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Acquired Urethral Diverticulum Following Prolonged Clean Intermittent Catheterization in a Child with Neurogenic Bladder

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Description

Clean intermittent catheterization is a cornerstone of long-term bladder management in children with neurogenic bladder, commonly resulting from conditions such as spina bifida or spinal cord malformations. While generally considered safe and effective, long-term catheterization carries risks, including urethral trauma, stricture formation, and, in rare cases, acquired urethral diverticula. A ten-year-old boy with spina bifida presented with persistent post-void dribbling, recurrent urinary tract infections, and occasional perineal discomfort. He had been performing clean intermittent catheterization every three to four hours since infancy, demonstrating good compliance and proper technique. There was no history of urethral instrumentation beyond routine catheterization, and he had no prior urologic surgery.

On examination, the child appeared well-nourished and in no acute distress. Genital examination revealed no abnormal external findings, and there was no palpable mass along the urethra. Abdominal examination was unremarkable, with no tenderness or organomegaly. Routine laboratory studies, including serum creatinine and urinalysis, were notable only for intermittent bacteriuria. Renal ultrasound showed normal kidneys with no hydronephrosis or structural abnormalities. However, post-void bladder residual volumes were elevated, consistent with the underlying neurogenic bladder condition. Given his symptoms, further evaluation of the urethra was undertaken.

Retrograde urethrography demonstrated a ventral outpouching of the bulbar urethra consistent with a urethral diverticulum. The diverticulum measured approximately 1.2 centimeters in maximum diameter, had a wide neck communicating with the urethral lumen, and appeared to collect urine during voiding. No evidence of urethral stricture or prior trauma was noted. Cystoscopic examination confirmed the diverticulum and revealed inflamed mucosa consistent with chronic irritation, but no evidence of malignancy or congenital anomaly. The urethral lumen was otherwise normal in caliber, and bladder capacity and compliance were appropriate for age, though detrusor overactivity was observed, consistent with his neurogenic bladder profile.

Given the symptomatic nature of the diverticulum, the patient underwent surgical excision. A ventral perineal approach was utilized, allowing careful dissection and removal of the diverticular sac while preserving surrounding urethral tissue. The urethral wall was

reconstructed primarily with absorbable sutures in a tension-free fashion. A urethral catheter was left in place for two weeks postoperatively to allow adequate healing and minimize the risk of stricture formation. Intraoperative and postoperative care emphasized meticulous handling of the urethral mucosa to prevent recurrence and additional complications.

Histopathologic analysis of the excised tissue revealed a diverticular sac lined with transitional epithelium and underlying chronic inflammatory changes, consistent with an acquired rather than congenital lesion. No neoplastic changes were observed. The chronic inflammation likely reflected repeated minor trauma from catheterization over the years, supporting the hypothesis that this diverticulum was an iatrogenic complication of long-term intermittent catheter use.

The postoperative course was uncomplicated. The urethral catheter was removed as scheduled, and the patient was able to void spontaneously without difficulty. Follow-up imaging at three months demonstrated complete resolution of the diverticulum, and the child reported no further post-void dribbling or perineal discomfort. Urinary tract infections decreased in frequency, and renal function remained normal. The patient continued clean intermittent catheterization under careful monitoring, with instruction to minimize trauma and ensure proper technique.

This case illustrates a rare but significant complication of long-term catheterization in pediatric patients with neurogenic bladder. While clean intermittent catheterization remains the standard of care for maintaining bladder health and protecting renal function, clinicians must remain vigilant for potential long-term sequelae, including urethral diverticula. Regular follow-up, including assessment of voiding patterns, post-void residual volumes, and targeted imaging when symptoms arise, is essential to identify complications early and prevent progression.

The pathophysiology of acquired urethral diverticula in children undergoing chronic catheterization likely involves repetitive mechanical trauma to the urethral wall, leading to localized weakening and eventual outpouching of the mucosa. Factors such as frequency of catheterization, catheter size, and technique may influence the risk of diverticulum formation. In addition, underlying neurogenic bladder dysfunction may contribute to abnormal voiding dynamics, further increasing local stress on the urethra. Awareness of these risk factors allows clinicians to optimize bladder management strategies and minimize long-term complications.

Surgical excision remains the definitive treatment for symptomatic urethral diverticula. Careful dissection and tension-free reconstruction are critical to preserving urethral integrity and preventing recurrence. Postoperative catheterization allows adequate healing, and ongoing surveillance is required to monitor for stricture formation or new diverticula. Multidisciplinary collaboration, involving pediatric urologists, continence specialists, and nursing staff, is essential in managing these complex cases and supporting families in safe long-term bladder care.

Conclusion

In conclusion, acquired urethral diverticula, although rare, should be considered in children with neurogenic bladder who present with post-void dribbling, recurrent infections, or perineal discomfort. Prompt recognition, appropriate imaging, and surgical management can resolve symptoms, prevent recurrent infections, and maintain long-term urethral and renal health. This case emphasizes the importance of vigilance in long-term bladder management and the need for individualized patient monitoring to minimize complications while preserving quality of life.