

LONG TERM OUTCOME OF RECTAL BLADDER USING MODIFIED DUHAMEL TECHNIQUE IN THE MANAGEMENT OF BLADDER EXSTROPHY IN DUHOK CITY, IRAQ

QADIR M. SALIH, MBChB, FIBMS (Ped. Surg)*

Submitted 09 January 2024; accepted 05 February 2024

ABSTRACT

Background: Urinary diversion continues to present considerable challenges in urological surgery. The Heitz-Boyer-Houvelac uretero-rectostomy, first described in 1912 and later validated experimentally by Shaw in 1937, remains a foundational approach. Bladder exstrophy, a severe congenital anomaly affecting the lower abdominal wall, urinary tract, genitalia, and pelvic bones, is a principal indication for urinary diversion. Despite advances in reconstructive techniques, approximately 10% of exstrophic bladders are of inadequate capacity and 30% of patients remain incontinent following staged reconstruction. This study aimed to evaluate the efficacy and safety of urinary diversion using a modified Duhamel uretero-rectostomy technique in the management of urinary incontinence associated with bladder exstrophy, focusing on renal preservation, continence outcomes, cosmetic results, and long-term complications.

Patients and Methods: A retrospective review (2009–2014) followed by a prospective analysis (2014–2021) was conducted on 27 patients (19 males, 8 females; mean age 6.8 years) treated by a single surgeon at two centers in Duhok, Iraq. Postoperative assessments included renal function, serum electrolytes, urinary pH, ultrasound, proctography, and annual proctoscopy with rectal biopsy.

Results: Mean operative duration was four hours, with uneventful recovery in all cases. Rectal pouch capacity increased significantly to a mean of 330 mL at one year. Continence improved progressively, and urinary tract infection occurred in four patients, with one requiring surgical correction. No histopathological abnormalities were observed.

Conclusion: The modified Duhamel uretero-rectostomy provides a reliable, technically straightforward, and functionally effective option for urinary diversion in bladder exstrophy, demonstrating durable long-term outcomes and a low complication rate.

Duhok Med J 2025; 19 (2): 11-19.

Keywords: Duhamel's pull-through; Bladder exstrophy; Urinary diversion

Urinary diversion remains a crucial component in the management of complex urological conditions, particularly in cases of persistent urinary incontinence following bladder exstrophy repair. The primary objective of urinary diversion in such patients is to preserve renal function while improving continence, comfort, and overall quality of life^[1].

Bladder exstrophy is a rare and severe congenital malformation characterized by an anterior midline defect of the lower abdominal wall, exposure of the posterior

bladder wall, and varying degrees of involvement of the urethra, genitalia, and pelvic bones. This anomaly results from failure of the infraumbilical mesoderm to properly migrate and fuse during early embryogenesis, leading to incomplete closure of the lower abdominal wall and bladder plate. The condition is typically recognized at birth and necessitates prompt surgical intervention to restore urinary tract integrity and achieve acceptable cosmetic and functional outcomes^[2].

* Assistant Professor, Consultant Pediatric Surgeon, Dept of Surgery, College of Medicine, University of Duhok

The standard management of bladder exstrophy involves staged reconstructive surgery, which includes bladder closure, bladder neck reconstruction, and genital reconstruction. Despite significant advancements in surgical techniques and postoperative care, long-term outcomes remain challenging. Up to 30% of children continue to suffer from urinary incontinence despite successful anatomical reconstruction, and approximately 10% possess a bladder of inadequate capacity to maintain continence. These issues can severely impair physical, emotional, and psychosocial well-being, emphasizing the need for alternative therapeutic approaches that provide continence without compromising renal function^[3,4].

In selected patients, urinary diversion represents a viable and effective alternative. Among various diversion techniques, uretero-rectostomy has regained attention due to its physiological and psychological advantages. Children with intact anal sphincter function can benefit from the creation of a neobladder using the rectum, which allows urine storage and voiding through the natural anal route. This method avoids the need for a permanent abdominal stoma or intermittent catheterization, thus preserving body image and facilitating social adaptation^[4].

The modified Duhamel uretero-rectostomy technique, derived from principles of colorectal surgery, offers additional benefits by ensuring a low-pressure reservoir and maintaining continence through the natural anal sphincter mechanism. Furthermore, it provides technical simplicity, reliable drainage of the upper urinary tract, and the potential for satisfactory long-term outcomes^[3,4].

This study evaluates the efficacy and safety of urinary diversion using the modified Duhamel uretero-rectostomy technique in children with persistent urinary incontinence following bladder exstrophy repair. It aims to assess functional and anatomical outcomes, renal preservation,

continence rates, and long-term complications, including metabolic and neoplastic risks, as well as to evaluate the overall impact on physical quality of life.

PATIENTS AND METHODS:

Five years retrospective study conducted from March 2009 to July 2014 and seven years prospective Sept.2014 to Nov.2021. Twenty-seven patients from both genders, their lower age limit 4 years, who have had repair of bladder exstrophy with urinary incontinence, all patients who were neglected and did not underwent repair, with normal faecal continence were included in the study. All patients underwent the same surgical technique by the same surgeon in two different hospitals, Paediatric Surgery Center at Heevi paediatric teaching hospital and Vazeen private hospital, anal sphincter function were studied in all patients by contrast enema and anal muscle electrical stimulator, all patients were admitted to the hospital two days before surgery for colonic preparation and antibiotic 3rd generation cephalosporin & metronidazole and for all cases the same procedure technique were used after placing the patient in the Lloyd-Davis position was used in surgeries where the abdomen was opened with a midline incision, although two patients had Pfannenstiel incisions instead and modified Duhamel was done as described in figure (1).

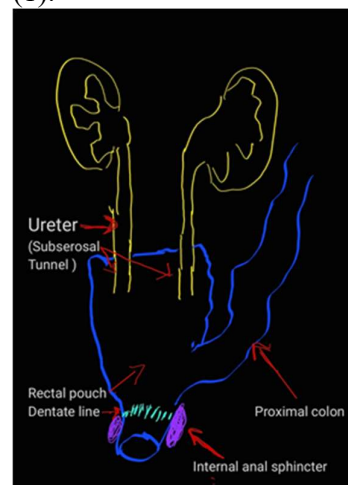


Figure (1) modified Duhamel technique

Following the mobilization of the sigmoid colon, the rectum was lifted into the abdomen using Babcock forceps, and a presacral space was created behind it through blunt dissection down to the pelvic floor as shown in figure (2).



Figure (2) dividing the sigmoid from the rectum

The sigmoid colon was divided above the rectum. And by the aid of Hegar dilator placed behind the rectum and viewing the anal canal from below the proper site for end to side anastomosis were identified above the dentate line and the internal anal sphincter. Suturing by 3:0 or 4:0 polydioxanone PDS interrupted stiches were done. Overswing of rectum were done by one layer continues 3:0 PDS as shown in figure (3).

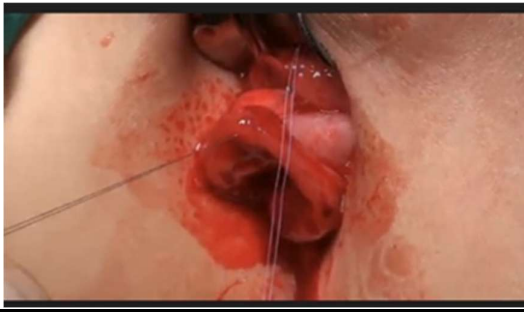


Figure (3) trans-anal anastomosis of sigmoid to the posterior side of the rectum.

The ureteral reimplantation were done using subserosa tunneling at least 4:1 to the ureter diameter at lateral rectal wall and transanastomotic ureteral catheter were placed (fig 4), and a pelvic tube drain were placed and removed later on, intensive toilet training started one month postoperatively for two months, renal function test, serum electrolytes and PH

were checked every two month for the first six months and then every six months for two years after that every year during the follow up period, renal ultrasound every three months for first year then every six months during follow up period were done, rectal pouch capacity were assessed at three months and one year postoperatively using proctography, annual proctoscopy with rectal biopsy was done annually, at each visit frequency of urination and nocturnal bed-wetting were assessed by direct interview with the child and the parents



Figure (4) reimplantation of ureters to the rectum with submucosal channel.

RESULTS:

The study included twenty-seven patients, nineteen male and eight female, age ranging 4 to 11 years mean age 6.8 years. Blood transfusion intraoperative in one patient, the mean operative time was four hours, in all patients the postoperative recovery was uneventful, during hospital stay blood PH, Electrolytes, RFT, Blood gases, haemoglobin level and haematocrit values were checked daily during hospital stay and all were within normal values and later according to follow up schedule as showed in table (1).

Table (1) Biochemical data of 27 patients followed for 24 months represented by median (minimum-maximum)

Biochemical data	2 nd month	4 th month	6 th month	1 st year	18 th month	2 nd year
PH of blood	7.44	7.46	7.46	7.41	7.39	7.40
Bicarbonate (mmol/l)	27	25	27	23	24	23
Sodium (mmol/l)	146	143	144	149	138	142
Chloride (mmol/l)	101	98	103	102	100	104
Potassium (mmol/l)	3.6	3.8	4.3	4.4	3.8	4.2
Creatinine (mg/dl)	0.8	1.1	0.9	1.2	1.1	1.2
BUN (mg/dl)	24	36	42	40	38	34

the rectal pouch capacity was significantly increased after one year with a mean of 330ml ranging from 220ml to 430ml assessed by using water soluble contrast proctography as showed in figure (5).



Figure (5) Postoperative contrast study to assess the capacity of the new bladder (rectal pouch)

The ability of retaining motions was improving with time with a mean of 4 hours at one year, Bedwetting was significantly decreasing with time postoperatively table (2) from 8 times per month at 3 months to 4 times per month at 6 months then twice monthly at one year and after two years once.

Table2 the postoperative new bladder evaluation and the nocturnal bedwetting

	3 months	6 months	12 months	24 months
Frequency of bowel motions/day	16	14	14	8
Nocturnal bedwetting/month	8	4	2	1

Table 2 the postoperative new bladder evaluation and the nocturnal bedwetting, data as mean monthly in follow up using direct interview with the child and the parent two, patients needed constipating agent for one month to assist rectal control, four patients had UTI, three of them without recurrence during follow up and one had recurrent UTI with febrile pyelonephritis and the cause was corrected surgically with right ureteral reimplantation due to pouch-kidney reflux as showed in figure (6).



Figure (6) Right side Vesico-Ureteral Reflux Grade IV

Perianal skin excoriation was in 5 patients, most of them respond well to local emollients, none of patients had neoplastic histopathology changes form the rectal pouch biopsy which was done annually

using flexible colonoscope and punch biopsy forceps as shown in table (3), regarding child satisfaction, girls were happier and more satisfied than boys..

Table 3 Rectal biopsy histopathology results after eight years of follow up

histopathology	Normal histopathology	Non-specific colitis	Squamous metaplasia	Neoplasia
In 27 Patients	17(62.9%)	7(25.9%)	3 (11.1%)	0

DISCUSSION

The objective of surgery for bladder exstrophy is to achieve a secure closure of the abdominal wall, ensure urinary continence while maintaining renal function, and provide satisfactory cosmetic and functional reconstruction of the genital area^[5]. The high rates of unsuccessful bladder reconstruction surgeries in children with bladder exstrophy in developing countries may be attributed to limited resources, delays in surgical intervention, and a lack of specialized centers and expertise. Consequently, many children seek urinary diversion, either initially or after unsuccessful surgeries. Additionally, cultural and social factors often discourage the use of external stomas, heightening the demand for internal continent urinary diversions^[6]. Urinary diversion for cases of ultimate reconstruction failure isn't new; the earliest attempts at diverting urine through the bowel were documented by Simon^[7] in 1852 via a fistula creation.

Various modifications of ureterosigmoidostomy techniques for patients with bladder exstrophy have been published, primarily aimed at preventing renal damage due to ascending infections by establishing a non-refluxing uretero-intestinal connection. Many of these methods, however, led to a significant incidence of unexplained metabolic issues, particularly hyperchloremic metabolic acidosis, resulting in the shift from ureterosigmoidostomy to ileal conduit urinary diversion in the mid-20th century. following a deeper understanding of hyperchloremic metabolic acidosis, the

introduction of alkalinizing agents, and Goodwin's ureteric implantation technique, many past complications of Uretero-sigmoidostomy were addressed, thereby rekindling interest in this approach^[8]. In this study, urinary continence significantly improved post-diversion, with one child managing bowel movements for 3-4 hours and averaging 7-8 motions daily. These results echoed those of Mohamed A. Baky Fahmy^[9], who observed six motions per day after 18 months of follow-up, this study also noted a reduction in nocturnal enuresis after two years, averaging once a month, which is better compared to the four instances per month reported by Baky Fahmy^[9]. No significant electrolyte imbalances were documented in this study, aligning with findings from Baky Fahmy⁹. Concerns regarding uretero-rectostomy urinary diversion include a potential increase in rectal cancer cases; however, this study found no malignancies over an eight-year period, with half the cases displaying normal histopathology, mirroring Baky Fahmy's outcomes. The improvements in quality of life were reported by the majority of patients and their parents, noting increased satisfaction over time as children gained better control over their bowel habits. Continent diversion should be prioritized, while always considering the preservation of renal function, which may necessitate transitioning to a continent ostomy or abdominal catheterization^[10]. Many surgeons express concern over the risk of malignancies in the bowel segments, citing latent adenocarcinoma in about 10% of

childhood ureterosigmoidostomy patients¹¹. This report updates previous research and summarizes work published since 1990 on the epidemiology, experimental, and clinical studies, all of which reinforce the heightened risk of colonic neoplasia following the mixing of fecal and urinary streams in uretero-sigmoidostomy and its newer variants. Conversely, tumors in transposed intestinal segments appear more tied to the underlying urinary tract disease rather than to urine exposure^[11]. In the present study, while we separate fecal and urinary streams, we apply ureterosigmoidostomy principles through a rectal bladder urinary diversion, which minimizes the sigmoid colon's exposure to urine kept in a rectal reservoir. This may clarify the absence of neoplastic changes after more than 150 proctoscope examinations over ten years. However, extended follow-up is necessary to substantiate the long-term safety of this procedure. The absence of hyperchloremic acidosis in this study may stem from minimal electrolyte absorption in the rectum, as none of the patients received alkalinizing drugs due to the lack of significant metabolic disturbances. This technique emerges as a straightforward, dependable, and viable option for continent urinary diversion in selected patients, associated with minimal pelvic dissection and establishing a practical rectal reservoir. Continence improved over time, leading to high satisfaction for both patients and their families

CONCLUSION

This study revealed that modified Duhamel technique is an accepted procedure to treat urinary incontinence in children with history of bladder exstrophy as it is not difficult to perform, the rate of early post-operative complication is low, the long-term outcome regarding urinary incontinence showed obvious improvement with time, low risk of neoplastic changes, no serious electrolyte disturbances and

patient and family satisfaction with the outcome were good.

Funding

This research did not receive any specific grants from funding organizations in the commercial, public, or non-profit sectors.

Disclosure of Interest

The authors state that there are no conflicts of interest.

Ethical Approval

Approval for the study was granted by the Health Ethics Committee of the local health directorate

REFERENCES

1. Mseddi MA, Sellami S, Samet A, Mejdoub B, Rebai N, Hadjslimene M. Mitrofanoff external continent urinary diversion in the management of bladder exstrophy-epispadias complex in adolescents. *Urol Case Rep.* 2021;38:101727. doi:10.1016/j.eucr.2021.101727
2. Ebert AK, Reutter H, Ludwig M, Rösch WH. The Exstrophy-epispadias complex. *Orphanet J Rare Dis.* 2009; 4, 23. <https://doi.org/10.1186/1750-1172-4-23>
3. Baird AD, Nelson CP, Gearhart JP. Modern staged repair of bladder exstrophy: a contemporary series. *J Pediatr Urol.* 2007;3(4):311-315. doi:10.1016/j.jpuro.2006.09.009
4. Mensah JE, Asante EK, Mensah WA, Glover-Addy H. Continent cutaneous diversion for bladder exstrophy in adults. *Afr J Urol.* 2013;19(2):94–98.
5. Shaw MB, Rink RC, Kaefer M, Cain MP, Casale AJ. Continence and classic bladder exstrophy treated with staged repair. *J Urol* 2004; 172:1450-3
6. Pierre K, Borer J, Phelps A, Chow JS. Bladder exstrophy: current management and postoperative

- imaging. *Pediatric Radiol* 2014; 44:768-86.
7. Simon J. Ectopia vesical operation for directing the orifices of the ureters into the rectum; temporary success, subsequent death, autopsy. *Lancet* 1982; 2:568-70.
 8. Kanojia RP, Rao KN, Menon P, Agarwal S, Bawa M, Mahajan JK, et al. Recto sigmoid bladder reservoir for patients with exstrophy: three-dimensional evaluation for outcome analysis. *J Pediatric Urol* 2015;10(6):1176-80.
 9. Mohamed A. Baky Fahmya, Abo Zid Aoud Mansourb, Alaa Mazy. Ureterorectostomy as a continent urinary diversion for complicated bladder exstrophy in children by using a modified Duhamel procedure: A case series *international Journal of Surgery*. 2007; 5: 394-398
 10. Duhamel BA. New operation for the treatment of Hirschsprung's disease. *Arch Dis Child* 1960
 11. Fahmy MA, Mansour A, Mazy A. Ureterorectostomy as a continent urinary diversion for complicated bladder exstrophy in children by using a modified Duhamel procedure. *Inter J Surg* 2007; 5:394-8.

نه‌نجامه دريژخايه‌نه‌كاني مئانه‌ي ره‌كتالي به به‌كارهيناني ته‌كنيكي دوو هامبئلي گور او له چاره‌ساري په‌چوانه‌بووني مئانه له شاري دهوك، عيراق

پوخته

پيشه‌كي:

گوريني رپر هوي مورين هيشتا يه‌كيكه له گهورنرين چالاكيه‌كان له جراحي سيستمې موري. يه‌گرتني حاله به رمكتوم به شينوازي هايترز-بوير-هوفلاك، كه يه‌گهمجار له سالي 1912 باسكرا و دواتر له سالي 1937 له لايمن شووه به شيوه‌ي تافيكردنه‌وه پشتر استكرا، بنه‌مايه‌كي گرنه‌گه له م بواره‌دا. په‌چوانه‌بووني مئانه ناهمواريه‌كي له‌دايكبووني قورسه كه ديوازي خوار هوي شكم، سيستمې موري، نه‌ندامه زاوژييه‌كان و ئيسكاني هموض توش دهكات و يه‌كيكه له گرنه‌گرتين هوكاره‌كاني گوريني مورين. سهرباري پيشكهوتنه‌كان له ته‌كنيكه‌كاني چاكسازي، نزيكه‌ي 10% له مئانه په‌چوانه‌بوو‌ه‌كان گنجايشي پيوستيان نيبه و نزيكه‌ي 30% له نه‌خوشان دواي چاكسازي به قوناغه‌كاندا هيشتا نه‌كونترولن. نم توژينه‌ويه نامانجي هلسه‌نگاندني كار يگرتني و پاريزگاري گوريني مورين به به‌كارهيناني ته‌كنيكي دوو هامبئلي گور او له يه‌گرتني حاله به رمكتوم همبوو، به تاييه‌ني له پاراستني كار كردني گورچه‌كان، نه‌نجامه‌كاني كونترول موري، رووخساري جوانكاري، و نالوزيه دريژخايه‌نه‌كان.

نه‌خوشان و ريگا:

پيداچونو هيه‌كي دوو باره (2009-2014) و دواتر توژينه‌ويه‌كي پيشه‌كي (2014-2021) له سهر 27 نه‌خوش (19 نير و 8 مئ، ناوه‌ندي ته‌ممن 6.8 سال) نه‌نجامدرا كه له لايمن يه‌ك جراح له دوو ناوه‌ند له دهوك، عيراق چاره‌سهر كران. هلسه‌نگاندنه‌كان دواي جراحي بريني بوون له تافيكردنه‌ويه كار كردني گورچه‌كان، نه‌ليكنرولايتنه‌كاني خوئين، pH-ي مورين، سونار، پروكتوگرافي، و پروكتوسكوپي سالانه له‌گهل و مرگرتني نمونه‌ي رمكتوم.

نه‌نجامه‌كان:

ماوه‌ي ناوه‌ندي جراحي چوار كاترمير بوو و هممو نه‌خوشان به‌بي كيشه چاكبوونه‌ه‌يان تيپه‌راند. گنجايشي كيسې رمكتالي به شيوه‌يه‌كي بهرچاو زياد بوو و دواي يه‌ك سال گه‌يشته ناوه‌ندي 330 مل. كونترول موري به شيوه‌يه‌كي هيواش هيواش باشتر بوو، توشبووني توشه‌ي موري له چوار نه‌خوشدا تومار كرا، كه يه‌كيكيان پيوستي به چاكسازي جراحي همبوو. هيج گورانكاريه‌كي نسجي نه‌په‌سندكراو بينرا.

كونتاي:

ته‌كنيكي دوو هامبئلي گور او له يه‌گرتني حاله به رمكتوم هلبزار ده‌يه‌كي متمانه‌پنكراو، ناسان له جيه‌جيكردن، و كار يگره بو گوريني مورين له په‌چوانه‌بووني مئانه، به نه‌نجامه دريژخايه‌نه جيجير و ريژه‌ي كه‌مبكي نالوزي.

الخلاصة

النتائج طويلة الأمد للمثانة المستقيمية باستخدام تقنية دوهامل المعدلة في تدبير انشقاق المثانة في مدينة دهوك، العراق

الخلفية:

لا تزال تحويلات البول تمثل تحديًا كبيرًا في جراحة المسالك البولية. تُعد مفاغرة الحالب بالمستقيم وفق تقنية هابيتس-بوير-هوفلاك، التي وُصفت لأول مرة عام 1912 ولاحقًا تم التحقق منها تجريبيًا بواسطة شو عام 1937، من الأساليب الأساسية في هذا المجال. يُعد انشقاق المثانة تشوّهًا خلقيًا شديدًا يصيب الجدار السفلي للبطن والجهاز البولي والأعضاء التناسلية وعظام الحوض، وهو من أهم دواعي تحويل البول. وعلى الرغم من التقدم في تقنيات الترميم، فإن نحو 10% من حالات انشقاق المثانة تكون ذات سعة غير كافية، كما يبقى حوالي 30% من المرضى غير متحكمين بالبول بعد إعادة البناء على مراحل. هدفت هذه الدراسة إلى تقييم فعالية وأمان تحويل البول باستخدام تقنية دوهامل المعدلة لمفاغرة الحالب بالمستقيم في تدبير سلس البول المرتبط بانشقاق المثانة، مع التركيز على الحفاظ على الوظيفة الكلوية، ونتائج التحكم بالبول، والمظهر التجميلي، والمضاعفات طويلة الأمد.

المرضى والطرق:

أُجريت مراجعة استيعابية للفترة (2009-2014) تلتها دراسة مستقبلية للفترة (2014-2021) شملت 27 مريضًا (19 ذكرًا و8 إناث، بمتوسط عمر 6.8 سنوات) عولجوا بواسطة جراح واحد في مركزين بمحافظة دهوك، العراق. تضمنت التقييمات بعد الجراحة قياس وظائف الكلى، وكهارل الدم، ودرجة حموضة البول، والتصوير بالأشعة فوق الصوتية، وتصوير المستقيم، إضافة إلى تنظير مستقيم سنوي مع أخذ خزعة مستقبلية.

النتائج:

بلغ متوسط زمن العملية الجراحية أربع ساعات، مع تعافٍ دون مضاعفات في جميع الحالات. ازدادت سعة الجيب المستقيمي بشكل ملحوظ لتصل إلى متوسط 330 مل بعد سنة واحدة. تحسن التحكم بالبول تدريجيًا، وسُجّلت التهابات في الجهاز البولي لدى أربعة مرضى، احتاج أحدهم إلى تصحيح جراحي. لم تُلاحظ أي تغييرات نسيجية مرضية.

الاستنتاج:

توفر تقنية دوهامل المعدلة لمفاغرة الحالب بالمستقيم خيارًا موثوقًا وسهل التنفيذ وفعالًا وظيفيًا لتحويل البول في حالات انشقاق المثانة، مع نتائج طويلة الأمد جيدة ومعدل منخفض للمضاعفات.