Chapter 25
Posterior Urethral Valves

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Abstract Posterior urethral valves (PUV) remain the most common cause of bladder outflow obstruction in male infants. Initial management involves bladder drainage following which radiological investigations are carried out. We describe our preferred operative technique, primary valve ablation, along with the complications that may be encountered. A check cystoscopy is routinely performed 3 months later at which time a circumcision may be offered.

Keywords Posterior urethral valves • Valve ablation • Antenatal hydronephrosis

Introduction

Posterior urethral valves (PUV) remain the most common cause of bladder outflow obstruction in male infants. The condition has an estimated incidence of 1/4,000–1/5,000 live births. It is a pan-urinary tract disorder with a variable spectrum of severity that can affect both the upper and lower urinary tract [1, 2]. It is one of the most common causes of chronic renal disease in boys.

The advent of antenatal ultrasound screening has dramatically changed the presentation, with more than 50 % of cases being detected on antenatal screening. At our institution, currently more than 90 % of boys with PUV have had the diagnosis suspected antenatally and confirmed in the first week of life. Antenatal scan findings

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may include bilateral or unilateral hydroureteronephrosis in a male child, oligohydramnios, or anhydramnios.

With increasing awareness of this condition and a low threshold for aggressively investigating boys with urinary tract infections, the diagnosis is being made sooner. The advantage is that the potential detrimental effects of obstruction and recurrent urinary infections on the upper and lower urinary tract are minimized following early intervention.

In children who have not had a prenatal diagnosis, the presentation in the neonatal period is usually with symptoms of urinary tract infections, pyrexia, vomiting, poor weight gain, or dry diapers with a poor urinary stream. In the older child, they classically present with difficulty in passing urine, dribbling incontinence, or urinary retention [3, 4].

The initial management on suspecting the diagnosis usually involves draining the bladder preferably by a suprapubic catheter. Alternatively the bladder could be drained via a urethral catheter.

Subsequently radiological investigations are carried out to confirm the diagnosis. These include an ultrasound examination of the urinary tract, a micturating cysto-urethrogram (VCUG), and an isotope renal scan to assess individual renal function (DMSA or MAG3 isotope scan). The ultrasound will document degree of hydrone-phrosis, and cortical echogenicity may reflect renal dysplasia. It will also give information about bladder wall thickening and volume. A classic keyhole sign has been described which may be seen [5]. On VCUG vesicoureteric reflux, unilateral or bilateral, may be noted, the posterior urethra will be dilated, and the bladder neck is usually prominent with a caliber change between the dilated posterior urethra and the nondilated anterior urethra (Fig. 25.1).

While the child is on catheter drainage, biochemical parameters are monitored, awaiting stabilization of renal function and achievement of a nadir creatinine level. Following catheterization, the child may go through a phase of post-obstructive diuresis. Therefore, fluid and electrolyte balance should be carefully monitored. Any concurrent urinary tract infection is treated with antibiotics.

In cases where there is significant renal impairment, the input of a pediatric nephrologist is extremely valuable. Following a period of stabilization (usually 10 days to 2 weeks), when the child is hemodynamically and biochemically stable, the obstructing valve membrane is ablated.

Contraindications

To effectively deal with a large majority of infants with posterior urethral valves, appropriate endoscopy equipment must be available.

A relative contraindication to primary valve ablation would include premature infants, in whom the urethra is not of sufficient caliber to accommodate even the smallest of the pediatric endoscopes. The options available in this situation include a temporary diversion with the vesicostomy or, alternatively, one could try and serially dilate up the urethra by passing increasing caliber urethral catheters over a 2- to 4-week period.

In the past, other techniques have been described to ablate the obstructing leaflets. These include a suprapubic transvesical endoscopic approach through the

Fig. 25.1 Appearances on
micturating cystourethrogram
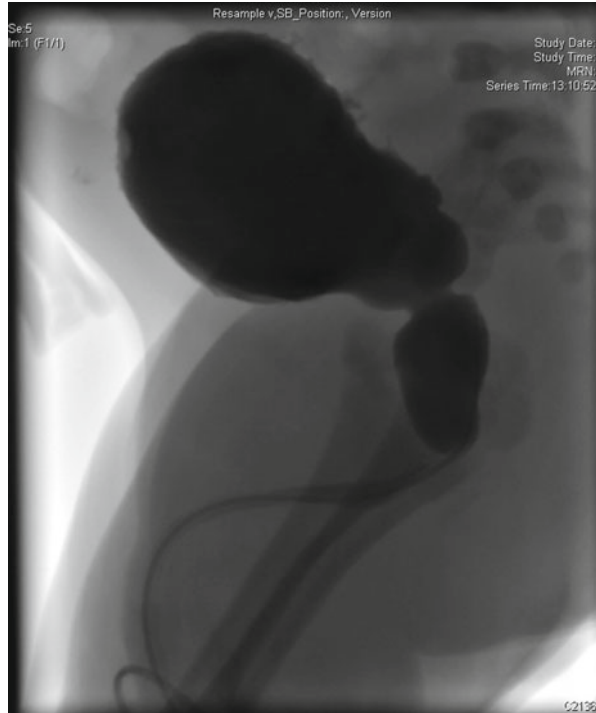
bladder neck, ablation via a temporary perineal urethrostomy, Fogarty balloon abla-
tion, and using Whitaker's hook. The availability of miniature endoscopes has made
these techniques redundant [6, 7].

Preoperative Investigation

Prior to resection of the posterior urethral valve membrane, ensure that the child is
hemodynamically and biochemically stable. Specifically, one should check the
serum values of creatinine, electrolytes, and acid–base balance to ensure that the
child is not acidotic. Radiological confirmation of the diagnosis with ultrasound and
MCUG is arranged prior to endoscopy.

Specific Instrumentation (See Figs. 25.2 and 25.3)

Instruments that should be available for valve resection include:

1. Pediatric cystoscope (6 F–7.5 F)
2. Pediatric resectoscope (11 F)
3. Cold knife, bugbee, and diathermy electrodes

Fig. 25.2 Resectoscope
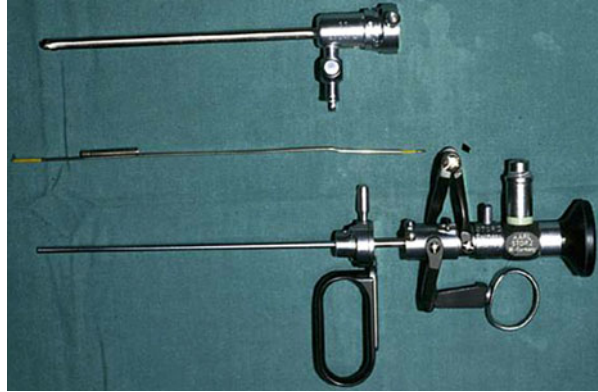
Fig. 25.3 Cold knife and
diathermy hook

Operative Technique

The child is placed in a lithotomy position. Prior to instrumentation, a dose of intra-
venous antibiotic covering the gram-negative spectrum of organisms is adminis-
tered (usually gentamicin or amikacin).

The foreskin is separated to retract and visualize the meatal opening. The meatus
is calibrated and if necessary serially dilated. An initial diagnostic cystoscopy is
performed. I use the 6 F–7.5 F graduated Wolfe cystoscope, which has an inbuilt 30°
telescope and a 3/4 F instrument channel.

Following the initial assessment, the valve ablation is carried out using a pediatric
11 Fr resectoscope, with a cold knife or a bugbee electrode. The advantage of the 11
F resectoscope (Storz) is that the tip of the sheath has no bakelite beak and is thus
less traumatic and easier to introduce.

In situations where the neonatal urethra is too small to accommodate the resec-
toscope, the membrane can be ablated using the 7.5 F cystoscope and a 3 F bugbee
electrode using a diathermy current.

My preference is to use a cold blade (sickle blade) to cut valve membrane at the
5 o'clock, 7 o'clock, and 12 o'clock positions. There may be some bleeding

encountered following the incision, which usually resolves spontaneously on passing a urethral catheter. (See the technique demonstrated in accompanying Video 25.1.)

Following satisfactory ablation of the valve membrane, a urethral catheter is placed in the bladder, and the suprapubic catheter (if present) is removed. Postoperatively the urethral catheter is left on drainage for a period of 24–48 h and removed.

Following removal of the urethral catheter, urine output is monitored by assessing and weighing diapers and, if possible, observing the urinary stream. Plasma creatinine value is monitored and checked prior to discharge.

The child is usually discharged on prophylactic antibiotics (trimethoprim 2 mg/kg once a day). Follow-up is planned in 3 months time, with repeat radiological investigations which include ultrasound, VCUG, and assessment of renal function with a DMSA or MAG 3 isotope renography.

During this admission, the child will also have a check cystoscopy to ensure adequacy of the valve ablation, and consideration may be given to performing a circumcision.

Complications

With miniaturization of the endoscopes, complications directly related to the procedure are uncommon. Potential complications associated with the procedure include:

1. Bleeding: This could be either the result of overzealous meatal dilatation resulting in a tear or occasionally one can encounter bleeding from the resected valve membrane, particularly with a cold knife incision technique.
2. Infection: It is prudent to ensure that any intervention is covered with broad-spectrum parental antibiotics.
3. Damage to external sphincter: An uncommon complication when the procedure is carefully performed and the landmarks are well visualized and identified.
4. Urethral stricture: This is likely to be associated with diathermy ablation of posterior urethral valves. The incidence is increased if the urethra remains dry in the immediate post-resection period. It can also occur with prolonged instrumentation particularly where the endoscope is a tight fit in the neonatal urethra.
5. Meatal stenosis: This occurs following forced meatal dilation to accommodate oversized instruments.
6. Incomplete resection: When using bugbee or diathermy electrodes, it is safer to err on the side of caution as overzealous diathermy causes greater damage to the neonatal urethra. It is our policy to reevaluate all boys 3 months after initial valve ablation with a repeat VCUG as well as a check cystoscopy. Any residual valvular obstruction is ablated at the second sitting.

Follow-Up

At our institution following the second check cystoscopy, the patients are followed up closely by the nephrologists and also in a dedicated posterior urethral valve clinic. The protocol includes regular evaluation of both upper and lower urinary tract anatomy and function along with periodic monitoring of renal function. GFR estimation is carried out after 1 year of age and videourodynamics performed at age 5 years.

The incidence of renal and bladder dysfunction varies, and a recent systematic review by Hennus et al. confirmed these findings. They found that only the nadir creatinine was a predictor of renal dysfunction [8].

Conclusions

Primary valve ablation is the preferred modality of treatment at our institution. It is physiological as it allows the bladder to continue cycling. The miniaturization of pediatric endoscopes allows for majority of valves to be ablated primarily. During the past 5 years, all boys with PUV have had the obstructing membrane primarily ablated at our institute following a period of temporary drainage.

In premature babies the urethra may not accommodate the smallest cystoscope, and catheter drainage (replaced twice weekly with increasing caliber) may be required for a few weeks before ablation can be safely performed.

The disadvantage of ablating the valve with smaller endoscopes is that once you have a bugbee catheter in the instrument channel, the flow of irrigation fluid is significantly reduced. It is important to ensure adequate visualization of landmarks to minimize complications.

Check cystoscopy within 3 months of primary valve ablation ensures adequacy of treatment and allows residual obstruction to be treated early. Significant complications like urinary incontinence due to sphincter damage are uncommon, and ensuring good visualization of important landmarks during the procedure will minimize problems.

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