Fetal Megacystis: Etiologies, Management, and Outcome According to the Trimester

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OBJECTIVE To describe the diagnostic criteria and outcome of fetal megacystis according to the gestational age at diagnosis.

METHODS A 7-year retrospective study was carried out from 2004 to 2011, including cases of megacystis referred to 2 prenatal fetal medicine units. The following data were collected and analyzed: maternal age, term at diagnosis (gestational weeks), ultrasonographic and magnetic resonance imaging data, karyotype, decision of the multidisciplinary prenatal team, fetopathology in cases of termination of pregnancy or fetal death, final diagnosis at birth after ultrasonography and voiding cystourethrography, and medical and surgical follow-up.

RESULTS Of the 69 fetuses included in this study, 82.6% were males; 26 were diagnosed during the first trimester, 21 during the second, and 22 during the third. During the first trimester, the main etiologies were urethral occlusions and prune-belly syndrome with poor fetal prognosis. Nineteen pregnancies (69%) were terminated for medical reasons including the association with other malformations, poor evolution, or miscarriage. Only 4 children were born alive. The main etiologies of megacystis discovered during the second and third trimesters were vesicoureteral reflux and urethral occlusion. Twenty of 22 fetuses (91%) were born alive when the fetal megacystis was discovered after 27 weeks of gestation.

CONCLUSION Antenatal discovery of megacystis is a complex and challenging prognostic situation. The prognosis depends on the gestational age at discovery. Megacystis is not always associated with obstruction. In a newborn with megacystis, bladder outlet obstruction has to be excluded. Optimal counseling of the involved parents requires a multidisciplinary approach. UROLOGY 84: 185–190, 2014. © 2014 Elsevier Inc.

Production of urine begins around the 10th week of gestation (WG), and the bladder then becomes theoretically visible on an ultrasound scan.[1] It must at least be evaluated on the 12th week ultrasound,[2,3] in which it appears as an oval pelvic anechoic structure whose volume varies during the duration of the examination. During the first trimester, between 10 and 14 WGs, the normal sagittal diameter is always <6 mm. Megacystis is defined as an increased sagittal diameter, >10% of the craniocaudal length.[2] This threshold varies, in different studies, between 6 and 8 mm.[1-3] The definition of megacystis in the second and third trimesters is more variable and includes an enlarged bladder with failure to empty over a period of at least 45 minutes.[4]

Prenatal megacystis is an ultrasound sign, which can occur in various etiologies and entail various renal function prognoses. The aims of this study were to assess the concordance between prenatal and postnatal (or on autopsy) diagnoses of megacystis, the different etiologies of megacystis, and determine the prognosis according to the gestational age at diagnosis.

PATIENTS AND METHODS

A retrospective study was carried out between January 2004 and January 2011 on fetuses referred to the prenatal clinics of our tertiary university hospitals with a diagnosis of megacystis found on routine prenatal ultrasound screening.[5] All patients who were identified as having megacystis on prenatal ultrasound were born in our center. Medical records were retrieved from our database (View point); the principal key word used for screening was megacystis. Information on associated anomalies (cardiac,

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

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Submitted: October 24, 2013, accepted (with revisions): February 15, 2014

0090-4295/14/$36.00

http://dx.doi.org/10.1016/j.urology.2014.02.018

limb, lung, or bowel) and karyotype was collected. The study was approved by the relevant local ethics committee.

For the first trimester (between 11 and 13 WGs), megacystis was defined as a sagittal bladder diameter >6 mm. The definition of megacystis during the second (between 20 and 23 WGs) and third trimesters (between 30 and 35 WGs) included an enlarged bladder with failure to empty over a period of at least 45 minutes.[4]

The following data were collected and analyzed: maternal age, term at diagnosis (WG), ultrasonographic and magnetic resonance imaging (MRI) data, karyotype, decision of the multidisciplinary prenatal team, fetopathology in cases of termination of pregnancy (TOP) or fetal death, final diagnosis at birth after ultrasonography and voiding cystourethrography, and medical and surgical follow-up.

Criteria of TOP: In accordance with the French law, TOP was possible at the parents' request in cases of poor renal prognosis as indicated by either the volume of amniotic fluid (oligohydramnios was defined as an amniotic fluid index <5 cm and anhydramnios as the absence of amniotic fluid[6]) and/or results of the dosage of $\beta 2$-microglobulin or in cases of severe associated malformation and/or chromosomal defect.

We determined the criteria for poor prognosis as follows:

1. Severe bilateral hydronephrosis (HN; Society for Fetal Urology [SFU] grade >3), anteroposterior diameter (APD) >10 mm
2. Unilateral HN (SFU grade 4) with APD >15 mm
3. Reduced renal parenchyma thickness and presence of renal cysts
4. Dilatation of the ureter
5. Thickening of the bladder wall
6. Anamnios and oligohydramnios.

The appearance of calices, renal pelvis, and renal parenchyma is essential in determining the grade of HN and the prognosis. The third trimester prenatal ultrasound was used to evaluate the SFU grade and APD. The aspect and degree of HN were also examined and evaluated during the second and third trimesters, according to the SFU grading system. The SFU system was graded 0-4 (0 = no HN; 1 = only visualization of the renal pelvis; 2 = dilatation of a few calyces; 3 = calyceal dilatation of all calyces; and 4 = thinning of the parenchyma).[7]

Final diagnosis was based on fetal autopsy in cases of TOP or intrauterine fetal death (IUFD). Histologic renal dysplasia was defined by tubular macrocysts or microcysts, medullary fibrosis, and nephron reduction. For live-born children, the final diagnosis was based on the results of the postnatal evaluation (surgery, clinical, and imaging findings).

The etiologies were isolated lower urinary tract obstruction (LUTO; including atresia, posterior urethral valve [PUV], urethral stenosis, and obstructive ureterocele), vesicoureteral reflux (VUR), associated congenital abnormalities (including prune-belly syndrome, caudal anomalies, and neurologic megacystis), and normal bladder.

The data were organized into 3 separate groups according to the gestational age at diagnosis: first trimester (group 1T) if diagnosis was made up to 13 WGs, second trimester (group 2T) if diagnosis was made between 14 and 26 WGs, and third trimester (group 3T) if diagnosis was made between 27 and 39 WGs. Megacystis of the second group did not include the 4 megacystis of the first trimester. Fetal outcome (mortality and morbidity) of these 3 groups was statistically analyzed using the Fisher exact test.

Table 1. Follow-up of megacystis according to the gestational age

Megacystis	Group 1T	Group 2T	Group 3T	Total
Born	4	17	20	41
TOP	18	3	2	23
IUFD	4	1	0	5
Total	26	21	22	69

1T, megacystis diagnosed during the first trimester ultrasound; 2T, megacystis diagnosed during the second trimester ultrasound; 3T, megacystis diagnosed during the third trimester ultrasound; IUFD, in utero fetal death; TOP, medical termination of pregnancy for megacystis.

RESULTS

Sixty-nine fetuses presenting with megacystis were included, with 57 males (82.6%). The etiologies were divided between

- 27 of 69 (39%): isolated LUTO atresia, PUV, urethral stenosis (23), obstructive ureterocele (4; 1 female)
- 13 of 69 (19%): VUR (3 females)
- 24 of 69 (35%): associated congenital abnormalities (prune-belly syndrome [7], caudal anomalies [10; 3 females], neurologic megacystis [1 female], megacystis-microcolon [1 female], and associated anomalies [7])
- 5 of 69 (7%): normal bladder (3 females).

Forty-one pregnancies were continued to term and 28 were not. Twenty-three pregnancies underwent TOP for megacystis. There were 5 IUFDs due to congenital urinary tract anomalies (Table 1). The mean maternal age was 31.44 years (range, 18-44 years).

In group 1T, there were more TOPs for poor renal function (18 of 26 [1 female cloaca]; 69%) than in group 2T (3 of 21; 14%) or group 3T (2 of 22; 9%; $P < .001$). There were no female TOPs for the second and third trimesters. Twenty of 22 fetuses (91%) survived in group 3T, 17 of 21 (81%) in group 2T, and 4 of 26 (15%) in group 1T (Table 1; $P < .001$).

In our series, TOPs and IUFDs were more frequent in boys (21 of 57; 37%) than in girls (2 of 12; 16%). Renal dysplasia on histologic examination was present in all isolated urologic malformations leading to TOPs and/or IUFDs.

Group 1T

The initial ultrasonography always showed a bladder size >10 mm. Maximal bladder size was 39 mm.

Only 4 pregnancies went to term (2 PUVs, 1 prune-belly syndrome, and 1 normal female child in which repeated antenatal ultrasonography showed a progressive reduction in bladder size).

Four IUFDs were observed, and 18 TOPs were performed because of associated urinary anomalies, increasing size of the megacystis, and poor prognosis due to impaired kidney function. Associated signs of involvement of the urinary tract were present in all cases: severe degree of HN, alteration of parenchyma with apparition of renal cysts, major dilatation of the ureter,