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Original Research Article

Long-term outcomes of sigmoid neobladder after radical cystectomy in Indian population: a single centre experience

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ABSTRACT

Background: Radical cystectomy with orthotopic neobladder is the standard of care for MIBC. Long-term data on sigmoid neobladder is limited. Sigmoid neobladder offers the advantage of low long-term metabolic and nutritional complications, due to sparing of ileum and ileo-caecal valve. We present our experience and long-term results of orthotopic sigmoid neobladder reconstruction after radical cystectomy.
Methods: The study included 57 male patients who underwent radical cystectomy and orthotopic sigmoid neobladder for muscle-invasive carcinoma of bladder from January 2002 to December 2019. Data was collected with regards to complication rate, voiding patterns, continence status, recurrence-free and overall survival.
Results: Mean age was 52.7 years (range 35 to 74). Median duration of follow-up was 62 months. There were 3 (5.3%) perioperative deaths. 15 patients (26.3%) developed early and 5 patients (8.7%) developed delayed complications. Node positive disease (N+) was found in 11 (19.3%) patients and 17 (29.8%) required adjuvant chemotherapy. 94.7% patients were continent and 42 (82.4%) patients had spontaneous voiding pattern. Daytime and nocturnal incontinence rate were 5.3% and 24.6%, respectively. Clean intermittent catheterization (CIC) was required in 8 (14.1%) cases. The recurrence-free survival (RFS) and overall survival (OS) were 57% and 50% at 5 years and 62.5% and 35.8% at 10 years, respectively.
Conclusions: Sigmoid neobladder remains a viable form of orthotopic urinary diversion and provides satisfactory long-term continence and voiding results with acceptable rate of complications. Good long-term results in sigmoid neobladder in Indian population may be due to long sigmoid colons in Indian patients with low incidence of diverticulosis.

Keywords: Overall survival, Radical cystectomy, Sigmoid neobladder

INTRODUCTION

Bladder cancer is the fourth most common cancer in men and the ninth most common cancer in women and prevalent worldwide.[1] While superficial bladder cancer can be treated effectively by transurethral resection or intravesical agents, standard treatment for muscle invasive disease is radical cystectomy and urinary diversion. Among various types of diversion, orthotopic diversion is currently considered as the gold standard because, most patients undergoing orthotopic diversion are continent, retain a normal voiding pattern, avoid the need for a cutaneous stoma or external urostomy appliance, and have better lifestyle and self-image. For the ideal bladder substitute, all parts of the bowel have been described in the literature, each having its own benefits and limitations. As long as principles of preservation of continence mechanism and construction of an adequate capacity and low pressure spherical reservoir are maintained, functional and clinical outcomes are excellent with any segment of bowel used. Detubularized ileum, right colon and sigmoid are most commonly used to reconstruct neobladders. Among them, sigmoid neobladder theoretically offers the advantage of

low long-term metabolic and nutritional complications, due to sparing of ileum and ileo-caecal valve. The use of sigmoid in construction of orthotopic substitute was initially described by Reddy and Lange in 1987.[2] Thereafter, various studies regarding modification of the technique, feasibility, complications and outcomes of sigmoid neobladder have been published. However, extensive long-term data on sigmoid neobladder is limited. In this study, we present our 15-year experience and outcomes of sigmoid neobladder, carried out in our institution.

Aim and objectives

To evaluate the long-term oncological and functional outcomes of sigmoid neobladder creation in patients undergoing radical cystectomy.

METHODS

After getting Institute's Ethical Committee approval, a retrospective study was carried out. Hospital records were retrieved of all patients who underwent radical cystectomy and sigmoid neobladder at our Institution from January 1992 to June 2008 for muscle invasive transitional cell carcinoma (TCC) of bladder were eligible for the study.

Inclusion criteria

Inclusion criteria for constructing sigmoid neobladder were; patients with a good performance status, negative transurethral (TUR) prostate biopsy prior to cystectomy, adequate length of sigmoid colon with a mesocolon, and well-motivated willing to use clean intermittent self-catheterization (CISC).

Exclusion criteria

Presence of locally advanced or distant metastasis, evidence of bladder neck or urethral involvement, females and in patients with pre-existing bowel pathology.

Radical cystectomies were carried out either by open, laparoscopic or robotic manner according to surgeon's choice and stage of the disease. Intraoperatively, the decision to create sigmoid neobladder over other forms of neobladder was based upon- surgeon's preference, patient's body habitus and gross morphology of small and large bowel. A 30-35 cm segment of sigmoid colon with a good blood supply and a long mesocolon was isolated and arranged in a U shaped configuration. The continuity of the colon was restored and the isolated segment completely detubularized and the neobladder was formed using the technique of Reddy et al.[2]

Ureteral reimplantation was performed in a tunnel antireflux fashion in most cases. Complications, if any were divided as: perioperative (within 30 days of surgery), early (within 3 months of surgery) and delayed (after 3 months of surgery). Postoperatively, as soon as patients recovered voiding function after removal of catheters, they were advised about regular timed voiding, Kegel exercises and daily morning saline irrigation/CISC to eliminate mucous for initial 2-3 months. Sodium bicarbonate powder or tablets were prescribed to prevent metabolic acidosis and to dissolve the mucous.

Patients were then advised for regular follow up at our specialized urocancer clinic. The follow-up included a detailed history, physical examination, complete blood count, kidney and liver function tests, venous blood gas analysis, urine examinations three monthly for first 2 years, every 6 monthly for next 3 years and annually thereafter. Routine ultrasonography was done initially 6 monthly for 2 years, then annually. IVU or CECT advised annually for 2 years and then once in 3 years. During each visit, patients were questioned regarding voiding pattern, continence status. Voiding pattern was determined by a detailed patient interview and classified into three categories: voiding with no assistance (spontaneous voiding), voiding with clean intermittent self-catheterization (CISC) assistance, CISC alone and/or indwelling catheterization. CISC was recommended when the post void residual urine volumes persistently exceeded 150 ml. Continence status was measured by recording daytime and nighttime continence, intervals between voiding, spontaneous leakage of urine or leakage while coughing, urgency and number of pads used. According to international continence society, patients with daytime continence were classified into 3 categories; a) continent i.e. completely dry without need for protection b) socially continent i.e. not more than 1 pad per day, damp once or twice a week c) incontinent i.e. more than 1 pad per day, wet or soaked.[3] Urodynamic evaluations were done at least 6 months, post-operatively and repeated as indicated. Parameters assessed were: peak and mean flow rate, compliance, maximum neobladder capacity, filling and voiding intra-reservoir pressure and uninhibited contractions, if any. The post-void residual urine volume was measured by using ultrasonography. Recurrence-free survival (RFS) was calculated from the time of cystectomy to date of first documented clinical recurrence or until last follow up if patient has not developed recurrence. Overall survival (OAS) was calculated from time of cystectomy to date of death. All deaths were counted as events. Patients who were alive at the time of last contact or lost to follow-up were censored.

Statistical analysis

Differences in the distribution of continuous variables were calculated by using student's t test and analysis of variance. Differences in distribution of categorical variables were calculated using chi-square test. Survival rates were calculated with Kaplan-Meier method and log rank test. P value <0.05 was considered significant. All statistical analyses were done by using Strata software.

RESULTS

Patient characteristics

A total of 57 patients were included in the study. Mean patient age was 52.7 years (range 25 to 74). Radical cystectomy was carried out by open, laparoscopic and robotic manner in 44, 11 and 2 cases respectively. Sigmoid neobladder was created extracorporeally in patients undergoing laparoscopic or robotic radical cystectomy.

Procedure time and blood loss

The mean operative time for cystectomy and reconstruction with the sigmoid neobladder was 325 (245-654) minutes. The average blood loss was 1120 (965-1630) ml.

Mortality and morbidity

Various complications noted in our patients are shown in Table 1. No intraoperative deaths were encountered. Perioperative deaths (i.e. death within 30 days of surgery) occurred in 3 out of 57(5.3%) patients. The causes of death include; peritonitis and fecal fistula- 1, deep venous thrombosis and pulmonary embolism- 1, acute respiratory distress syndrome (ARDS)- 1. Early complications (i.e. within 3 months of surgery) occurred in 15 (26.3%) patients. Most of the early complications were minor and managed conservatively. These included mild chest infection- 7, paralytic ileus- 5, wound dehiscence- 2, anastomotic leak- 1. Delayed complications (i.e. after 3 months of surgery) were noted in 5 (8.7%) patients. These were either diversion related (n=3) or diversion unrelated (n=2). No nutritional related complications related to the use of sigmoid neobladder were noted in our patients. No patient required vitamin B_{12} and or folic acid supplementation. None of the patients developed adenocarcinoma of the reservoir. We encountered a rare complication of spontaneous perforation of neobladder in a 50 year old patient. He was successfully managed with bladder and peritoneal drainage.

Table 1: Patient characteristics.

Total number of patients	N=57
Mean age of patients (years)	52.7 (25-74)
BMI (kg/m^2)	26.1 (24.2-30.4)
Associated co-morbidity	21 (36.8%)
Radical cystectomy	
Open	44
Laparoscopic	11
Robotic	2

Pathologic outcomes

Node-negative organ confined (T2) disease was found in 32 (56.1%) patients, node-negative extravesical disease (T3) in 23 (40.3%) and node-positive tumors were noted in 11 (19.3%) patients. 17 patients (29.8%) received adjuvant chemotherapy.

Voiding and continence status

Results are shown in Table 2. In our series, spontaneous voiding pattern without SCIC assistance was noted in 47 (82.4%) patients, while 8 (14.1%) patients' required once or twice daily SCIC. 2 patients could not void spontaneously at all and remained on SCIC only. Regarding daytime continence, 45 (78.9%) patients were completely continent, 9 (15.8%) were socially continent and 3 (5.3%) patients were incontinent. Nighttime continence achieved in 43 (75.4%) patients and 14 (24.6%) had nocturnal incontinence.

Table 2: Continence and voiding status.

Characteristics		N=57 (%)
Continence status		
Daytime	Continent	45 (78.9)
	Socially continent	9 (15.8)
	Incontinent	3 (5.3)
Night time	Continent	43 (75.4)
	Incontinent	14 (24.6)
Voiding pattern		
Volitional voiding		47 (82.4)
Volitional voiding + CIC		8 (14.1)
CIC only		2 (3.5)

Urodynamic findings

The mean peak and average flow rate were 14.4 and 7.6 ml/sec, respectively. The mean post-void residual volume was 34 (0-270) ml. The maximum neobladder capacity ranged from 270 to 620 with a mean of 316 ml. Pressure flow study revealed mean filling and voiding intra-reservoir pressure of 9.7 (7-17) and 32.7 (12-68) cm H_2O respectively. The mean reservoir compliance was 24.7 (8-49) ml/cm H_2O (Figure 2).

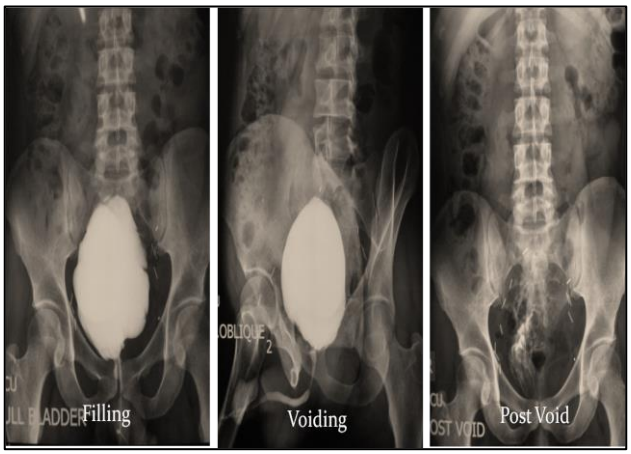

Figure 1: Voiding cystouretrogram of neobladder.

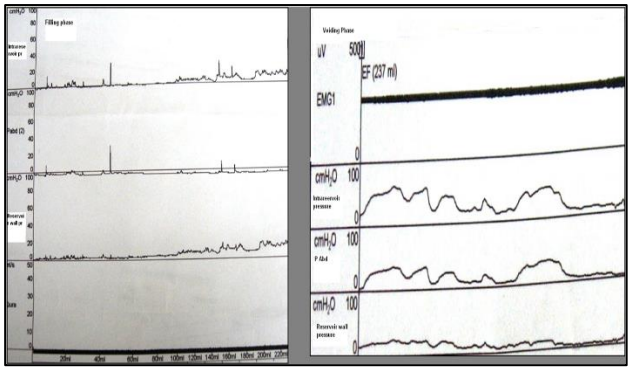

Figure 2: Pressure flow study of neobladder.

Recurrence and survival

Mean duration of follow-up was 62 months (range= 8-150 months). A total of 9 patients developed recurrence, out of which 4 patients developed local and 5 patients developed distant recurrences. Urethral recurrence near anastomotic site occurred in a patient at 1 year postoperatively. Most of the recurrences (90%) occurred within 60 months of surgery. The median time to local and distant recurrences was 14 and 22 months. RFS at 5 years and 10 years were 57% and 50% (Figure 3), whereas OAS at 5 years and at 10 years were 62.5% and 35.8%, respectively (Figure 4).

Table 3: Complications.

Characteristics	N=57 (%)
Perioperative deaths (within 30 days)	3 (5.3)
Early complications (<3 months)	15 (26.3)
Wound dehiscence	3
Paralytic ileus	5
Mild Chest infection	7
Delayed complication (>3 months)	5 (8.7)
Adhesive intestinal obstruction	2
Urolithiasis	1
Spontaneous perforation	1
Renal failure	1

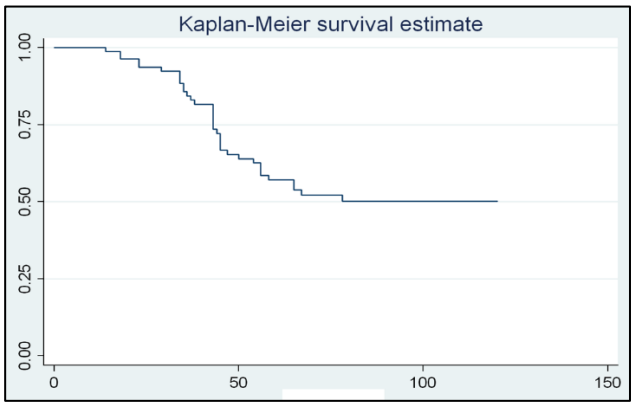

Figure 3: Recurrence-free survival.

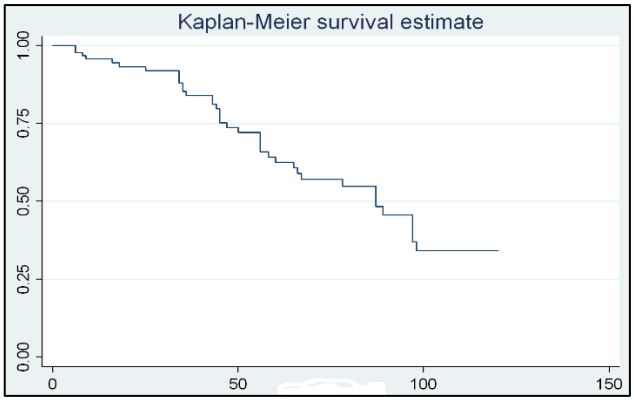

Figure 4: Overall survival.

DISCUSSION

The orthotopic neobladder after radical cystectomy represents the urinary diversion of choice in appropriately selected patients. All forms of orthotopic diversion have the same goals: normal voiding through the urethra, low-pressure storage of urine, preservation of renal function and acceptable urinary continence. The sigmoid colon as a continent voiding pouch offers some potential advantages. These include, embryologically, both bladder and sigmoid colon derive common innervations. The sacral parasympathetic nerves originating from the S_2 to S_4 segments of the spinal cord pass through the pelvic nerves and supply the bladder and the distal half of the large intestine particularly, sigmoid and rectal regions. Fujisawa et al reported that patients with sigmoid neobladder often have the sensation of bladder fullness as before the operation.[4] Koraitim et al concluded that neobladders constructed from the sigmoid colon are richly supplied by parasympathetic nerves and they can produce strong contraction.[5] He also reported that contraction of the sigmoid neobladder wall contributed 80% of intrareservoir pressure, significantly more than with ileocecal or ileal neobladders. According to this view, a sigmoid neobladder theoretically could be emptied with minimal straining. In addition, because of its location in the pelvis, it can be easily brought down to the membranous urethral region for urethrointestinal anastomosis. Also, ureteral implantation into tenia of colon is reliable and carries minimal complications. Furthermore, this bowel segment is expendable with little, if any impact on the nutritional status or bowel habits of the patient. There are some concerns regarding the use of sigmoid colon. These include, sigmoid colon is often affected by diverticulosis and/or malignancy and might not be a suitable bowel segment for long-term urinary diversion. But for Indian population where incidence of diverticulosis is low because of the habit of high fiber diet and relatively long sigmoid colon, creation of sigmoid neobladder may be relatively safe and viable option.

We encountered a slightly higher mortality rate (5.3%) compared to the published literature of 1-3%. This may

be due to associated co-morbidity, excess blood loss and advanced stage of the disease. Perioperative mortality rate of sigmoid neobladder was similar to patients who underwent ileal conduit (5.8%) or other continent diversions (6.1%) during the same period. Both early (26.3%) and delayed complications (8.7%) rate are comparable to other series.[6]

We preferred to do complete detubularization of the sigmoid colon, as it decreases the spontaneous contractions, thereby minimizing the incontinence episodes. In addition, detubularization allows a good mucosa-to-mucosa anastomosis of urethra and gut segment under vision. Narrowing of the uretero-intestinal anastomosis is a common delayed complication with a reported incidence of 6.3% in the literature.[7] We did not encounter any case of uretero-intestinal anastomotic stricture in our series. We believe that this complication can be avoided to a certain extent by preserving the blood supply to the ureteric ends and by doing a wide anastomosis. Electrolyte imbalance following orthotopic urinary diversion depends on the site of the bowel, the length used and the duration of contact between urine and bowel segment. When sigmoid colon is used for urinary diversion, there is a chance of hypokalaemic hyperchloraemic acidosis. With persistent acidosis, the excess protons are buffered by the bone, with release of bone calcium, which in turn is excreted by the kidney and is responsible for osteomalacia or renal rickets, growth retardation and urolithiasis. These can be reduced by avoiding the creation of an oversized neobladder, by frequent voiding, and using CISC. Whenever needed, alkalinizing agents such as oral sodium citrate or bicarbonate, and a chloride uptake inhibitor such as chlorpromazine and nicotinic acid, can be used.

Urinary continence after neobladder construction depends on creating an adequate storage system and preserving the sphincter mechanism. Overall daytime continence rates after sigmoid bladder substitution have been reported to be between 77% and 100% in the literature.[2,8-10] In the present study, the overall daytime continence rate was 78.9%, within acceptable limits. Night time incontinence is a common problem following neobladder procedures. The reasons for this phenomenon are not well known although contributing factors undoubtedly include including loss of the vesicourethral reflex, which normally permits an increase in urethral sphincter tone as the bladder distends, decreased muscle tone and urethral closure pressure during sleep, high amplitude involuntary contractions of the reservoir, decreased sensitivity of the membranous urethra after radical cystectomy, the shift of free water from the reservoir into concentrated urine to obtain isoosmotality and decreased vigilance of the patient during sleep.[11,12] Nocturnal incontinence episodes can be reduced by frequent voiding, CIC before going to sleep. The rate of CIC in this study was low 8 (14.1%), but comparable with other studies.[13,14] In this study, urodynamic parameters were favorable in most patients. Maximum neobladder capacity, filling and voiding pressure and flow rates remained remarkably uniform throughout follow-up.

The long term consequences of sigmoid neobladder are rare, but known. These include upper tract deterioration, hyperchloremic metabolic acidosis, renal failure, adenocarcinoma of reservoir, urethral tumor recurrence at anastomotic site, spontaneous perforation of neobladder. To prevent these, patients with sigmoid neobladder require long term careful follow-up. Currently, we recommend orthotopic neobladder reconstruction for patients satisfying the following criteria: those with muscle-invasive bladder cancer with no medical contraindications, those willing to comply with voiding re-education and follow-up, with no clinico-radiological evidence of spread to adjacent organs, no regional lymphadenopathy, no metastasis, negative pelvic lymph nodes on preoperative imaging and negative transurethral prostatic biopsy.

Limitations

Limitations of our study are: retrospective in nature, small sample size, no comparisons were made with other forms of orthotopic diversion and procedures were performed by multiple surgeons, hence results may vary.

CONCLUSION

Orthotopic neobladder substitution has emerged as the procedure of choice after radical cystectomy in properly selected patients. Sigmoid neobladder remains a viable form of orthotopic urinary diversion and provides satisfactory long-term continence and voiding results with acceptable rate of complications. Good long-term results in sigmoid neobladder in Indian population may be due to long sigmoid colons in Indian patients with low incidence of diverticulosis. However, each reconstructive method is associated with specific problems and complications. The surgeon should be technically familiar with more than one procedure (to avoid undue reliance on any one) and customize the operation for each patient and disease.

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