*Grzegorz Kudela, Marta Bunarowska, Tomasz Koszutski, Janusz Bohosiewicz

Application of appendix in treatment of children with neurogenic dysfunction of bladder and anal canal

Wykorzystanie wyrostka robaczkowego w leczeniu dzieci z neurogenną dysfunkcją pęcherza moczowego i kanału odbytu

Department of Pediatric Surgery and Urology, Medical University of Silesia, Katowice
Head of Department: prof. Janusz Bohosiewicz, MD, PhD

Summary

Introduction. The aim of the treatment of neurogenic bladder and anal canal dysfunction is the prevention of upper urinary tract deterioration, urinary and fecal continence and controlled bowel movements. The application of Mitrofanoff appendicovesicostomy or Malone appendicostomy facilitates bladder catheterization and bowel movements control which are essential elements of the treatment.

Material and methods. In 2002-2012 appendicular stomas were performed in 23 children with neurogenic bladder and anal canal dysfunction. 19 Mitrofanoff and 7 Malone stomas were done. In 3 children simultaneous Mitrofanoff and Malone stomas were performed. In 4 children autoaugmentation and in 4 children enteric bladder augmentation were done. We keep catheters in the stomas for 6 weeks. After this time the Mitrofanoff stoma is catheterized every 3 hours. The appendix had been sutured to the umbilicus or to the V-shape skin flap or using VQZ-plasty in the lower abdomen. To create Malone stoma we use appendix which is not detached from the cecum.

Results. Complete obstruction of the Mitrofanoff stoma was observed in 3 children. 1 child has a urine leakage through the stoma. Malone stoma stricture developed in 2 children and redo operation was necessary. The unaesthetic mucosal eversion is observed in 6 children, among them is only 1 child operated on with VQZ-plasty.

Conclusions. We recommend appendical stomas for intermittent bladder catheterization or antegrade enemas in children with neurogenic blader and anal canal dysfunction. The stomas can be effectively catheterized by the children themselves.

Key words: neurogenic bladder, constipation, cutaneous fistula, urinary fistula

Streszczenie

Wstęp. Leczenie neurogennej dysfunkcji pęcherza moczowego i kanału odbytu ma na celu zapobieganie uszkodzeniu górnych dróg moczowych, uzyskanie trzymania moczu i stolca oraz świadome wypróżnianie. Zastosowanie przetoki pęcherzowo-wyrostkowo-skórnej Mitrofanoffa oraz wyrostkowo-skórnej Malone'a ułatwia samodzielne cewnikowanie pęcherza oraz wypróżnianie jelita, które są istotnymi elementami leczenia dysfunkcji.

Materiał i metody. W latach 2002-2012 wykonaliśmy przetoki z wykorzystaniem wyrostka robaczkowego u 23 dzieci z neurogenną dysfunkcją pęcherza moczowego i kanału odbytu. Wykonaliśmy 19 przetok Mitrofanoffa i 7 przetok Malone'a. U 3 dzieci wykonano równocześnie przetokę Mitrofanoffa i Malone'a. U 4 dzieci wykonano także autoaugmentację, a u 4 innych pacjentów pęcherz powiększono przy użyciu jelita. Obecnie po zabiegu utrzymujemy w przetokach cewniki przez 6 tygodni. Po tym okresie przetoka jest cewnikowana co 3 godziny. Przetokę przyszywaliśmy do pępka lub w prawym podbrzuszu, zespalając go z płatem skóry w kształcie litery V lub przy użyciu plastyki VQZ. Wykonując przetokę Malonea, wykorzystujemy wyrostek robaczkowy, którego nie odcinamy od kątnicy.

Wyniki. U 3 dzieci doszło do całkowitej niedrożności przetoki Mitrofanoffa. U 1 dziecka obserwujemy wyciek moczu przez przetokę. U 2 dzieci doszło do zwężenia przetoki Malone'a, co wymagało reoperacji. U 6 dzieci stwierdza się nieestetyczne wynicowanie błony śluzowej wyrostka robaczkowego; wśród nich jest tylko 1 dziecko operowane z zastosowaniem techniki VQZ połączenia wyrostka ze skórą.

Wnioski. Wytworzenie przetok z wyrostka robaczkowego celem przerywanego cewnikowania pęcherza lub wykonywania zstępujących u dzieci z neurogenną dysfunkcją pęcherza moczowego i kanału odbytu jest zabiegiem godnym polecenia. Dzieci mogą same skutecznie wykorzystywać przetoki.

Słowa kluczowe: pęcherz moczowy neurogenny, zaparcia, przetoka skórna, przetoka moczowa

INTRODUCTION

Spinal injury caused in children mostly by myelomeningocele results in urinary bladder and anal canal dysfunction (1). The lack of sensation and lower urinary tract control can lead to upper urinary tract damages and consequently to renal failure. Therefore the prevention of the upper urinary tract deterioration is the most important aim of the management of neurogenic bladder. Urinary and fecal continence as well as adequate voluntary bladder and bowel emptying are equally important for school and kindergarten age children. These aims can be achieved in the majority of children by means of intermittent catheterization and the use of anticholinergic medications (1-3). This treatment should be introduced immediately after birth, especially in children with high-pressure bladder and detrusor-sphincter dyssynergia, because renal damage starts often within the first half year of life (2, 4). The anticholinergic drug used since the infant age is oxybutinine chloride in the dosage of 0.3-0.4 mg/kg body weight, divided over 3-4 doses per day (4, 5). Besides that, the children are put on prophylaxis of urinary tract infections, mostly furaginum 1-2 mg/kg body weight per day. Intermittent catheterization, oxybutinine and prophylaxis of infections since early infancy allow obtaining normal bladder capacity, its compliance and consequently preventing progressive renal damage. Moreover, this approach has significantly reduced the need for bladder augmentation in these children (2). Small children are catheterized by their parents and other caregivers. Since about 6 years of life, sufficiently intellectually and manually dexterous children are taught to catheterize themselves. A creation of the continent appendico-vesicostoma (Mitrofanoff procedure) is an optional solution in children in whom self-catheterization through their native urethra is difficult e.g. in girls with severe deformations of lower limbs (2). Malone antegrade continence enema through the appendicular stoma is an efficient management option for children with severe constipations and bowel incontinence due to neurogenic dysfunction of anal canal (6).

AIM

The aim of the paper is the assessment of the appendicular stomas in treatment of children with neurogenic dysfunction of bladder and anal canal.

MATERIAL AND METHODS

The Mitrofanoff stoma is constructed utilizing the appendix which is detached from the cecum but its vascularization is preserved. Distal end of the appendix is sutured through the submucosal tunel into the bladder. The other end of the appendix is connected to the umbilicus or to the skin in the right lower quadrant. Till 2009 we created a V-shape skin flap which was anastomosed into an incised proximal part of the appendix. Since 2010 we have used VQZ plasty for the connection of the appendix into the skin. In this technique, besides a V-flap, a parallel quadrilateral flap is created from the skin. This flap is inverted and anastomosed to the edge of the appendix and to the V-flap. With this technique the stoma is more aesthetic and its mucosa is hidden in the skin tunnel. Currently we keep catheter in the stoma for 6 weeks after the procedure. After this period, the stoma is catheterized every 3 hours.

We create the Malone stoma using the appendix which is not detached from the cecum. We do a window in the mesentery of the base of the appendix. Then the cecum is wrapped around the base of the appendix to form the antireflux mechanism. The distal end of the appendix, incised along its anti-mesenteric border, is connected to the V-shape skin flap or with VQZ technique. We keep catheter in the stoma also for 6 weeks after this procedure. The antegrade enemas are done through the catheter left in the stoma beginning from the second day after the operation. After 6 weeks the stoma is catheterized once a day for performing enema.

In years 2002-2012 in our institution catheterizable appendicular stomas were constructed in 34 children. In this number 23 children had neurogenic dysfunction of urinary bladder and anal canal. The indications for Mitrofanoff procedure in the other children were: bladder extrophy syndrome (8 children), prune belly syndrome (1 child), persistent cloaca (1 child), isolated urogenital sinus (1 child) and urethral atresia (1 child). The causes of neurogenic dysfunctions of the bladder and the anal canal in 23 operated children were: meningomyelocele (21 children), anal atresia and sacral agenesis (1 child), Currarino triad (1 child). The age of the operated children was 11-18 years. 19 Mitrofanoff stomas and 7 Malone stomas were constructed (tab. 1). There were three children in whom the appendix was divided and both Mitrofanoff and Malone stomas were done. Different techniques of bladder augmentations were performed simultaneously with catheterizable stoma in 8 children; autoaugmentation (detrusorectomy) was done in four children and augmentation of the bladder by ileocystoplasty or colocystoplasty was performed in four children. The catheter was kept in the stoma for 2 weeks in early patients and since 2010 – for 6 weeks. The catheter left in the bladder after autoaugmentation was clamped for 2-3 hours and after these periods the bladder was emptied. The aim of this approach is the prevention of bladder collapse and scar formation in the place of detrusorectomy.

Table 1. Stoma types in children with neurogenic dysfunction of urinary bladder and anal canal.

Types of operations	Number of patients
Mitrofanoff stoma	9 (39%)
Malone stoma	4 (17.4%)
Mitrofanoff stoma + Malone stoma	1 (4.35%)
autoaugmentation (detrusorectomy + Mitrofanoff stoma	3 (13%)
autoaugmentation (detrusorectomy) + Mitrofanoff stoma + Malone stoma	1 (4.35%)
augmentation by enterocystoplasty + Mitrofanoff stoma	3 (13%)
augmentation by enterocystoplasty + Mitrofanoff stoma + Malone stoma	1 (4.35%)
Closure of the bladder neck + Mitrofanoff stoma	1 (4.35%)
Total	23 (100%)

RESULTS

In assessing the long-term results of the treatment, the cosmetic effect, as well as the complications, which have a serious impact on the functioning of the stoma were taken into consideration (tab. 2).

An injury and complete obstruction of the appendicular stoma making its catheterization impossible, was observed in three children operated on before 2010. These children are still catheterized through the urethrae. The urine leakage through the stoma at the maximal bladder filling is observed in one child. The Malone stoma stenosis requiring reoperation was found in two children. Currently the stomas in these children are easily catheterized. An unaesthetic eversion of the mucosa of the appendix is observed in 6 children. Five of them were operated before the introduction of the VQZ technique. Since 2010 this type of complication has been found only in one child.

Table 2. Complications of appendiceal stomas in children with neurogenic bladder and anal canal.

Complications	Number of patients
Complete obstruction of the Mitrofanoff stoma	3 (25%)
Urine leakage through the Mitrofanoff stoma	1 (8.3%)
Malone stoma stenosis requiring reoperation	2 (16.7%)
Unaesthetic eversion of the mucosa of the appendix	6 (50%)
Total	12 (100%)

DISCUSSION

The introduction of the intermittent catheterization (7) in the 70's of the 20th century was a major breakthrough in the treatment of the neurogenic bladder dysfunction. Catheterizing children by guardians, mainly parents, is a relatively simple procedure. Also, children who are intellectually and manually dexterous are able to catheterize themselves. However, for some children self-catheterization can be a big inconvenience, especially for girls in wheelchairs or boys with narrowed urethrae, resulting from long-term catheterization. For such patients, the best solution is to create an alternative, easier way to catheter the bladder by using the method suggested in 1980 by Paul Mitrofanoff (8). In 1990 Padraig Malone inspired by the idea of Mitrofanoff, described a method of creating appendicular stoma in order to perform antegrade continence enema (9). In both types of surgery the appendix is used to create a continent catheterizable stoma. Sometimes, however, the child does not have an appendix or the appendix is too short. In such cases, the most common solution is an application of the Monti method involving the use of a detubularized and transversely re-tubularized 2-cm-long ileal segment (8). The length of a tube created in this way may be increased by implementing a slightly longer fragment of the intestine and retubularizing it along the diagonal flap (10). In cases where there is a need to produce two stomas: for bladder catheterization and antegrade continence enema, the appendix can be divided (11). A Mitrofanoff stoma is constructed using distal part of the appendix and the proximal part of the appendix is used for Malone stoma. An essential condition is the suitable length of the appendix, which must be no less than 9 cm. In our center we have simultaneously performed Mitrofanoff and Malone stomas on three children. According to data from the literature the risk of complications after the appendicular stoma contruction is 19-28% (12, 13). Apart from the unaesthetic appearance of the stoma, serious complications in our group occurred in 6 children (26%). **The most serious complication in our patients was an injury of the stoma and consequently its occlusion.** These complications occurred in obese children operated on before 2010, when the catheter was kept in the stoma relatively short after the operation. Since the catheter is kept in the stoma for 6 weeks, no such complication has been observed.

We connected Mitrofanoff stoma to the skin at the umbilicus or at the right lower quadrant whereas Malone stoma was always constructed at the right lower abdomen. The location of the stoma is decided based on the anatomical conditions and the preferences of the patient. **The location of the stoma has no influence on the complication rate** (14, 15). When the lower right abdomen was chosen, the proximal part of the appendix was incised lengthwise and it was anastomosed to the V flap of the skin. The purpose of this was decreasing the risk of narrowing the stoma. Nonetheless the stoma frequently took on the form of an unaesthetic, everted mucosa. In the year 2010 we introduced a new tactic of stoma construction. We leave the catheter inside the stoma for a period of 6 weeks, and we connect the appendix with the skin utilizing VQZ technique (7, 13). As a result the number of complications has decreased and the stoma is more aesthetic (fig. 1). Both all children who are earnestly and regularly catheterizing themselves via the Mitrofanoff stoma and/or performing enemas via Malone stoma and their parents emphasize an improvement in the quality of their life. Data from literature confirm our observations (16). The children feel more independent while the parents gain a bit more free time in their already task filled lives.

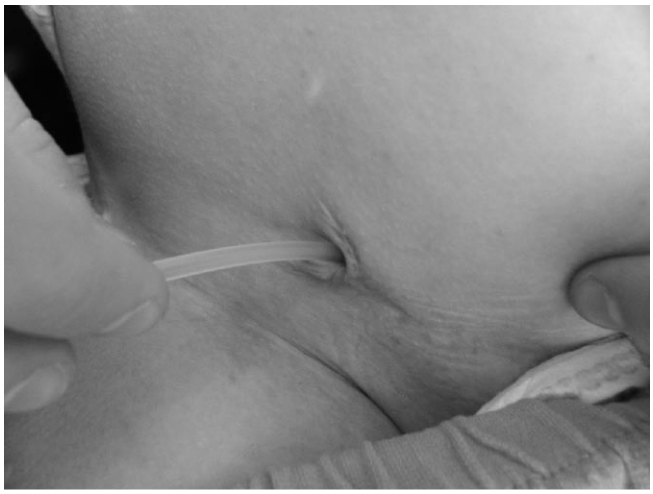

Fig. 1. Catheterizing through the stoma with VQZ-plasty.

CONCLUSIONS

The construction of the appendicular stoma both for intermittent catheterization of the bladder and for antegrade continence enema in children with a neurogenic dysfunction of the bladder and the anal canal is a surgical procedure worth of recommendation. Children efficiently catheterize themselves through the stoma, in this way decreasing the amount of their guardians' duties, while teenagers become increasingly happy as a result of their growing independence.

BIBLIOGRAPHY

1. Mingin GC, Baskin LS: Surgical management of the neurogenic bladder and bowel. International Braz J Urol 2003; 29: 53-61.
2. de Jong TPVM, Chrzan R, Klijn AJ, Dik P: Treatment of the neurogenic bladder in spina bifida. Pediatr Nephrol 2008; 23: 889-896.
3. Koszutski T, Mikosiński M, Kudela G: Neurogenna dysfunkcja pęcherza moczowego u dzieci – postępowanie diagnostyczne i terapeutyczne – cz. II. Lekarz 2006; 3: 39-45.
4. Kasabian NG, Bauer SB, Dyro FM et al.: The prophylactic value of clean intermittent catheterization and anticholinergic medication in newborns and infants with myelodysplasia at risk of developing urinary tract deterioration. Am J Dis Child 1992; 146: 840-843.
5. van Gool JD, Dik P, de Jong TPVM: Bladder-sphincter dysfunction in myelomeningocele. Eur J Pediatr 2001; 160: 414-420.
6. Malone PS, Ransley PG, Kiely EM: Preliminary report: the antegrade continence enema. Lancet 1990; 336: 1217-1218.
7. Lapides J, Diokno AC, Silber SJ, Lowe BS: Clean, intermittent self-catheterization in the treatment of urinary tract disease. J Urol 1972; 107: 458-461.
8. Farrugia M-K, Malone PS: Educational article: The Mitrofanoff procedure. J Pediatr Urol 2010; 6: 330-337.
9. Malone PS, Ransley PG, Kiely EM: Preliminary report: the antegrade continence enema. Lancet 1990; 336: 1217-1218.
10. Skobejko-Włodarska L: Własne metody wytwarzania szczelnej przetoki moczowej u wybranych chorych na neurogenną dysfunkcję pęcherza moczowego. Urol Pol 2007; 60: 64-69.
11. Kajbafzadeh AM, Chubak N: Simultaneous Malone antegrade continent enema and Mitrofanoff principle using the divided appendix: report of a new technique for prevention of stoma complications. J Urol 2001; 165: 2404-2409.
12. Barqawi A, De Valdenebro M, Furness PD et al.: Lessons learned from stomal complications in children with cutaneous catheterizable continent stomas. BJU International 2004; 94: 1344-1347.
13. Clark T, Pope JC, Adams MC et al.: Factors that influence outcomes of the Mitrofanoff and Malone antegrade continence enema reconstructive procedures in children. J Urol 2002; 168: 1537-1540.
14. Thomas JC, Dietrich MS, Trusler L et al.: Continent Catheterizable Channels and the Timing of Their Complications. J Urol 2006; 176: 1816-1820.
15. Suzer O, Vates TS, Freedman AL et al.: Results of the Mitrofanoff procedure in urinary tract reconstruction in children. Br J Urol 1997; 79: 279-282.
16. Merenda LA, Duffy T, Betz RR et al.: Outcomes of Urinary Diversion in Children With Spinal Cord Injuries. J Spinal Cord Med 2007; 30: 41-47.

received/otrzymano: 20.02.2013
accepted/zaakceptowano: 10.04.2013

Address/adres:
*Grzegorz Kudela
Department of Pediatric Surgery and Urology
Medical University of Silesia
Upper Silesian Centre for Child's Health
ul. Medyków 16, 40-752 Katowice
tel.: +48 (32) 207-1750, +48 501-460-285
fax: +48 (32) 207-1802
mail: kudela@mp.pl