

Urodynamic evaluation of patients with studer orthotopic urinary diversion and the impact of body mass index on micturition parameters

Studer ortotopik üriner diversiyon uygulanan hastaların ürodinamik değerlendirilmesi ve vücut kitle indeksinin miksiyon parametrelerine etkisi

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Abstract

Objective: We aimed to evaluate functional and urodynamic outcomes together with the influence of body mass index (BMI) on the voiding patterns of patients with Studer type orthotopic ileal neobladder.

Material and methods: Between 2000 and 2008, out of 61 patients who underwent a Studer type orthotopic ileal neobladder construction following radical cystoprostatectomy, 18 patients who were regularly followed without local recurrence or distant metastases were enrolled in the study to evaluate the functional results and urodynamic characteristics of the neobladder.

Results: Maximum pouch capacity, compliance, maximum flow rate and mean residual urine volume were 320.5 ± 64.8 mL, 35.6 ± 23.3 mL/cmH₂O, 14.1 ± 6.5 mL/sec, and 63.3 ± 40.4 mL, respectively. The nighttime and daytime incontinence rates were 44.4% and 16.6%. No significant correlation was found between daytime and nighttime continence rates or between the capacity and compliance of the neobladder and BMI. However, stress incontinence rate was statistically higher in patients with high BMI values ($p=0.04$).

Conclusion: Despite the more frequent occurrence of stress urinary incontinence, orthotopic urinary diversions with successful functional outcomes and continence rates can be achieved in patients with high BMI values.

Key words: Body mass index; orthotopic ileal neobladder; urinary incontinence; urodynamic study; voiding function.

Özet

Amaç: Studer ortotopik ileal neobladder uygulanan hastalarda, ürodinamik ve fonksiyonel sonuçlar ile vücut kitle indeksinin (VKİ) miksiyon parametreleri üzerine etkisini değerlendirmeyi amaçladık.

Gereç ve yöntem: 2000-2008 yılları arasında radikal sistoprostatektomi sonrası Studer ortotopik ileal neobladder konstrüksiyonu uygulanmış 61 hastadan, lokal nüks ve uzak metastazı olmayan ve düzenli takipte kalan 18 hasta nebladerın fonksiyonel ve ürodinamik olarak değerlendirilmesi için çalışmaya dahil edilmiştir.

Bulgular: Maksimum pouch kapasitesi, komplians, maksimum akım hızı, rezidüel idrar miktarı sırasıyla 320.5 ± 64.8 mL, 35.6 ± 23.3 mL/cmH₂O, 14.1 ± 6.5 mL/dak ve 63.3 ± 40.4 mL olarak saptandı. Gece inkontinans oranı %44.4, gündüz inkontinans oranı ise %16.6 olarak tespit edildi. Gece ve gündüz kontinans arasında ya da mesane pouch kapasitesi ve kompliansı ile VKİ arasında anlamlı bir ilişki saptanmadı. Ancak VKİ yüksek hastalarda stres inkontinans oranının istatistiksel olarak daha yüksek olduğu saptandı ($p=0.04$).

Sonuç: Neobladder stress idrar inkontinansı VKİ'si yüksek hastalarda daha sık görülmesine rağmen, bu hastalarda ortotopik üriner diversiyon ile başarılı fonksiyonel sonuçlar ve kontinans oranları elde edilebilir.

Anahtar sözcükler: İdrar inkontinansı; işeme fonksiyonu; ortotopik ileal neobladder; ürodinamik çalışma; vücut kitle indeksi.

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Radical cystoprostatectomy (RCP) together with pelvic lymph node dissection (PLND) is the only curative therapy for muscle invasive bladder cancer.

[1] Independent of survival, the most important factor that affects the quality of life after RCP is the

type of urinary diversion performed.^[2] Certainly, the ideal urinary diversion for the best quality of life in these patients is orthotopic urinary diversion, which imitates normal vesicle anatomy and physiology more than the other procedures.^[3] In these urinary

diversions, a colonic segment, an ileal segment, or a combination of both segments is constructed in a fashion that will provide a high capacity-low pressure reservoir that is directly anastomosed to the urethra. As the bladder neck no longer exists after RCP, urinary continence in orthotopic substitutions is maintained merely by the urethral rhabdosphincter.^[4,5] Patients void by relaxation of the external sphincter and increasing intraabdominal pressure.^[6] In the presence of normal rhabdosphincteric activity, it is essential to create a high capacity reservoir with low intraluminal pressure in order to maintain day and night continence. By refolding the detubularized intestinal segment, it is possible to create a compliant reservoir that has such specifications with the use of a shorter intestinal segment. Moreover, myogenic activity through the longitudinal intestinal muscle fibers to the circular fibers is not conducted in the detubularized segment; thus, the amplitude of isoperistaltic contractions is lowered. This is especially important for nighttime continence.^[7]

Many authors have found no significant difference between the surgical techniques employed with regard to functional results and complication rates.^[4] The ultimate goal is to preserve renal function, decrease post void residual urine volume and provide day and night continence by antirefluxive mechanisms and low intraluminal pressure.

Obesity is a well-known risk factor for development of hypertension, coronary artery disease, and diabetes. The perioperative morbidity and mortality in patients undergoing surgery is greater among obese patients. Obesity can cause a variety of problems both for the surgeon and patient, including surgical difficulties, prolonged operation time, infection, hernias and voiding difficulties. Many studies have examined the impact of obesity in patients undergoing radical cystectomy. A few studies focused on the impact of body mass index (BMI) on orthotopic neobladder and their micturition parameters.

We assessed functional aspects and urodynamic results of patients with a Studer type of ileal neobladder together with the influence of BMI on voiding patterns.

Materials and methods

Between 1995 and 2008, we performed 206 RCPs in patients with muscle invasive bladder cancer. From 2000 to 2008, 61 patients, aged between 45 and 74, underwent a Studer type orthotopic ileal neobladder

construction following RCP and bilateral PLND. Out of these, 18 male patients with regular follow-up and without local recurrence or distant metastases were enrolled in the study to evaluate the functional results and urodynamic characteristics of the neobladder. Patients with a follow-up period over 1 year (range 12-60 months) were evaluated.

Following RCP and bilateral PLND, an ileal segment of 45 cm in length was dissected with care taken not to injure its mesentery 15 cm proximal of the ileocecal valve. The remaining proximal and distal ileal segments were anastomosed with a running suture of 3/0 polyglactin. The proximal end of the resected ileal segments where the ureters were anastomosed over 2 single j catheters using the Wallace technique was closed to form the tubular afferent segment with a length of 15 cm. The distal portion was detubularized on its antimesenteric border and further over folded with 3/0 polyglactin sutures to form a spherical reservoir. Urethral anastomosis at the most dependent part of the neobladder was performed over a 20 ch urethral catheter. The ureteral catheters were removed on the 12th postoperative day. On the 21st postoperative day, a cystogram was performed to assess urine extravasation, and the urethral catheter was removed afterwards.

Urodynamic evaluations were performed at least 12 months after orthotopic neobladder substitution (range 12-60 months). Prior to urodynamic evaluation, each patient was assessed with a voiding diary, and any urinary tract infection was treated with proper antibiotics. Initially, free uroflowmetry was performed, maximum flow rate (Q max) values were recorded, and residual urine volumes were calculated in each patient. With the patient in the supine position, an 8 Fr dual lumen cystometry catheter was introduced into the neobladder, and an 8 Fr rectal catheter was used to measure intraabdominal pressures. EMG electrodes were attached on the perineum to record pelvic floor activity. At room temperature (20°C), isotonic fluid was administered through the urethral dual lumen catheter at a rate of 50 mL/min until either the patient felt overfilled or incontinence occurred or a maximum volume of 500 mL was reached. Maximum capacity of the neobladder and the volume where the first sense was perceived (initial awareness of filling) were recorded, and compliance of the neobladder was calculated. Neobladder sensations during filling reported by the patients were marked. While the pouch was moderately full, patients were asked to

perform Valsalva maneuvers (coughing or abdominal pushing) to check for stress incontinence. Then, the patients were asked to void in the sitting position, and the maximal pressures in the neobladder and voided volume were recorded.

BMI was calculated as the weight divided by the height (kg/m^2). The patients were categorized according to BMI: group 1, BMI less than 25 kg/m^2 ; group 2, BMI 25 to 29.9 kg/m^2 ; and group 3, BMI greater than 30 kg/m^2 , according to the standard described by the World Health Organization.

For statistical analyses, Chi-Square and Mann-Whitney tests were used to compare non-parametric and parametric variables, respectively. When groups of more than two were compared, Kruskal-Wallis variant analysis was performed. All statistical analyses were performed with SPSS 13.0 software package, and a value of $p < 0.05$ was considered statistically significant.

Results

All patients were able to void in the sitting position during free uroflowmetry. Mean Q max was $14.1 \pm 6.5 \text{ mL/sec}$ (range 5-28 mL/sec), and mean residual urine volume was $63.3 \pm 40.4 \text{ mL}$ (range 10-140 mL). In only 4 patients was the residual urine over 100 mL. However, no patient required continuous catheterization.

Maximum cystometric capacity was between 207 mL and 420 mL (mean $320.5 \pm 64.8 \text{ mL}$). Rhythmic intestinal contractions were observed during the filling phase in each patient. First sensation occurred at 90-312 mL (mean $170.3 \pm 50.8 \text{ mL}$). Compliance of the neobladder was calculated as $35.6 \pm 23.3 \text{ mL/cmH}_2\text{O}$ (range 4-85 mL/cmH₂O). Maximum intraluminal pressure of the neobladder was between 59-178 cmH₂O (mean $113.0 \pm 31.6 \text{ cmH}_2\text{O}$).

Ten out of 18 patients in this study were daytime and nighttime continent (maximum 1 pad); five were incontinent during the night, and three patients had diurnal incontinence. The nighttime incontinence rate was 44.4%, and the daytime incontinence rate was 16.6%. Maximum neobladder capacity in eight patients who were nighttime incontinent was between 207 mL and 420 mL (mean $299.3 \pm 73.1 \text{ mL}$), which was not different than the cystometric capacity of the continent patients ($p > 0.05$) (Tablo 1).

BMI values in these patients were between 19 kg/m^2 and 35 kg/m^2 (mean $27 \pm 3.98 \text{ kg/m}^2$). There was no

significant correlation between the daytime and nighttime continence rates or between the capacity and compliance of the neobladder and BMI. In contrast, urinary stress incontinence rates were statistically higher in patients with high BMI values ($p = 0.04$) (Tablo 2).

Discussion

RCP and bilateral PLND constitute the keystone treatment modality in muscle invasive bladder cancer. The most significant factor affecting quality of life after RCP is the type of urinary diversion. Every patient with proper mental health and normal hepatic-renal functions, showing no urethral involvement with bladder malignancy and no history of malignant urethral stricture and having a competent external sphincter function, is a potential candidate for orthotopic urinary diversion.^[8] Various studies have shown that each reservoir that is created with different intestinal segments can reach an adequate capacity over a period of 6 to 12 months.^[2,6,9-12] In different series, Skolarikos et al.^[11] and Laguna et al.^[12] were not able to demonstrate a significant difference between capacity and continence rates in their 6-9-month and 5-year functional evaluations. In addition, a study by Şenkul et al.^[10] did not find significant differences between 6-month and 2-year neobladder capacity of sigmoid and ileal neobladders. Skolarikos et al.^[11] found a cystometric capacity of 391 mL at 6 months, whereas Laguna et al.^[12] reported stabilization of cystometric capacity (300 mL) at 3 months. We did not evaluate cystometric capacity in our patients a second time, but we observed a sufficient capacity after 12 months. Urinary incontinence and retention are the most encountered long-term complications in orthotopic urinary diversion. In large series, daytime continence rates vary between 80% and 100%, whereas nighttime continence rates are reported to be between 50% and 93%.^[13-16]

It is possible to provide a higher capacity by using longer intestinal segments for bladder substitution; however, as continence rates increase with higher capacity values, voiding dysfunction rates also rise.^[17,18] The rate of metabolic disorders that may be life threatening also goes up when longer intestinal segments are used.^[1] Independent of the length of the intestinal segment, the surgical technique may also affect the maximum capacity of the neobladder. W-shaped pouches have the largest capacity and highest continence rates when compared to other techniques. It has been stated that W-shaped pouches

Table 1. Basic demographic and clinical characteristics of patients according to continence status (mean±SD)

	Total continent (n=10)	Daytime continent (n=5)	Total incontinent (n=3)	p value
Age (years)	61.7±7.9	58.4±8.0	64.0±9.5	>0.05
Mean BMI (kg/m ²)	27.6±2.6	28.2±6.1	23.0±1.0	>0.05
Maximum pouch capacity (mL)	342.4±54.8	294.2±78.9	308.0±78.1	>0.05
Compliance (mL/cmH ₂ O)	39.0±23.0	29.6±20.9	21.3±16.5	>0.05

BMI: Body mass index.

Table 2. Patients' urodynamic results according to body mass index (mean±SD)

	BMI <25 kg/m ² (n=6)	BMI 25-30 kg/m ² (n=7)	BMI >30 kg/m ² (n=5)	p value
Maximum voiding pressure (cmH ₂ O)	113.6±21.6	112.5±35.6	114.2±41.8	>0.05
Q max (mL/sec)	13.5±5.9	15.8±7.9	12.4±5.8	>0.05
Residual urine volume (mL)	53.3±37.7	54.3±32.1	88.0±50.0	>0.05

BMI: Body mass index.

could reach a capacity of 1,240 mL, a 93% continence rate and a 4-33% rate of need for clean intermittent catheterization (CIC).^[1,3,13,18]

In our patients, we used a maximum length ileal segment of 45 cm, and the continence rates for day and night were 83.6% and 55.6%, respectively. None of the patients required CIC. Though our continence rates are similar to those reported in the literature, the fact that we did not encounter chronic urine retention and the need for CIC in our patients may be attributed to the presence of peristaltic contractions in the non-detubularized ileal segment and the relatively small capacity of the neobladder, which was less prone to kinking.^[1,2] Catheterization seems to be noninvasive; however, pouch perforations and fistula formation due to catheterization have been reported in the literature.^[19,20] In order to avoid these serious complications, a system that will not necessitate catheterization must be created. Although voiding dysfunction is less frequently encountered, nighttime incontinence is more frequent in pouches where non-detubularized segments are used. Peristaltic contractions, originating from this segment, together with diminished external sphincter tonus during the night, play a major role in nighttime incontinence. Thus, nighttime incontinence rates are reported in a wide range between 0% and 67%.^[4,13,21]

Obesity is a growing, serious concern worldwide. Although there are many reports showing a relationship between obesity and the rising incidence of

malignancies, no such connection has been established with bladder cancer. It has been stated that perioperative risks and complications following RCP increase with an increase in BMI.^[22] All patients with orthotopic neobladders void by increasing intraabdominal pressure and relaxation of pelvic floor muscles. There is little knowledge in the literature concerning the effect of obesity on Valsalva maneuvers and voiding functions. In a series of 116 patients with orthotopic neobladder, Reyes et al.^[23] reported an increase in the rates of urinary tract infections and pyelonephritis; however, they did not demonstrate a significant difference in continence rates and voiding functions. We categorized our patients into three groups with regard to BMI values; none of the patients had morbid obesity. No significant difference was seen between day and nighttime continence rates, intraneobladder pressures and maximum flow rates. Obesity does not impair voiding functions; however, stress urinary incontinence is more frequently encountered in the group of patients with BMI >35 kg/m² (p=0.04). This finding is not unique to the orthotopic substitutes; stress urinary incontinence rates also increase with obesity in the healthy population. Intraabdominal pressure values during rest are also higher in people with high BMI values. As a consequence, Valsalva maneuvers such as coughing and sneezing further increase intraabdominal pressure, which easily exceeds intraurethral pressure, thereby causing stress urinary incontinence.^[24]

Our study has some limitations. First, our sample size is small. There have been several studies about this topic in the literature, but few focus on BMI. The difference in our study is the investigation of voiding pattern according to BMI. Additionally, we did not evaluate the correlation between patient age and stress urinary incontinence. We know that stress urinary incontinence incidence rises with age, and this may be taken into account in future studies.

As a conclusion, despite the more frequent occurrence of stress urinary incontinence, orthotopic urinary diversions with successful functional outcomes and continence rates can be achieved in patients with high BMI values. Studer ileal neobladders offer a reliable and acceptable voiding pattern, and quality of life for patients undergoing radical cystectomy.

Conflict of interest

No conflict of interest was declared by the authors.

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