SEROUS LINED EXTRAMURAL ILEAL VALVE: A NEW CONTINENT URINARY OUTLET

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ABSTRACT

Purpose: We report the functional results following the use of serous lined extramural valve as an antireflux technique and urinary outlet for continent urinary diversion.

Materials and Methods: The procedure was performed in 18 men and 5 women. The technique entails fashioning 2 serous lined extramural troughs in a detubularized W-shape ileal reservoir. A tapered ileal segment is embedded in 1 trough as an antireflux valve and the ureters are anastomosed to its proximal end. Another tapered ileal segment or the appendix is embedded in the second trough and acts as a continent cutaneous outlet.

Results: No operative or postoperative mortality was observed. One patient had prolonged ileus which was treated conservatively. All patients were evaluable with a mean followup of 19 months. All patients but 1 were continent day and night. No catheterization difficulties were reported. Evacuation intervals were 4 to 5 hours. Radiographic evaluation demonstrated a continent compliant reservoir, stable and straight outlet, and absence of pouch and ureteral reflux.

Conclusions: This procedure is technically feasible, surgically versatile, applicable for urinary diversion or conversion and associated with satisfactory outcome.

Key Words: urinary diversion; ileum; urinary reservoirs, continent

PATIENTS AND METHODS

Patients. Between January 1993 and January 1998 a continent urinary outlet technique was used in 18 men and 5 women. Patient age ranged between 5 and 58 years (mean 31.7). Formal continent cutaneous urinary diversion was performed in 18 patients for whom bladder substitution was indicated. The remaining 5 patients underwent urinary conversion from an orthotopic ileal neobladder to a continent cutaneous reservoir following total urethrectomy due to isolated urethral tumor recurrence (see table).

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Indications for continent cutaneous urinary reservoirs

<table>
<thead>
<tr>
<th>Indication</th>
<th>No. of Patients</th>
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<tbody>
<tr>
<td>Diversions</td>
<td></td>
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<tr>
<td>Bladder Ca</td>
<td>8</td>
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<tr>
<td>Neuropathic bladder</td>
<td>6</td>
</tr>
<tr>
<td>Contracted bladder + sphincteric deficiency</td>
<td>2</td>
</tr>
<tr>
<td>Bladder extrophy</td>
<td>2</td>
</tr>
<tr>
<td>Conversion: urethral recurrence following orthotopic diversion</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
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</table>

Urinary diversion. A 60 cm. segment of the terminal ileum is isolated and the continuity of the bowel is reestablished. The isolated bowel segment is subsequently subdivided into 3 parts. The 40 cm. middle segment is used for construction of the reservoir, the 10 cm. oral segment is used for creation of the antireflux mechanism and the 10 cm. caudal segment is used for creation of the outlet valve (fig. 1, A). Alternatively, if the appendix is healthy with adequate caliber and blood supply it can be used for construction of the outlet (fig. 1, B).

The middle segment is arranged in a W configuration and its antimesenteric border is incised by a diathermy knife. The edges of the 2 medial flaps are joined by a single layer of continuous 3-zero polyglactin sutures. The 2 lateral limbs are left to serve as serous lined troughs. The oral and caudal short segments are tapered around a 22F catheter using an automatic gastrointestinal stapler. Then 3 to 4 mesenteric windows are created between the arterial arcades supplying these segments. Each tailored segment is inlaid in its corresponding serous lined trough. The 2 adjacent limbs of each trough are approximated using 3-zero silk seromuscular suture passing through the mesenteric windows. The tapered segments are embedded and fixed within the serous lined extramural troughs. Thus, the bulky mesentery is excluded behind the pouch (fig. 1, C). The spatulated distal ends of the tapered segments are Anastomosed to the tunnel flaps and the ileal trough is closed in front of the embedded segment.
using interrupted 4-zero polyglactin suture (fig. 1, D). The ureters are anastomosed to the proximal end of the inlet by a stented end-to-side mucosa-to-mucosa technique using 4-zero single polyglactin suture. The stents are brought out through the anterior wall of the pouch and exteriorized via separate stabs in the abdominal wall (fig. 1, E).

Urinary conversion. The orthotopic neobladder is exposed, and the urethroileal anastomosis is identified and separated with an adequate safety margin. A 15 cm. segment is isolated and divided into 2 equal parts (fig. 2, A). The distal part is tapered around a 22F catheter and 3 to 4 windows are created in its mesentery. This segment will serve as a continent outlet. The proximal segment is opened along its antimesenteric border. An incomplete rectangular flap is raised (7 cm. long and 3 cm. wide) from the anterior wall of the pouch, and care is taken not to compromise its blood supply (fig. 2, B). The base of this flap is joined to the serosa of the opened ileal segment using 3-zero silk suture passing through the mesenteric windows of the tailored segment (fig. 2, C). Accordingly the continent outlet segment is inlaid and fixed within a serous lined trough, and the edges of the trough are approximated in front of the tapered segment, forming a serous lined extramural tunnel. The defect in the pouch is closed by the remaining free flap of the opened ileal segment (fig. 2, D). The distal end of the outlet is brought out at a suitable site in the anterior abdominal wall. Urethrectomy is performed via a perineal approach with adequate drainage of the perineum and pelvic cavities.

Postoperative care. Parenteral fluids are maintained until bowel habits resume. Prophylactic antibiotics are given routinely for 5 days. The draining tubes are removed when drainage ceases. The pouch is kept drained for 21 days before training by intermittent catheter clamping. All patients start self-catheterization 2 days before being discharged from the hospital. A 2-hour interval is allowed in week 1, which is increased gradually until the pouch matures. By the end of week 6 most patients evacuate the pouch every 4 to 5 hours. Patients who undergo conversion already have mature reservoirs and, hence, need no pouch training.

RESULTS

No operative or postoperative mortality was observed. None of the patients had postoperative complications but 1 had prolonged ileus which was treated conservatively. Mean followup was 19 months (range 3 to 66) and all patients were evaluable. All but 1 patient were dry day and night. This patient complained of some nocturnal leakage due to a fistula between the outlet and pouch. He preferred to use a collecting device at night rather than undergo further corrective surgery.

None of the patients had catheterization difficulties. Contrast medium opacification of the outlet demonstrated a straight outlet tract without kinking or angulation (fig. 3). Gravity (50 cm. water) ascending pouchogram documented a the absence of reflux to the upper tract and confirmed outlet competence (fig. 4). Mean capacity was 460 ± 150 ml. at 6 months after the operation. Excretory urography revealed a normal upper tract in all patients (fig. 5). Three-dimensional computerized tomography demonstrated pouch topography, delineated the serous lined extramural antireflux ileal valve and outlined the configuration of the outlet (fig. 6).
DISCUSSION

Continent cutaneous urinary diversion is frequently indicated. In many instances the use of natural sphincters for urethral or anal control is impossible or contraindicated. Furthermore, conversion from an incontinent loop diversion to a continent reservoir may be required or desired. A high capacity, low pressure reservoir with a reliable continence mechanism is the ultimate goal of successful continent urinary diversion. Detubulization and double folding are the basic prerequisites to construct a compliant reservoir, regardless of the bowel segment used. Construction of an efficient outlet remains a problem. The ideal outlet should be constructed from a readily available and surgically versatile intestinal segment without the need for synthetic materials. It should provide reliable continence and allow easy catheterization in the long term with feasible endoscopic access and minimal need for surgical revision. Although the intussusception nipple valve has been optimized following technical modifications, the complexity of the procedure, use of an extra length of bowel, need for metallic staples and risk of stone formation are limiting factors.

Continent outlets using plicated or tapered ileum with or without ileocecal reinforcement have been used by many urologists. The principle evolved from the Gilchrist procedure first described in 1950. Rowland et al initially used the plication technique for the ileal outlet. Incontinence and catheterization difficulties were encountered in a fourth of the patients. Further modifications were adopted in the form of tapering and stapling of the terminal ileum with the addition of a few silk sutures at the ileocecal valve. Following these modifications the continence rate improved to greater than 90%. Similar results have been reported by Lockhart and Bloch et al. It must be noted that in such procedures the continence mechanism of the outlet relies mostly on the passive tubular resistance.

However, exclusion of the ileocecal segment may result in shortening of the intestinal transit time with subsequent development of diarrhea and the malabsorption syndrome. These sequelae are more significant in patients who undergo bowel resection and children with myelomeningocele. The reversed inkwell hydraulic valve may be legitimately criticized, since catheterization of serosa lined stomal tract can evoke trauma, fibrosis and stomal stenosis. The reported complication rate ranged from 19% to 40% for valve incompetence, fistula, necrosis and/or stomal stenosis.

In 1980 Mitrofanoff achieved a continent outlet by submu-
cosal embedding of the appendix in the detrusor using the Leadbetter technique. The principle was soon used by other investigators but use of the appendix is not feasible in about 18 to 30% of cases. Again, it was noted that there is a trend of increased incidence of stomal stenosis of 21 to 50%. The principle of embedding a tubular structure within a serous lined extramural tunnel has been developed at our department. The technique is versatile and can be used to achieve different objectives. It was initially used for reflux prevention in conjunction with orthotopic ileal bladder substitution. Evidence of its efficiency was provided initially in animal experiments and subsequently in the clinical setting. The reported excellent clinical outcomes have been reproduced by others. Although the initial application was for ureteroileal reimplantation, the technique also was used subsequently for colonic reservoirs.

Since the technique of embedding a tubular structure within a serous lined extramural tunnel can provide a unidirectional flow of urine, the feasibility of its use to construct a continent cutaneous outlet was explored in experimental animals. A tapered short ileal segment was fashioned to provide the tubular structure and initial clinical results were reported. For construction of a continent outlet the appendix can be used as an alternative to a tapered ileal segment. In either situation and to avoid embedding a bulky mesentery within the tunnel, 4 to 5 mesenteric windows between the mesenteric arcades were created, which allows fixation of the outlet within the trough and excludes the bulky and fatty mesentery.
CONCLUSIONS

Embedding the tapered ileum within the serous lined tunnel reduces significantly the likelihood of fistula formation. Furthermore, embedding provides an outer support, a straight channel is created and catheterization is easy. Continence is provided by a passive mechanism derived from tubular resistance of the tapered ileal segments and a dynamic mechanism that results from embedding the outlet within the wall of the reservoir. The former prevents leakage at low pressure while the latter prevents leakage during filling of the reservoir and/or at high pressure. As a result of the high leak point pressure encountered with this system, incorporation of an efficient antireflux mechanism is mandatory to guard against upper tract damage.

The mucous lining of the continent outlet tolerates the trauma of and provides a natural lubricant for catheterization. In addition, the continent outlet is enveloped within a serous lined sleeve, providing support and a straight channel, which ensure easy access for catheterization and rigid endoscopy if needed. Finally, the serous lined extramural ileal valve technique has a wide range of surgical versatility. The ileum is available and suitable for continent cutaneous reservoir construction as an initial procedure or for conversion following orthotopic substitution. Alternatively, the appendix may be used, if feasible, for construction of the efferent limb.
REFERENCES


