Original Article

Study of modified technique of ileal neobladder-Frog neobladder

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Abstract

Purpose: Orthotopic neobladder is a well-established technique for continent urinary diversion after radical cystectomy. In this study, we evaluated a new Frog ileal neobladder technique. Since the reconstructed neobladder appears like a frog, the name Frog Neobladder was given to it. We have used two isoperistaltic ileal segments and implanted ureters in the nondetubularized proximal end of the ileal segment.

Subjects and Methods: This was a prospective, single-center (tertiary care hospital) study conducted from February 2008 to January 2018. Study patients were aged 39–94 years with biopsy-proven muscle-invasive localized bladder carcinoma. One hundred and twenty patients were included in the study, who had undergone Radical Cystectomy and were offered "FROG BLADDER"– a type of neobladder. Evaluation of complications, renal function, urodynamic parameters, post-void residual urine (PVR), continence, and need for clean intermittent catheterization was done in all patients with neobladder.

Results: A total of 120 patients were included in the study, the average age of the patients was 62 years. The operative mean time was 280 ± 29.8 min. There was no perioperative death, and perioperative or early and late complication rates were 31.2% and 18.7%, respectively. Six patients had uretero-enteric anastomosis stricture, of which two were managed by retrograde ureteroscopic dilatation, another three strictures were treated with antegrade approach, and one patient underwent open surgery. All patients were able to void urine, except for three patients who required self-catheterization. The mean capacity was increased to average of 398 ± 220 ml at 12 months in all patients. The mean PVR at 1 year was 46 ± 54.4 ml.

Conclusion: The Frog neobladder has similar outcome similar to other neobladder technique, with added advantage of ability to accommodate shorter ureteric length and the ease of accessing ureter by retrograde approach for intervention.

Keywords: Carcinoma bladder, FROG neobladder, neobladder, orthotopic

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Received: 03.09.2019, **Accepted:** 20.04.2020, **Published:** 19.01.2021.

INTRODUCTION

Bladder cancer (BC) is the 11th most common cancer worldwide. After prostate cancer, it is the second most common urologic malignancy worldwide.[1] Over the past century, there has been an evolution of methods for lower urinary tract reconstruction following cystectomy, from being simple means of diverting urine to techniques allowing normal voiding pattern through the intact native urethra. These innovations in urinary diversions should

Access this article online	
Quick Response Code:	Website: www.urologyannals.com
	DOI: 10.4103/UA.UA_119_19

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How to cite this article: Shimpi RK, Patel DN, Raval K, Shah P, Shah B. Study of modified technique of ileal neobladder-Frog neobladder. Urol Ann 2021;13:19-23.

allow patients to lead a near-normal lifestyle, eliminating the need for a urostomy, passing urine from the native urethra and remain continent in the day and night. Various methods for continent urinary diversion has been developed to provide such realistic options.

In the mid-1980s, orthotopic neobladders were first used in patients, and due to the excellent functional and clinical results and positive experiences, the interest in neobladder formation increased.

We report a new type of bladder, "The FROG Bladder" – A modified neobladder with isoperistaltic chimney configuration which, resembles a frog in its appearance. It satisfies the principles of continent urinary diversion, such as reservoir of satisfactory capacity, low pressure, minimal postvoid residue (PVR), and minimal surface exposure to avoid metabolic disorders with sufficient length of the ileum for tension-free uretero-ileal anastomosis without reflux, with minimal intraoperative and postoperative complications after radical cystectomy. We have studied this newer ileal neobladder technique on the pig model, and results were satisfactory on animal models.

SUBJECTS AND METHODS

This was a prospective, single-center (tertiary care hospital) study conducted from February 2008 to January 2018. Study patients were aged 39–94 years with biopsy-proven muscle-invasive localized bladder carcinoma. One hundred and twenty patients were included in the study, who had undergone radical cystectomy and offered "FROG BLADDER"– a type of neobladder.

The study protocol was reviewed and approved by the institutional ethics committee and the scientific committee of our institute. The study was conducted in accordance with the International Conference on Harmonisation Good Clinical Practice, and ethical principles that have their origin in the Declaration of Helsinki. Each study participants was provided with the written informed consent before any study-related procedure.

In this study, all neobladder reconstructions were performed by one surgeon with our modification of the "FROG BLADDER" technique. The protocol for preoperative investigations consisted of routine blood investigations, urine examinations, urine cytology chest X-rays, ultrasonography of abdomen, computed tomography (CT) scan abdomen and pelvis, cystoscopy, and bladder tumour muscle deep biopsy to diagnose muscle-invasive bladder cancer(BC). Preoperative biopsy from the prostatic urethra in males and bladder neck in females was also carried out at the same time.

Surgical technique

Radical cystoprostatectomy in male patients and radical cystoprostatectomy with hysterectomy and salpingo-oophorectomy in females, with bilateral pelvic lymphadenectomy was done in standard fashion.

Salient features

The salient features of these bladders include two segments of the ileum of 30 cm each were used. Both segments were placed in isoperistaltic manner side by side, and 5-10 cm of the proximal part of both the ileal segment was not detubularized (depending on the remaining length of the ureter on that side), only distal 25-20 cm was detubularized. Both the segments were anastomosed side by side in such a way that these two non-detubularized segments were in isoperistaltic fashion, which was used for tension-free uretero-ileal anastomosis, stented with 8Fr Ryle's tube [Figure 1]. The distal end of both the segments was detubularized at the anti-mesenteric border and a pouch was created and used for urethra-neobladder anastomosis [Figure 2]. We were able to manage even the shorter length of the ureters by keeping the proximal end of the ileal segment longer as required.

All patients were followed up at 3, 6 months and 1 year, and thereafter yearly, by clinical history, physical examination, blood investigations (hemogram, renal function, serum electrolytes, and arterial blood gas analysis), urine analysis, urine culture, and sensitivity, urine cytology, abdominal ultrasonography, CT abdomen and pelvis, urodynamic study, cystoscopy, and urethral washing, and in selected cases DTPA renogram.

Evaluation of complications, such as renal function, urodynamic parameters (maximum neobladder capacity, pressure at maximum capacity, maximum flow rate, PVR, continence, and clean intermittent catheterization (CISC) need, was done in all patients with neobladder. Complications were recorded as early complications (within 3 months) and late complications (after 3 months).

RESULTS

A total of 120 (102 males and 18 females) patients were included in the study, the average age of the patients was 62 years. The operative mean time was 280 ± 29.8 min. Intraoperatively, there was no problem in placing the neobladder in the pelvis, as well as there was no fear of tension on the suture line of uretero-intestinal anastomosis,

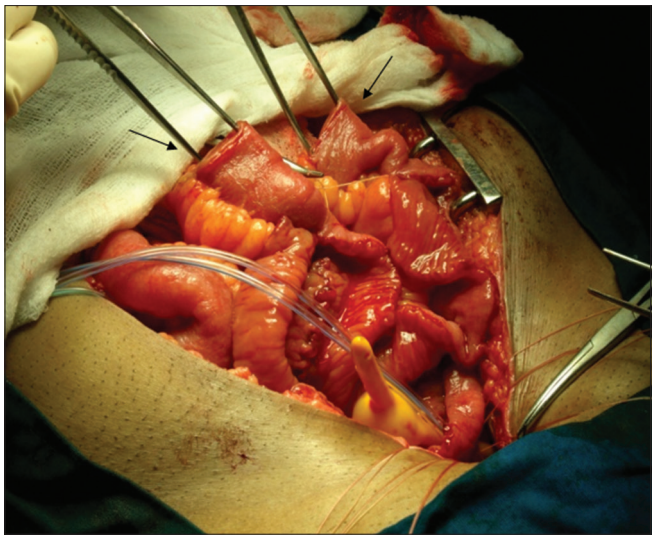

Figure 1: FROG neobladder (arrow showing nondetubularized proximal ileal segment-horn of neobladders, for uretero-ileal anastomosis

as we could adjust the length of the tabularised ileum. There was no perioperative death, and perioperative or early and late complication rates were 31.2% and 18.7%. Paralytic ileus was among the most common early complication which was managed conservatively in all patients. Six patients had uretero-enteric anastomotic stricture between 6 months to 1 year post-operatively, of which two were managed by retrograde ureteroscopic dilatation, another three strictures were treated with antegrade approach and one patient, who had dense stricture, had to undergo open surgery.

All patients were able to void urine, except for three patients who required self-catheterization for a period of 3–6 months. The mean capacity was increased to average of 398 ± 220 ml at 12 months in all patients. PVR at 1 year was 46 ± 54.4 ml. Twenty-four hour voiding frequency at 6 months was 11 times (8–14), whereas at 1 year, it was 7 times (5–10); daytime continence was 76% at 6 months, whereas at 1 year, it was 92%; night time continence at 6 months was 56%, whereas at 1 year that was 82%. Maximum pressure at full capacity was average 13 ± 6.2 mm of H_2O.

Renal functions and metabolic status were comparable before surgery and 1 year after the surgery. Moreover, pyelography revealed normal condition of the upper urinary tract 1 month post-operatively in almost all cases, although at the end of a 1 year follow-up, 20% of patients' renal function deteriorated. Of these, 12.5% (15) of patients had episodes of bacteriuria and pyelonephritis, which were managed with antibiotics. There was no significant demonstrable reflux on Micturating Cystourethrography (MCUG) in whom renal function deteriorated. Twelve patients developed local recurrence, which was treated with chemoradiotherapy [Table 1].

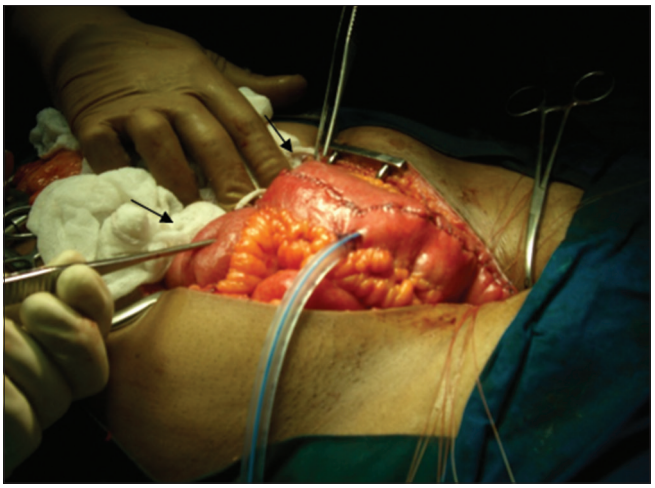

Figure 2: Completed FROG ileal neobladder with supra-pubic catheter (SPC) *in situ* (arrows showing horn of ileal neobladder, which resembles legs of sitting FROG from above

Table 1: Perioperative and follow-up evaluation of different parameters (*n*=120)

Parameter	Results
Age (years), mean	61
Operative time (min)	280±29.8
Complications, *n* (%)	
Early	37 (31.2)
Late	22.4 (18.7)
At 1-year follow-up	
Maximum neobladder capacity (ml)	
6 months	256±167
1 year	398±220
3 years	412±215
Pressure at maximum capacity (cm of H_2O)	13±6.2
Maximum flow rate (ml/s)	14.4±8.7
Postvoid residue (ml)	46±54.4
Continence, *n* (%)	
Daytime	109 (90.1)
Nighttime	105 (87.5)
CISC rate, *n* (%)	3 (2.5)
Urethral/pelvic recurrence, *n* (%)	12 (10)
Creatinine	
Preoperative	0.9±0.24
Postoperative	1.0±0.45

CISC: Clean intermittent catheterization

DISCUSSION

Orthotopic neobladder is a well-established treatment option after radical cystectomy with localized carcinoma of the bladder with advances and refinement of neobladder techniques, patients are able to achieve a very good satisfaction with improved quality of life postcystectomy with orthotopic neobladders. The long-term results are as good as any other urinary diversion, and thus, more and more surgeons are being trained in the operative procedure, making the number of patients getting neobladders increase steadily in the past several years. Newer neobladder techniques are able to achieve anatomical and physiological goals, almost

similar to the native neobladder. Achieving tension-free ureteric anastomosis, location of neo-ureters which can be negotiated by retrograde approaches such as native bladder, non-refluxing anastomosis without significant anastomotic strictures; we have addressed these difficulties in our newer technique by adding an isoperistaltic horn in the neobladders. At the same time, other parameters are not compromised and are at par with other neobladder techniques.

Hollowell first introduced the modification of the Hautmann neobladder with chimney modification for non-refluxing ureteric anastomosis.[2] Refinement was done over time in this technique by various surgeons. Lee *et al.* (2014) compared Hautmann and Studer orthotopic neobladder retrospectively in 130 patients technique (Studer-93 patients and Hautmann 37 patients) and evaluated the clinical parameters, age, gender, procedure time, blood loss, rate of complications, and continence.[3] He found that the mean procedure time was 5.9 h and 5.3 h in Studer and Hautmann technique. The overall complication rate was similar between Studer and Hautmann orthotopic neobladders whether it was early (10% vs. 16%) or late (27% vs. 14%), respectively.

In our study, the mean age was found to be 60 years (range: 54–67 years). All patients performed well even at extremes of ages, showing that the Frog neobladder is a good option, if the patient is well taught and motivated for bladder training in the post-operative period. Motivation is required with active patient participation, to ensure the proper maintenance of the reservoir. Appropriate patient selection is critical to the success of orthotopic diversions. It should not compromise the cancer control of a potentially curative surgery.

In the present study, the overall rate of early and late complications was similar to that of the reported series.[4,5] The majority of uretero-enteric anastomotic strictures occur within the first 1–2 years postoperatively; regardless of the type of ureteric replant. In our study, six patients (5%) had uretero-enteric anastomosis at 6 months to 1 year of follow-up. As implantation of the ureters was done in the horns of the neobladder, an expected location, we were able to locate the ureteric orifices in three patients. Two strictures were managed by retrograde balloon dilatation and stenting in one patient, who had a dense stricture, had to undergo open surgery for reimplantation. The remaining three strictures were managed by antegrade balloon dilatation and stenting. Stricture and obstruction rates was in accordance with the findings of De Carli *et al*.[5]

In the present study, the average maximum bladder capacity at 3 months was 290 ml, which increased to 400 ml at the end of 1 year. The capacity of the neobladder was not compromised despite the less length of ileum being used. This emphasizes that large initial volumes are not necessary to ultimately achieve an adequate voiding volume.

In a study by Lee *et al*., 9.5% and 8.3% of patients with Studer and Hautmann orthotopic neobladder required intermittent catheterization because of the inability to void or maintain a postvoid volume of <100 ml.[6] All our patients were advised timely voiding and not to prolong voiding intervals. All patients, except three, voided well with good flow by Valsalva maneuver and relaxing pelvic floor muscles. The patient determines the time to void by a feeling of lower abdominal fullness or by strictly voiding by the clock every 4–6 h. Hypercontinence was not seen in our study, but in the present study, three patients required Clean Intermittent Self-Catherization (CISC) because of incomplete voiding, and postvoid residual urine volume was ≥100 ml. In some patients, incomplete voiding was associated with an inability to sustain abdominal straining compared to those who emptied completely. The CISC rate in our study was similar to other reported studies.[7]

Night-time incontinence could be because of decreased sphincter muscle tone or abolishment of the normal reflex, and rise in urethral pressure during reservoir filling. Studer et al. observed 92% daytime continence achieved at 1 year and 80% night-time continence after 2 years.[5] Hautmann *et al*. reported a rate of 96% daytime and 95% night-time continence after 57 months of follow-up.[4] In the present study, daytime and night-time incontinence improved with increasing neobladder capacity as described by Hautmann.[8] In our study, 90% of patients were continent in day-time and night-time at 1 year.

Most patients were satisfied simply because they could void naturally and did not require a stoma. Most patients were able to maintain their lifestyle, particularly their daily living activities and occupational status. Similarly, better quality of life with neobladder compared to ileal conduit was reported in different series.[9]

Renal function

Thoeny *et al*. evaluated the upper urinary tracts of patients with Studer neobladder followed for 25 years. De novo shrinkage of the parenchyma was observed in only 1% of preoperatively normal renal units. Stricture of uretero-intestinal anastomosis occurred in 3% of 148 units. In 9%, dilated upper tracts were noted, but without obstruction, confirming that the dilatation is not always due to obstruction.[10]

In the present study, at 3 months, there was no deterioration in renal function as revealed by serum creatinine. The mean creatinine value postoperatively was 1 mg/dl. Twenty-four patients had deterioration of renal function at 1 year, of which, ten patients had episodes of pyelonephritis, metabolic acidosis, and bacteriuria. Those patients also had high pressure at maximum neobladder capacity. On follow-up, six patients had unilateral hydronephrosis due to the stricture of uretero-enteric anastomosis, but in those patients, serum creatinine was normal.

Even in patients with deterioration of the renal function, there was no demonstrable reflux on micturation cysto-urethrogram (MCUG) study. Both the horns of the chimney were fashioned in an isoperistaltic manner, and the use of split-cuff nipple valve helped preventing the reflux, and the incidence of stricture formation is minimal. Although there was mild dilatation of the upper tract ,it was not associated with obstruction, as confirmed with renal function study. Stricture and obstruction rates were in accordance with the findings of De Carli *et al*., who reported that split-cuff nipple ureteral reimplantation has low rates of obstruction (3.1%–7%) and reflux (3.2%–10%).[5]

In patients with Vesico-Ureteric Junction (VUJ) and ureter involvement with tumor, where ureter length was short, we were able to extend the horns of the Frog Neobladder till mid-ureter without any tension on the anastomosis. On follow-up, there was no increase in any anastomotic complications with increase in the length of the chimney.

CONCLUSION

Frog neobladder has a similar outcome as other neobladder techniques, with the added advantage of the ability to accommodate the shorter ureteric length and accessing ureter by retrograde approach for intervention in future.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. GLOBOCAN 2018: Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2018. International Agency for Research on Cancer; 2018. Available from: http://globocan.iarc.fr/Pages/fact_sheets_population.aspx. [Last accessed on 2019 Feb 20].
2. Hollowell CM, Christiano AP, Steinberg GD. Technique of hautmann ileal neobladder with chimney modification: Interim results in 50 patients. J Urol 2000;163:47-50.
3. Lee RK, Abol-Enein H, Artibani W, Bochner B, Dalbagni G, Daneshmand S, *et al*. Urinary diversion after radical cystectomy for bladder cancer: Options, patient selection, and outcomes. BJU Int 2014;113:11-23.
4. Hautmann RE, de Petriconi R, Gottfried HW, Kleinschmidt K, Mattes R, Paiss T. The ileal neobladder: Complications and functional results in 363 patients after 11 years of followup. J Urol 1999;161:422-7.
5. Cancrini A, De Carli P, Pompeo V, Fattahi H, Lamanna L, Giuseppe C, *et al*. Lower urinary tract reconstruction following cystectomy: Experience and results in 96 patients using the orthotopic ileal bladder substitution of Studer *et al*. Eur Urol 1996;29:204-9.
6. Lee KS, Montie JE, Dunn RL, Lee CT. Hautmann and studer orthotopic neobladders: A contemporary experience. J Urol 2003;169:2188-91.
7. Steers WD. Voiding dysfunction in the orthotopic neobladder. World J Urol 2000;18:330-7.
8. Hautmann RE. Urinary diversion: Ileal conduit to neobladder. J Urol 2003;169:834-42.
9. Philip J, Manikandan R, Venugopal S, Desouza J, Javlé PM. Orthotopic neobladder versus ileal conduit urinary diversion after cystectomy – A quality-of-life based comparison. Ann R Coll Surg Engl 2009;91:565-9.
10. Thoeny HC, Sonnenschein MJ, Madersbacher S, Vock P, Studer UE. Is ileal orthotopic bladder substitution with an afferent tubular segment detrimental to the upper urinary tract in the long term? J Urol 2002;168:2030-4.