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Case Report

Prenatal diagnosis of congenital megalourethra: case report and literature review

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ABSTRACT

Background. Congenital megalourethra is an uncommon cause of lower urinary tract obstruction that is rarely prenatally diagnosed in second trimester sonographic examination as a cystic genital mass.

Case. In the presented case, the megalourethra was accompanied with bilateral mild pelviectasis. The newborn had no morbidity during follow-up period. To review the literature, electronic databases including PubMed, Web of Science and Google Scholar were searched up to February 15, 2021. In 51 prenatally diagnosed cases in the literature, most of the cases had accompanying congenital anomalies, especially structural abnormalities in the genitourinary.

Conclusions. In the absence of associated abnormalities, the condition of the upper urinary tract is the main determinant of postnatal outcome. The outcome of congenital megalourethra may be good as in our case, but there may also be serious disorders such as renal failure, pulmonary hypoplasia, erectile dysfunction and fertility issues.

Key words: congenital megalourethra, lower urinary tract obstruction, obstructive uropathy, prenatal diagnosis, prenatal sonography.

Lower urinary tract obstruction, a pediatric end-stage kidney disease cause, is seen in 3.34 of 10,000 live births.[1] Congenital megalourethra is a rare form of lower urinary tract obstruction, resulting from the dysgenesis of penile erectile tissue.[2] Congenital maldevelopment of mesodermal penile erectile structures, which normally supports the urinary tract during micturition, can cause urine stasis and functional dilatation.[3]

Megalourethra is classified into two types according to urethrographic findings. In the scaphoid variant which is the most common type, a bulging occurs in the ventral urethra due to the hypoplasia or aplasia of corpus spongiosum. Whereas in the fusiform variant, associated with worse prognosis, the defect of spongy and cavernous tissues leads to a circumferential enlargement of the urethra. However, there are intermediate phenotypes between these two types and it is not always easy to precisely classify patients.[4]

While it is usually diagnosed in the neonatal period, the number of prenatally reported cases is gradually increasing with advances in sonographic imaging. However, since being described for the first time by Benacerraf, in 1989, the number of prenatally reported cases is not very large.[5,6]

In this report, we aimed to analyze the prenatal sonographic findings and postnatal outcomes of a congenital megalourethra case, and to review the previous prenatally diagnosed cases in the relevant literature.

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For the literature review, the following search strategy was carried out: the keywords of 'congenital megalourethra' and 'prenatal diagnosis' were searched in PubMed, Web of Science and Google Scholar databases up to February 15, 2021 and the references of previous studies were reviewed. Inclusion criteria comprised case reports written in English and published in peer-reviewed journals, prenatally diagnosed cases and congenital megalourethra. Studies that did not provide sufficient clinical data on gestational age and ultrasound findings were excluded.

In this way, we retained 30 studies, which reported a total of 51 prenatally diagnosed congenital megalourethra cases; 6 of these studies reported at least two cases. The largest series included 10 cases.[2] We reviewed these 51 cases according to the following criteria: gestational week at diagnosis, pregnancy outcome, prenatal ultrasound findings, postnatal findings and fetal interventions. The results are summarized in Table I.

Case Report

A 28-year-old woman, gravida 1, was referred to our clinic with suspicion of ambiguous genitalia due to a cystic structure in the fetal penis. Her past medical history was unremarkable, with no teratogenic exposure and no family history of hereditary disease, congenital abnormalities and consanguinity. The first trimester examination and combined test were performed in the referring clinic and there were no abnormalities.

At first ultrasound examination in our clinic, fetal growth was appropriate for gestational age, 21-week, and amniotic fluid was normal. A cystic mass that was ballooning up from the penile shaft between two legs was detected (Fig. 1). There was no vascularization in color Doppler. The urinary bladder was of normal size (Fig. 2). Both renal pelvises were 4.5 mm in diameter (Fig. 3). The case was diagnosed as megalourethra with bilateral mild pelviectasis.

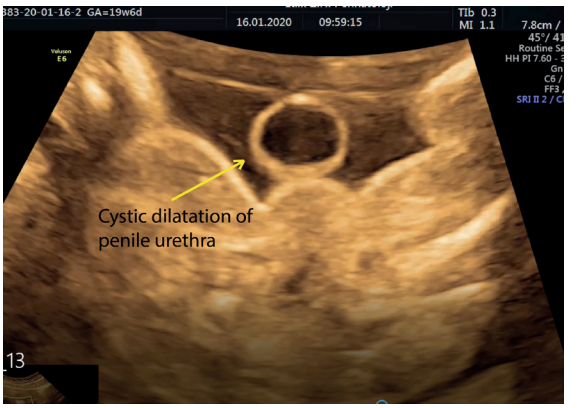

Fig. 1. Ultrasound showing penile shaft as a cystic mass between two legs.

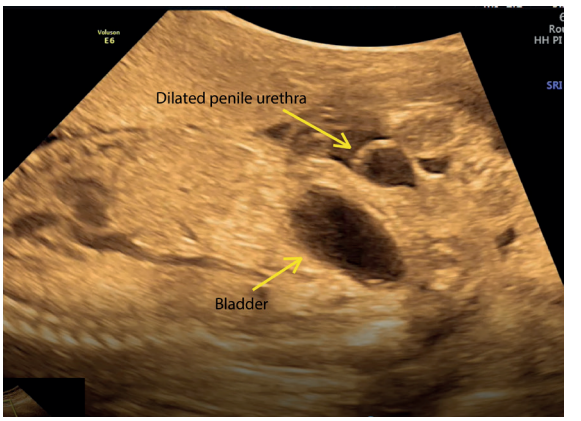

Fig. 2. Ultrasound showing normal sized urinary bladder and cystic dilatation of penile urethra.

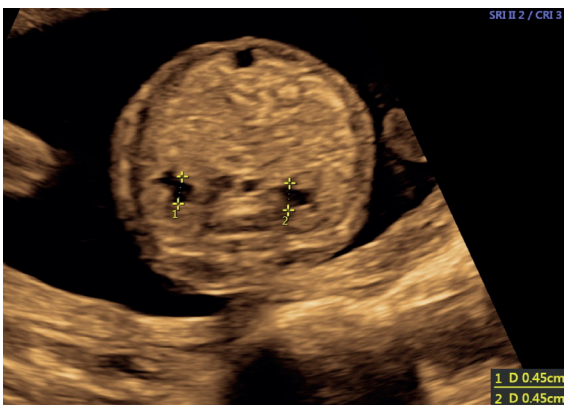

Fig. 3. Ultrasound revealing mild bilateral pyelectasis (both renal pelvises were 4.5 mm in a diameter) and normal amniotic fluid.

No other fetal structural defect was detected and fetal echocardiography was normal. Patient underwent amniocentesis for genetic anomaly evaluation. Fetal karyotype and chromosomal

Table I. Review of 51 prenatally diagnosed megalourethra cases reported by previous studies.

Publication	GW at diagnosis/ delivery (pregnancy outcome)	Obstructive uropathy/ amniotic fluid index	Prenatal additional findings	Postnatal additional diagnosis/ renal functions	Fetal interventions
Benacerraf et al., 1989 [6]	21/36 (live birth)	Bilateral/Polyhydramnios	-	Prune-belly variant	-
Fisk et al., 1990 [7]	18/ - (TOP)	Bilateral/Oligohydramnios	PBS	-	In utero cystourethrogram, bladder aspiration
Simma et al., 1992 [13]	22/39 (live birth, neonatal death)	Unilateral/Oligohydramnios	Right renal dysplasia	Esophageal atresia, imperforate anus, malformed sacrum, VSD rectovesical fistula, splenic duplication,	Bladder aspiration
Sepulveda et al., 1993 [14]	24/37 (live birth)	Bilateral/Normal	-	PBS, normal kidney function at 7 day	Bladder aspiration
Stephens and Fortune, 1993 [15]	14/ Abortion	Megacystis only/Normal	Gastrochisis, scoliosis, rectal atresia	Abortion	-
Dillon et al., 1994 [16]	16/term (live birth)	Unilateral/-	Imperforate anus, renal dysplasia	-	-
Wu et al., 1995 [17]	18/ - (TOP)	Bilateral/Oligohydramnios	Renal dysplasia	PBS	Bladder aspiration
Smith et al., 1996 [18]	24/37 (live birth)	Bilateral/Normal	-	PBS	-
Lam and Tang, 2000 [19]	13/ - (TOP)	Bilateral/Normal	-	-	Transabdominal fetoscopy
Perrotin et al., 2001 [20]	23/38 (live birth)	Bilateral/Normal	Umbilical cord cyst, cryptorchidism	Renal impairment 6-year-old	Bladder aspiration
	21/37 (live birth)	Bilateral/Oligohydramnios	-	Renal impairment 3-year-old	Bladder aspiration
Krapp et al., 2002 [21]	13/ - (TOP)	Megacystis only/ Oligohydramnios	Tracheoesophageal fistula, anal atresia, spina bifida, SUA, unilateral renal agenesis	-	Distal urethral aspiration
Ardiet et al., 2003 [22]	20/36 (live birth, twin)	Bilateral/Normal	VACTERL association	Normal renal function at 2 year	-

GIS: gastrointestinal system, GW: gestational week, PBS: prune-belly syndrome, SUA: single umbilical artery, TOP: termination of pregnancy, VSD: ventricular septal defect.

Table I. Continued.

Publication	GW at diagnosis/ delivery (pregnancy outcome)	Obstructive uropathy/ amniotic fluid index	Prenatal additional findings	Postnatal additional diagnosis/ renal functions	Fetal interventions
Nijagal et al., 2004 [8]	14/36 (live birth)	Bilateral/Normal	-	Cryptorchidism, normal function at 10 year	Bladder aspiration
	20/38 (live birth)	Bilateral/Normal	-	Cryptorchidism, normal function at 2 year	Bladder aspiration
	18/term (live birth)	Bilateral/Normal	-	Normal function at 2 year	-
Misseri et al., 2004 [23]	15/38 (live birth)	Megacystis only/ Oligohydramnios	-	Normal kidney function, anterior urethrotomy	Bladder aspiration
Sepulveda et al., 2005 [24]	20/ - (TOP)	Bilateral/Oligohydramnios	-	-	-
	24/28 (live birth, neonatal death)	Bilateral/Oligohydramnios	Multicystic dysplastic kidney	Pulmonary hypoplasia	-
	28/term (live birth, neonatal death)	Bilateral/Oligohydramnios	-	PBS, pulmonary hypoplasia	-
	28/31 (live birth, neonatal death)	Bilateral/Oligohydramnios	-	Pulmonary hypoplasia	-
Torcia et al., 2007 [25]	21/term (live birth)	Not present/Normal	-	Intrauterine resolution after 3 weeks	-
Gandhi et al., 2008 [26]	22/ - (TOP)	Not present/ Oligohydramnios	Hypoplastic left heart, imperforate anus	Gastrointestinal abnormalities	-
Wax et al., 2009 [9]	21/38 (live birth)	Bilateral/Normal	-	Resolution of dilatation at 32 weeks, normal kidney function	-
Promsonthi and Viseshsindh, 2010 [27]	34/38 (live birth)	Bilateral/Normal	Cryptorchidism, club feet	PBS, normal kidney function	-

GIS: gastrointestinal system, GW: gestational week, PBS: prune-belly syndrome, SUA: single umbilical artery, TOP: termination of pregnancy, VSD: ventricular septal defect.

Table I. Continued.

Publication	GW at diagnosis/ delivery (pregnancy outcome)	Obstructive uropathy/ amniotic fluid index	Prenatal additional findings	Postnatal additional diagnosis/ renal functions	Fetal interventions
Amsalem et al., 2011 [2]	18/38 (live birth, twin)	Bilateral/Normal	Clubfoot	PBS, normal kidney function at 3 year	-
	24/35 (live birth)	Bilateral/Oligohydramnios	Clubfoot	PBS, impaired kidney function at 2 year	Vesicoamniotic shunting, bladder aspiration
	18/- (TOP)	Bilateral/Oligohydramnios	Clubfoot, single umbilical artery (SUA)	Skeletal abnormalities, anal atresia, dextrocardia	-
	20/38 (live birth)	Bilateral/Normal	-	PBS, normal kidney function at 2 year	-
	25/39 (live birth)	Megacystis only/Normal	Clubfoot	Normal kidney function at 2 months	-
	19/ - (TOP)	Bilateral/Normal	-	-	-
	24/38 (live birth)	Bilateral/Normal	-	End stage kidney disease	-
	13/39 (live birth)	Bilateral/Oligohydramnios	-	Rectovesical fistula, imperforate anus	Vesicoamniotic shunting, bladder aspiration
	13/39 (live birth)	Bilateral/Oligohydramnios	-	End stage kidney disease	-
	20/ -(TOP)	Bilateral/Oligohydramnios	Unilateral renal agenesis	Rectovaginal fistula, imperforate anus, SUA	-
Asma & Jumana, 2012 [12]	16/36 (live birth)	Bilateral/Oligohydramnios	-	Renal impairment	Bladder aspiration
Rogers & Sohaey, 2013 [28]	21/term (live birth)	Bilateral/Normal	PBS	-	-
van der Merwe et al., 2013 [29]	27/ - (TOP, both twin)	Bilateral/Normal	Omphalocele, talipes, ventriculomegaly	İmperforate anus, GIS abnormalities, cryptorchidism in one	-
Yamamoto et al., 2013 [30]	17/ - (TOP)	Bilateral/Oligohydramnios	-	Imperforate anus, intestine malrotation	Transabdominal fetoscopy

GIS: gastrointestinal system, GW: gestational week, PBS: prune-belly syndrome, SUA: single umbilical artery, TOP: termination of pregnancy, VSD: ventricular septal defect.

Table I. Continued.

Publication	GW at diagnosis/ delivery (pregnancy outcome)	Obstructive uropathy/ amniotic fluid index	Prenatal additional findings	Postnatal additional diagnosis/ renal functions	Fetal interventions
Di Meglio et al., 2014 [31]	13/ - (TOP)	Megacystis only	Meckel Syndrome	Ambiguous genitalia, anorectal atresia	-
	18/ - (TOP)	Not present/Normal	-	TOP/ pseudohermaphroditism	-
Migliorelli et al., 2015 [32]	21/38 (live birth)	Bilateral/Oligohydramnios	-	Normal kidney function, hydroureter	Fetoscopic laser coagulation of urethral meatus
Moaddab et al., 2015 [5]	20/39 (live birth)	Megacystis only/ Normal	-	Vesicoureteral fistula, VSD, esophageal atresia/normal renal function	-
	23/34 (live birth)	Bilateral/Oligohydramnios	-	Anterior urethral valve, renal impairment	-
	30/39 (live birth)	Not present/Normal	-	Anterior urethral valve normal renal function	-
	22/ - (TOP)	Bilateral/Polyhydramnios	Facial dysmorphia, club feet, clenched hand, renal dysplasia	-	-
	18/ - (TOP)	Bilateral/Normal	-	Anterior urethral valve	-
	20/fetal demise	Bilateral/Normal	-	-	-
Singh et al., 2018 [11]	23/37 (live birth, neonatal death, twin)	Bilateral/Normal	VATER syndrome	Pulmonary hypoplasia	-
Anh et al., 2019 [33]	17/ - (TOP)	Bilateral/Normal	Renal dysplasia	-	-
Chao et al., 2019 [34]	22/ - (TOP)	Bilateral/-	Imperforate anus	-	-

GIS: gastrointestinal system, GW: gestational week, PBS: prune-belly syndrome, SUA: single umbilical artery, TOP: termination of pregnancy, VSD: ventricular septal defect.

microarray analysis were normal. Since urinary dilation was mild and amniotic fluid was normal, it was not necessary to perform any invasive therapeutic procedure. The sonographic findings did not show any significant change during the follow-up scans at 24 and 28 weeks of gestation. At 30th week of gestation, penile urethral dilatation was decreased; and renal pelvic dilatation was resolved.

At the 35th week of gestation, a male newborn, weighing 3000 g and 48 cm in length with Apgar score of 10 at 5 minutes, was delivered by caesarean section due to preeclampsia. The physical examination of neonate was unremarkable, except mildly enlarged penis. Both testes were in scrotal sacs (Fig. 4). Kidney and urinary tract were normal in postnatal sonographic evaluation. Blood urea nitrogen, serum creatinine and urinary protein-to-creatinine ratio were also normal. Under general anesthesia, cystoscopy was performed and the diagnosis of megalourethra was confirmed. The newborn had no urination problems and no intervention was required. At the time of writing this report, the baby was six-month-old and had no problems related to megalourethra and no abnormalities were detected in blood or urine tests during follow-up. He was followed up by the pediatric urology clinic with a plan to evaluate for reconstructive surgery at the age of one.

Written informed consent was obtained from the family for the publication.

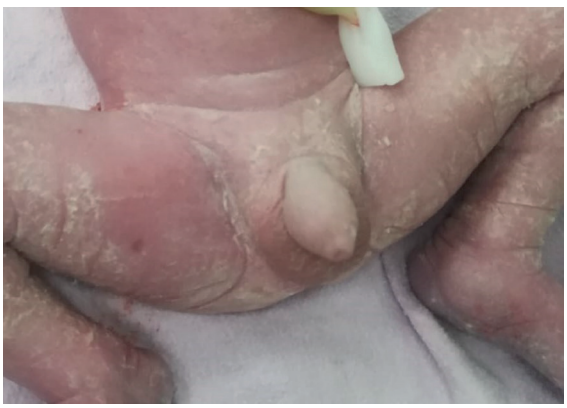

Fig. 4. Postpartum examination of neonate revealing mildly swollen penis.

Discussion

Congenital megalourethra is not inherited and is probably not associated with chromosomal anomalies. Embryological cause is still not well defined. The most commonly presumed causes are differentiation failure of mesenchymal phallic tissues and transient urethral obstruction caused by delayed canalization.[4]

In previous prenatally diagnosed cases, megalourethra was generally detected in the second trimester (40 of 51 reviewed cases; 78.4%). In seven cases, the diagnosis was made in the first trimester. Pregnancy outcomes were as follows: live birth in 32 cases, termination in 17 cases and fetal loss in two cases. Pregnancies were terminated due to the presence of multiple associated anomalies and findings suggesting kidney failure.

Prenatal diagnosis of megalourethra is made by sonographic imaging of fluid filled, cystic, tubular or abnormally shaped dilated penile urethra in a male fetus. Dilated cystic phallus may mimic a loop of umbilical cord between fetal legs. The lack of blood flow on color Doppler may enable to distinguish dilated phallus from the umbilical cord.[7] The keyhole sign, which is specific to lower urinary tract obstruction causes such as posterior urethral valve, can sometimes be seen in megalourethra.[5]

In the vast majority of 51 reviewed cases, genital cystic mass accompanied with varying degrees of urinary tract dilation: bilateral hydroureteronephrosis (39 cases), unilateral hydroureteronephrosis (2 cases) and megacystis (6 cases). In four cases only, there were no sign of urinary tract dilation. In our case, a bilateral mild pelviectasis was observed. As megalourethra has similar consequences such as urinary system dilatation and amniotic fluid reduction, it should be differentiated from other lower urinary tract obstruction causes (e.g. posterior urethral valves, urethral atresia, prune-belly syndrome).[1]

Megalourethra usually occurs together with other congenital anomalies, especially

structural abnormalities of the genitourinary system. In 36 of the 51 reviewed cases (70,5%), other accompanying anomalies were reported. Prune-Belly syndrome, characterized by abdominal wall defect and cryptorchidism, is most frequently associated anomaly with megalourethra (11 cases). Other commonly observed anomalies were imperforate anus, rectal atresia, anterior urethral valve, vesicoureteral fistula, rectovesical fistula, tracheoesophageal fistula, esophageal atresia, gastrochisis, cryptorchidism, VACTERL association, skeletal and cardiac abnormalities (Table I). In our case, no accompanying anomaly was observed.

In mild cases of megalourethra, spontaneous resolution of urethral and urinary tract dilatation in fetus has been reported.[8,9] In our case, we observed some improvement in penile urethral dilatation; and renal pelvic dilatation was resolved.

Fetal intervention has been undertaken in 16 of the 51 reviewed cases. Fetal vesicoamniotic shunting, fetal bladder aspiration and fetal cystoscopy were performed to manage obstructive uropathy and improve renal and pulmonary outcomes. The data was not enough to evaluate the effectiveness of the interventions.

In the postpartum period, anterior urethral valve and urethral diverticula, which have similar clinical presentations such as penile urethra swelling and urinary obstruction complaints, should be considered in the differential diagnosis of congenital megalourethra. Swelling in the megalourethra can be much more severe, and imaging studies such as cystoscopy, retrograde urethrography or voiding cystourethrography may help to diagnose and to differentiate these disorders.[10]

Perinatal and postnatal morbidities caused by megalourethra, if there are no other associated abnormalities, are similar to other causes of lower urinary tract obstruction, and the condition of upper urinary system determines the final result: kidney failure and secondary pulmonary hypoplasia due to oligohydramnios. Like with structural obstructive lesions, the presence of oligo/anhydramnios, bilateral hydroureteronephrosis and renal cysts and echogenity are associated with poor prognosis.[5] Besides these, megalourethra may cause urination problems and sexual dysfunction (e.g. erectile and ejaculatory dysfunction) that can affect patient's quality of life.[4] These complaints tends to be worse in fusiform variant than that of the scaphoid type. In these cases, several reconstructive urosurgical interventions may be required in the postpartum period and later in life, and the long-term prognosis depends on the success of these interventions.[11,12]

In the postnatal period, satisfactory cosmetic and functional results are often provided with penile reconstruction (reduction urethroplasty), especially in scaphoid variants. However, depending on the severity of the defect, especially in the fusiform variants, major interventions such as reassignment of sex may be required.[3]

Congenital megalourethra is a rare cause of fetal lower urinary tract obstruction that is seen mostly in second trimester sonographic examination as a cystic genital mass. In prenatal assessment, extensive systemic evaluation for associated abnormalities and serial follow-up for obstructive uropathy complications are important. Postnatal outcomes may be good as in our case, but there may also be serious disorders such as renal failure, pulmonary hypoplasia, erectile dysfunction and fertility issues. Prior to delivery, the patients should be informed about postnatal outcomes of megalourethra.

Ethical approval

Written informed consent was obtained from the family for the publication.

Author contribution

The authors confirm contribution to the paper as follows: study conception and design: DŞ and FHO; literature review: GGT and FHO; data collection: EE and HTT; draft manuscript preparation: FHO. drafted the manuscript. All authors contributed to critical revision to the paper and approved the final manuscript.

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Conflict of interest

The authors declare that there is no conflict of interest.

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