

Background

Posterior urethral valves (PUV) are the most common cause of congenital lower urinary tract obstruction in male fetuses. Prognosis depends mainly on the degree of renal parenchymal damage and pulmonary hypoplasia secondary to oligo-/anhydramnios. Fetal Magnetic Resonance Imaging (MRI) complements ultrasound by providing multiplanar evaluation of urinary tract anatomy and objective assessment of fetal lung volume.

Objective

To present three fetuses with posterior urethral valves and illustrate the value of fetal MRI in assessing urinary tract morphology, renal parenchymal appearance, amniotic fluid status, fetal lung volume, and postnatal correlation.

Methods

Three fetuses with prenatal ultrasound suspicion of lower urinary tract obstruction underwent fetal body MRI. MRI findings were reviewed for bladder size and wall morphology, posterior urethral dilatation, hydroureteronephrosis, renal parenchymal thinning, amniotic fluid volume, and total fetal lung volume. Available postnatal imaging was reviewed for correlation.

Main MRI Findings

Across all three cases, fetal MRI demonstrated imaging features consistent with lower urinary tract obstruction due to posterior urethral valves: megacystis, proximal urethral dilatation, bilateral hydroureteronephrosis, renal parenchymal thinning, and variable bladder wall thickening. The most important differences between cases were amniotic fluid status and fetal lung volume.

Discussion

These cases demonstrate the spectrum of fetal posterior urethral valves on MRI. Although all fetuses showed obstructive urinary tract abnormalities, the degree of pulmonary involvement differed substantially. This highlights the role of fetal MRI not only in confirming urinary tract obstruction, but also in assessing prognostically relevant features such as renal parenchymal thinning and pulmonary hypoplasia. MRI-based volumetry of the lungs, and potentially of the renal parenchyma, may improve prenatal counselling and multidisciplinary perinatal planning in fetuses with suspected posterior urethral valves.

Conclusion

Fetal MRI is a valuable adjunct to ultrasound in suspected posterior urethral valves. It provides detailed evaluation of the bladder, posterior urethra, ureters, kidneys, renal parenchyma, amniotic fluid volume, and fetal lungs. In suspected lower urinary tract obstruction, fetal lung volumetry and renal parenchymal assessment may help refine prognosis and guide perinatal management. Future studies are needed to determine the key prognostic cut-off values.

Teaching Points

- In suspected posterior urethral valves, fetal MRI should systematically assess the bladder, posterior urethra, ureters, kidneys, amniotic fluid, and lungs.
- Megacystis with proximal urethral dilatation and bilateral hydroureteronephrosis strongly supports lower urinary tract obstruction.
- Prognosis depends not only on urinary tract dilatation, but also on renal parenchymal damage, amniotic fluid status, and fetal lung volume.
- MRI lung volumetry may provide additional prognostic information when pulmonary hypoplasia is suspected.

Case	Key Fetal MRI Findings	Amniotic Fluid / Lung Volume	Postnatal Correlation
1	Bilateral nephromegaly, severe bilateral hydroureteronephrosis, marked renal parenchymal thinning, megacystis (40x34x34 mm) with thickened bladder wall, dilated proximal urethra, 19 mm simple right renal cyst.	Reduced amniotic fluid. Total lung volume ~23.5 mL, below expected values for gestational age.	Foeticide.
2	Markedly distended bladder without wall thickening, dilated proximal urethra, bilateral nephromegaly, severe bilateral pelvicalyceal dilatation, bilateral hydroureters, renal parenchymal thinning to 2-6 mm. Ascites and bilateral hydroceles.	Preserved amniotic fluid. Total lung volume ~60 mL, at the lower limit of normal.	No respiratory complications; permanent urine catheter, on antihypertensive therapy
3	Anhydramnios, thick-walled reticulated megacystis, dilated bladder neck and proximal urethra, tortuous hydroureters, bilateral hydronephrosis with ballooned calyces, asymmetric renal parenchymal thinning.	Anhydramnios. Total lung volume ~30 mL, markedly below expected values.	Lung hypoplasia, bilateral pneumothorax, multi-organ failure → exitus lethalis

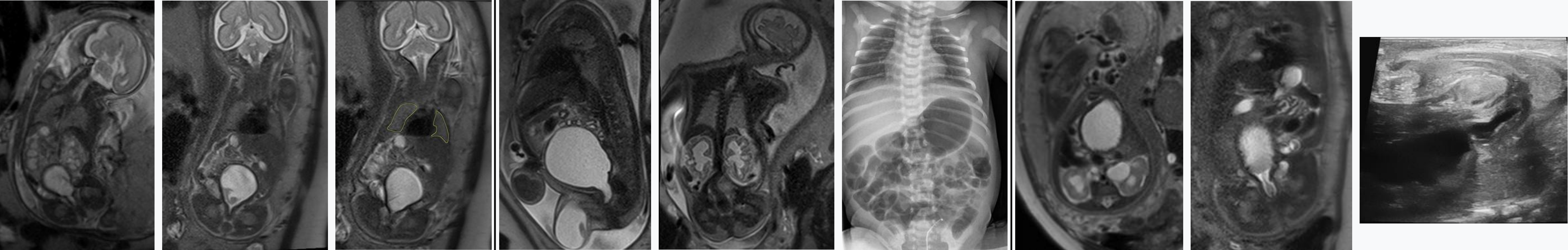


Figure 1. Case 1: Coronal T2-weighted fetal MRI demonstrates megacystis, bilateral hydroureteronephrosis, and renal parenchymal thinning, hypoplastic lungs, reduced amniotic fluid.

Figure 2. Case 2: Sagittal and Coronal T2-weighted fetal MRI shows a distended bladder with typical keyhole sign (dilated proximal urethra), bilateral hydroureteronephrosis, postnatal babygram shows mild lung hypoplasia.

Figure 3. Case 3: Axial and Coronal T2-weighted fetal MRI demonstrates distended bladder with trabeculated wall and keyhole sign, bilateral hydroureteronephrosis, lung hypoplasia. Postnatal sagittal transperineal ultrasound shows thickened bladder wall and dilated proximal urethra.

References

1. Bingham G, Leslie SW, Rentea RM. Posterior Urethral Valves. StatPearls. Treasure Island (FL): StatPearls Publishing; updated 2024.
2. Prayer D, Malinge G, Brugger PC, et al. ISUOG Practice Guidelines: performance of fetal magnetic resonance imaging. Ultrasound Obstet Gynecol. 2017;49:671-680.
3. Rypens F, Metens T, Rocourt N, et al. Fetal lung volume: estimation at MR imaging. Radiology. 2001;219:236-241.