of treatment was proposed.

However, the limited number of cases presented and the relatively short follow-up did not allow a clear comparison with the reservoir originally described by Studer. Herein, our objective is to describe some feasible technical modifications. Further cases are needed in order to assess whether our technical details can give some advantages in terms of better urinary storage and decrease in anastomotic urethral strictures.

## CONCLUSIONS

Bladder substitution with Studer orthotopic diversion is a well-defined technique in urological practice, for both its surgical ease of use and the advantages intrinsic to configuration. The modifications we described may be an aid to improve the morphology and urinary tract restoration, potentially decreasing complications typical of urinary orthotopic diversion. A wider series with longer follow up is required to support advantages of this technical modification.

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**FIGURE CAPTIONS**

Figure 1. Folding of the posterior plate

Figure 2. Folding of the anterior plate: reconstruction begins with a first stitch, which passes between the middle of the left side and that of the right side, and then we proceed with a continuous suture downwards ending at the bottom, configuring a conic neobladder neck. This passage facilitates the anastomosis between urethral stump and neobladder. The superior hemi-suture is then performed transversally.

Figure 3. Final configuration of the neobladder, which gains a “heart-like” shape.

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