Management of Bladder Diverticula in Menkes Syndrome: A Case Report and Review of the Literature

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Menkes syndrome is a genetic disorder of copper metabolism, often with urologic complications, including bladder diverticula and vesicoureteral reflux. A 1-year-old boy with Menkes syndrome presented with recurrent urinary tract infections and incomplete bladder emptying secondary to 2 large bladder diverticula. He underwent robot-assisted excision of both diverticula with subsequent improved emptying and resolution of urinary tract infections. There is no consensus on management of bladder diverticula in Menkes syndrome. Because the life span of these patients is significantly shortened, one must select an intervention based on their clinical condition, potential morbidities, and informed expectations of the family. UROLOGY 86: 162–164, 2015. © 2015 Elsevier Inc.

Menkes syndrome is an X-linked recessive defect in copper-transporting adenosine triphosphatase occurring in 1 of 100,000 to 250,000 live births.[1] Urologic complications are common in Menkes syndrome, such as bladder diverticula, bladder outflow obstruction, renal rupture,[2] cryptorchidism, urinary tract infections (UTIs), and vesicoureteral reflux.[3] These complications may be attributed to decreased lysyl oxidase activity, which is necessary for collagen formation.[1]

A 2006 study evaluated the efficacy of copper therapy in preventing urologic complications in a retrospective review of 57 cases. These complications were found to increase progressively with patient age despite instituting copper therapy. Specifically, the rate of bladder diverticula is 38% in their reported patient cohort. They did conclude, however, that treatment may slightly delay the worsening of the complications.[2] This article presents a case of bladder diverticula in Menkes syndrome and a review of the literature on this rare urologic condition.

CASE REPORT

A 1-year-old boy presented with a history of 2 febrile UTIs over the previous 3 months. Each urine culture isolated >100,000 cfu/mL of *Escherichia coli*. He was admitted to an outside facility for the most recent infection and was noted to have some difficulty voiding. Because of high residual urine volumes, intermittent catheterization was instituted. His medical history is significant for Menkes syndrome, for which he receives copper injections. He is otherwise healthy, and has no neurological or cardiac sequelae of the disease. His physical examination is unremarkable except for coarse hair and hypotonic extremities. After treatment of the UTI, an ultrasonography scan demonstrated 2 large bladder diverticula (Fig. 1). This was confirmed on voiding cystourethrography (VCUG; Fig. 2).

He underwent robot-assisted excision of both diverticula. A 3-port technique was used, and no complications were encountered using the robot-assisted approach. A suprapubic catheter was left in place for 1 month to allow for voiding trials postoperatively. A follow-up VCUG after 1 month demonstrated resolution of the targeted diverticula but slight enlargement of previously noted small diverticula (Fig. 3). It has been 6 months since the operation, and he has been free of any UTIs without the use of antibiotic prophylaxis.

COMMENT

Because of the rarity of this disease process, there is currently no consensus on the treatment of bladder diverticula in patients with Menkes syndrome. There is little literature available on this topic, most common being case reports. Some of the patients in these case reports were managed conservatively with observation, cutaneous vesicostomy, or catheterization, and some underwent surgical excision of the diverticula. The longest documented surgical follow-up is 2 years.[3] Because the life span of these patients is significantly shortened, there is a question whether surgical treatment is warranted given their propensity to recur and generally poor overall prognosis.

In a case reported by Zaffanello and Fanos,[4] a child presented with recurrent UTIs and high-grade vesicoureteral reflux. He was found to have multiple large

Financial Disclosure: *The authors declare that they have no relevant financial interests.*

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Submitted: February 4, 2015, accepted (with revisions): March 31, 2015

http://dx.doi.org/10.1016/j.urology.2015.03.030
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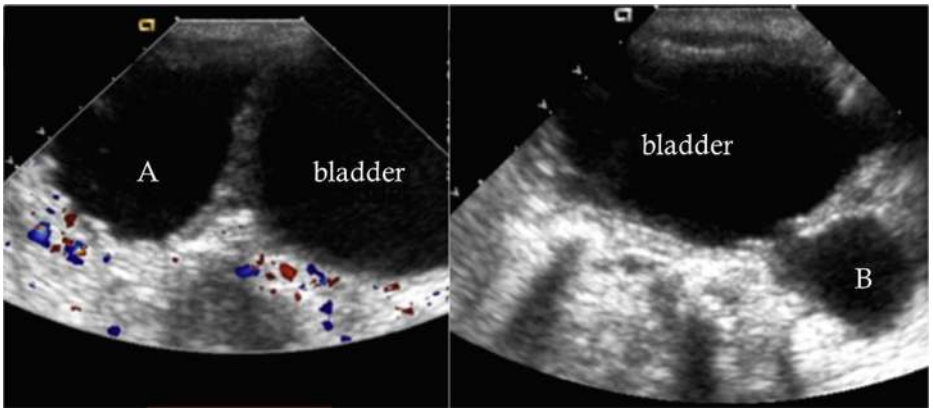

Figure 1. Bladder ultrasonogram revealing a large diverticulum protruding posterior to the dome of the bladder **(A)** and a second smaller one posteriorly near the bladder neck **(B)**. (Color version available online.)

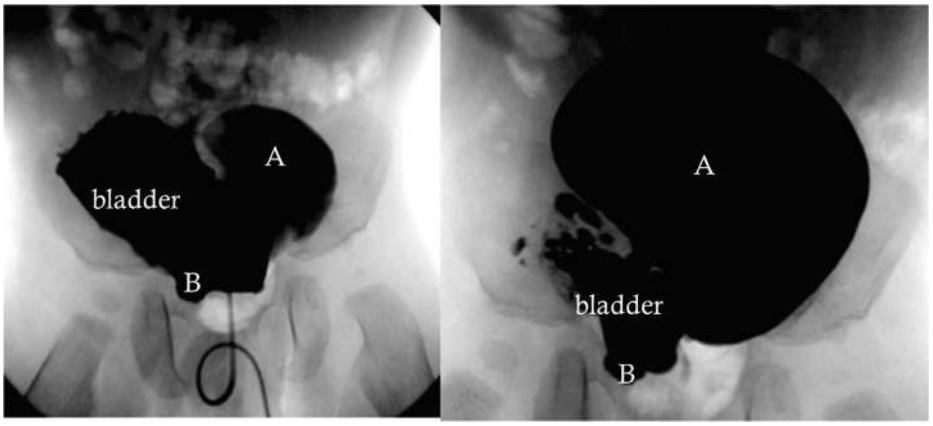

Figure 2. In the left panel, the voiding cystourethrogram demonstrates the large superior diverticulum **(A)** and a smaller one posteriorly near the bladder neck **(B)**. In right panel, postvoid film reveals the residual urine volume within the diverticulum.

bladder diverticula and hydronephrosis. He underwent a cutaneous vesicostomy as definitive management. Another patient with the same clinical presentation underwent a diverticulectomy and subsequently developed new diverticula 3 months later along with bladder calculi.

Daly and Rabinovitch[5] described 3 patients with Menkes syndrome and bladder diverticula. The first patient was managed with intermittent catheterization for UTIs and high residual volumes. This patient subsequently developed bladder calculi and required a cutaneous vesicostomy. The second patient was reported to be alive, and the third patient died at the age of 2 months.

Conversely, there have been reports of successful surgical management. Kageyama et al[3] reported a 2-year-old child who underwent a bladder diverticulectomy and ureteral reimplantation for UTIs in the setting of a large bladder diverticulum and inability to perform intermittent catheterizaton. His postoperative cystogram 6 months later revealed no residual or new diverticula. At last report, he was still doing well at the age of 4 years. Eradi and Rajimwale[6] described a 2-year-old patient with Menkes syndrome who was found to have 2 large bladder diverticula on VCUG. These were causing high residual volumes and recurrent UTIs. He underwent a bladder diverticulectomy and was found to have a thin bladder wall with multiple bladder stones within the diverticula. He required only temporary CIC and resumed spontaneous voiding. Length of follow-up was not reported.

In addition, Oshio et al[7] described 2 patients with Menkes syndrome and bladder diverticula. One patient died 1 month after diagnosis of the urologic complication of Menkes syndrome. The second patient suffered a rupture of a large bladder diverticulum, requiring exploratory laparotomy and diverticulectomy.

In summary, this article adds to the few published cases of surgically managed bladder diverticula in Menkes syndrome with postoperative follow-up imaging. The life span of these patients is significantly shortened to as little as 3 years.[8] However, it is common for patients to survive longer. Therefore, we suggest selecting an intervention based on the clinical condition of the individual patient and the suspected life expectancy. Our patient's recurrent UTIs and incomplete emptying had a significant effect on his quality of life. He demonstrated no neurologic or cardiac sequelae of his disease, and thus, his clinical condition made

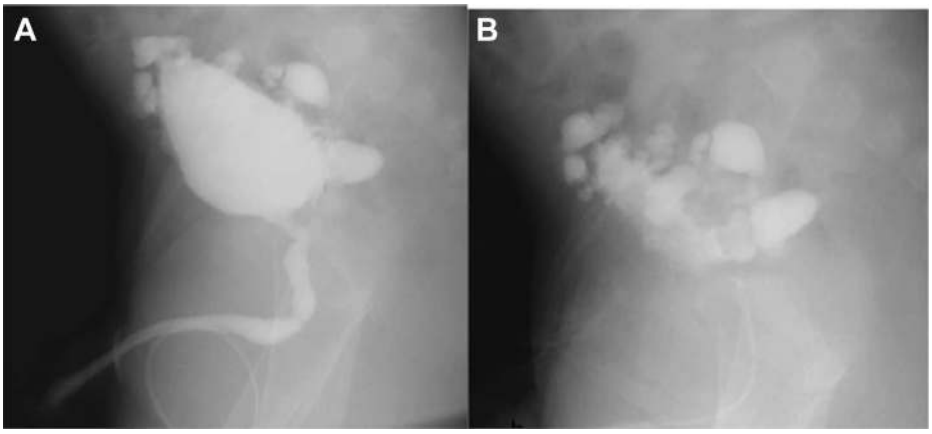

Figure 3. Voiding cystourethrogram 1 month after operation demonstrating multiple small diverticula during voiding **(A)** and after voiding **(B)**.

surgical intervention reasonably beneficial despite potential for future recurrence. Managing long-term urologic expectations is of utmost importance. There appears to be no special accommodations or alterations in surgical technique needed for these children when performing robotic-assisted diverticulectomy. If surgical management is elected, these patients require follow-up for the evaluation of progressive or recurrent diverticula and UTIs as well as for assessing bladder emptying.

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