Diagnosis of fetal pyelectasis and urinary pathology in infants

C. Mărginean[1], Oana Mărginean[2], Carmen Duicu[3], C. Eșanu[1], B. Szabo[1], L. Pușcașiu[1], V.C. Molnar[1]

1. Obstetrics and Gynecology Clinic I, Târgu-Mureș
2. Pediatric Clinic I/Ultrasonography competence, Târgu-Mureș
3. Pediatric Clinic II/ Nephrology Department, Târgu-Mureș
4. University of Medicine and Pharmacy, Târgu-Mureș

Correspondence:
Claudiu Mărginean
e-mail: marginean.claudiu@gmail.com

Abstract

Introduction: *The present study proposes the follow up of intrauterine tracked fetuses with uni- or bilateral pyelectasis.* ***Material and method:*** *In the period April 2006-May 2008 in the Gynecology Clinic I Tg. Mureș 27 second trimester pregnancies were tracked with fetuses having uni, bilateral pyelectasis. We followed the increase of pylon dilation, calyx and urinary bladder. Newborns underwent ultrasounds evaluation after birth and at the age of 3-6 months.* ***Results and discussions:*** *In our cohort needed surgical procedures in the first year 5 children (20%), concerning in bilateral nephrostomy, resection of urethral valve and ureterocele resection. Of the 25 infants with hydronephrosis, 11 (44%) had nephrosis of 3rd or 4th degree.* ***Conclusions:*** *The growth of pyelectasis or fetal hydronephrosis is not a predictive factor for severity of fetal hydronephrosis. Our study emphasizes the importance of fetal pyelectasis disclosure and of tracking the new born during their first life months with regards to preservation of renal functions.*

Keywords: *renal, fetal pylon, hydronephrosis*

Introduction

The normal fetal renal pylon measured in the anteroposterior diameter, generally doesn't exceed 5 mm in the 2nd semester. The pyelectasis is defined over 5 mm. The presence of this anomaly is described as one of the most easily to define by ultrasounds antenatally. The definition of fetal pyelectasis is not unitary, and in specialized literature it is indicated as normal limit in the 2nd trimester of pregnancy:

- 3 mm[1];
- 4 mm[2];
- 5 mm[3,4];
- 10 mm[5].

Other authors insist on different fetal pylon dimensions accepted as normal, according to gestational age:

- Maximum 4 mm at 15-19 weeks, maximum 5 mm at 20-29 weeks, maximum 8 mm at 30-40 weeks[6].
- Pyelectasis is defined as starting from 4-6 mm in the 2nd trimester and 8-10 mm in the 3rd trimester[7].
- Maximum 4 mm in the 1st trimester and maximum 7 mm in the 3rd trimester[8].

Fetal hydronephrosis is defined most simply as having a fetal pylon of more than 15 mm in the anteroposterior diameter[7]. Other classifications of hydronephrosis take into account the gestational age and define this pathology starting from 10 mm of fetal pylon in the 2nd semester[9]. At this size the evaluation of pelvis/kidneys ratio is added, that does not normally exceed 0,5 and the calyx dilation is not visualized by ultrasound[5,10].

Even if there are different opinions on the definition of pyelectasis, the majority of authors agree that an anteroposterior diameter of the fetal pylon with dimensions of over 10 mm requires supplementary follow up of both fetus and new born[3,5,7,8].

The hydronephrosis degrees according to the Society of Fetal Urology[10] are the following:

The frequency of pyelectasis is described between 1%[5], 2%[3] and 4%[8]. Authors Corteville and Bernacerraf, cited in Latin and his collaborators [3] and in Terinde and Flock[7], draw the attention on the increased frequency of Down syndrome in fetuses with mild pyelectasis, over 4-5 mm. The present study proposes the pursuance of intrauterine tracked fetuses, with uni- or bilateral pyelectasis, without other pathological associations.

Material and method

During the period 2006 April - 2009 May 33 2nd semester pregnancies with unique fetuses were tracked in the Gynecology Clinic I Tg-Mures. From the pregnancies admitted in clinics there had been studied all that had fetus with pyelectasis and didn't have any other associated diseases. They had uni- or bilateral pyelectasis, without other pathological associations. Pregnancies were monitored every 2 weeks by ultrasound, following the growth of fetal pylon dilation, the possible occurrence of bilateral pathology, oligoamnios, calyx dilation or urinary bladder of over 6 cm diameter. The infant tracking was done in 31 of the cases, and 2 did not show up for checkup after release from maternity ward. The newborns underwent ultrasound evaluation in the first 4-5 days and later on, at 3-6 months, ultrasound, retro cystography/ intravenous urography and scintigraphy. The urinary tract pathology in new born was noted and reevaluated dynamically. In this study the urinary tract status in the 6 months old infant is taken into account.

During pregnancy, fetal pyelectasis increased in diameter, often being in the situation to define hydronephrosis, with a pylon of over 10 mm in the anteroposterior diameter.

Pyelectasis and fetal hydronephrosis were divided in 3 groups according to the dimensions reached by the kidney anteroposterior axis:

- 6-10 mm 1st degree;
- 11-15 mm 2nd degree;
- Over 15 mm 3rd degree.

The hydronephrosis in new born and child up to 6 months was assessed sonographically and enlisted in 4 degrees. All the children underwent kidney ultrasounds, 24 were investigated through intravenous urography and retrocystography. The vesicoureteral reflux was enlisted in 5 degrees of severity.

Kidney scintigraphy was performed only in 6 cases, and only one child had an abnormal function of renal function (MAG - 3, Tc - 99m).

Results

Each group of fetuses with pyelectasy was separately evaluated, according to the new born or infant pathology.

From the 26 children with urinary system pathology, 5 children (19.23%) required surgical procedure in the first year, 2 with bilateral nephrostomy at 9 months, 2 children with resection

Table 1

Classification of ANH by APD (ANH = antenatal hydronephrosis; anterior posterior diameter = APD)[9]

ANH Classification	APD (mm)	
	Second Trimester	Third Trimester
Mild	≤ 7	≤ 9
Mild/moderate	< 10	< 15
Moderate	7-10	9-15
Moderate/severe	≥ 7	≥ 9
Severe	≥ 10	≥ 15

Table 2

Hydronephrosis grading

Grading-ul hidronefrozei conform Societății de urologie fetală	
Degree O	No hydronephrosis
1st Degree	Visualised renal pelvis (renal pelvis dilation visible ecographically)
2nd Degree	Moderate dilation of renal pelvis and visualisation of a few calyces
3rd Degree	Hydronephrosis with visualisation of almost all calyces, dilated renal pelvis and good parenchyma
4th Degree	Hydronephrosis with visualisation of almost all calyces, dilated renal pelvis and attrofiated or thin parenchyma

Table 3

Causes of antenatal hydronephrosis[11] (most of them causing a bilateral hydronephrosis)

Causes	Frequency (% of the total)
A. Reno-urinary	
■ transitory hydronephrosis	48%
■ physiological hydronephrosis(pyelectasis)	15%
■ obstruction of pyeloureteral junction	11%
■ vesicoureteral reflux	9%
■ megaurether with or without obstruction	4%
■ multi-cystic renal dysplasia	2%
■ ureterocele	2%
■ syndrome of posterior urethral valve	1%
■ ectopic urether, Prune belly syndrome, urethral atresia, urachal cyst	
B. Non reno-urinary	
■ ovarian cyst, hidrocolpos	
■ sacrococcygeal teratoma	
■ intestinal dupplication, duodene atresia	
■ meningocele	

Table 4

Description of fetuses' cohort/infants with pyelectasis/hydronephrosis

Total number of fetuses/pyelectasis	1st Degree 6-10 mm	2nd Degree 11-15 mm	3rd Degree over 15 mm
33	17	11	5
Total **number** of infants with hydronephrosis	15	11	5

of urethral (cytoscopic) valve and one with ureterocele resection.

From the 26 infants with hydronephrosis, 11 (42.30%) have had hydronephrosis of 3rd and 4th degrees.

To notice that there is no link between the growth of fetal pyelectasis and hydronephrosis in infants. Only 5 infants (16.12%), of a number of 31 fetuses with pyelectasis did not exhibit the symptoms of hydronephrosis. Of 26 infants with hydronephrosis only 3 (11.53%) exhibited functional hydronephrosis. Pertaining to the 31 fetuses with pyelectasis, a total of 8 infants (25.80%) had a physiological or possibly transient hydronephrosis.

Discussions

Compared to the studies mentioned at the beginning of our paper, regarding the transitory and antenatal physiological hydronephrosis, in our studies the incidence of these modifications is much lower (9.67% physiological hydronephrosis plus 16,12% fetuses with pyelectasis but without pathology in infants represent a total of 25.80% compared to the study of Woodward and Franck of 63% from 2002[11]). This can be explained by infant tracking over 12 months in the study of the above mentioned authors as compared to 6 months monitoring in our cohort's infants.

Referring to the need of surgical procedures in fetuses with obstructive pathology of the urinary system tracked before birth, data published in specialty literature are relatively similar

Table 5

1st Group of fetal pyelectasis and the urinary tract pathology in infants

1st Group fetal pyelectasis 6-9 mm 15 infants						
Hydronephrosis degree in infants						
Degree O	1st Degree	2nd Degree	3rd Degree	4th Degree		
5 33,33%	4 26,66%	3 20%	2 3,33%	1 6,66%		
Urinary system pathology in children						
Sd. of pylo-ureteral junction	Cong. Mega urether	VUR	Functional hydro-nephrosis	Uretero-vesical stenosis	Sd. of post. urethral valve	No pathology
2 13,33%	1 6,66%	4 26,66%	1 6,66%	1 6,66%	1 6,66%	5 33,33%

Legend: VUR: vesicourethral reflux
To notice the lack of urinary pathology in children in about 1/3 of fetuses with pyelectasis below 10 mm during pregnancy.

Table 6

2nd Group of pyelectasis/fetal hydronephrosis and the urinary systems pathology in infants

2nd Group fetal pyelec-tasy 11-15 mm 11 infants						
Hydronephrosis degree in the infants						
Degree 0	1st Degree	2nd Degree	3rd Degree	4th Degree		
0	2 18,18%	5 45,45%	3 27,27%	1 9,09%		
Urinary system pathology in children						
Sdr. of pylo-ureteral junction	Cong. Mega urether	VUR	Functional hydro-nephrosis	Uretero-vesi-cal stenosis	Sdr. of post. urethral valve	Uretero-celee
2 18,18%	-	4 36,36%	2 18,18%	1 9,09%	1 9,09%	1 9,09%

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3rd Group pyelectasis / fetal hydronephrosis and the urinary systems pathology in infants

Group III fetal pyelec-tasis over 15 mm 5 infants						
Hydronephrosis degree						
Degree 0	1st Degree	2nd Degree	3rd Degree	4th Degree		
0	-	1 20%	2 40%	2 40%		
Urinary system pathology in children						
Sdr. of pylo-ureteral junction	Cong. Mega urether	VUR	Functional hydro-nephrosis	Uretero-vesical stenosis	Sdr. of post. urethral valve	Uretero-celee
2 40%	-	2 40%	-	-	1 20%	-

Table 8

The assessment of the urinary system pathology in infants, for the entire cohort

Type of pathology/ lack of pathology	No. of children/ percentage (31 children - 100%)
Vesico-urethral reflux	10 (32,25%)
Pyeloureteral junction syndrome	6 (19,35%)
Functional hydronephrosis	3 (9,67%)
Posterior urethral valve syndrome	3 (9,67%)
Ureterovesical stenosis	2 (6,45%)
Congenital megaurether	1 (3,22%)
Ureterocele	1 (3,22%)
No pathology	5 (16,12%)

to those provided by our study (26% in Nejat Aksu and collaborators' study[12], compared to 19.23% in our study).

The only group of fetal pyelectasis, which is found in infants without pathology, is the one with an anteroposterior diameter of the renal pelvis below 10 mm. In this case 1/3 of infants will probably exhibit no pathology of the urinary system.

Conclusions

In the majority of cases, fetal pyelectasis is followed by the urinary tract pathology in children. The increase of the diameter in pyelectasis or in hydronephrosis is not a predictive factor for the severity of fetal hydronephrosis.

The most frequent urinary tract pathology in infants was the vesicoureteral reflux, followed by the pyeloureteral junction syndrome. Considering the presence of a 3rd or 4th degree hydronephrosis in almost half of the newborns with hydronephrosis, it is important to disclose fetal pyelectasis and follow up newborns in the first years of life, in order to examine and preserve the renal function. ■

References

1. Avni Fred E., Maugey-Laulom Brigitte, Cassart Marie, Eurin Danielle, Massez Anne, Hall Michelle, The fetal genitourinary tract, in Ultrasonography in Obstetrics and Gynecology, 5th edition, edited by Peter W. Callen, 2008, Saunders Elsevier, 640-675.
2. Betarmino James M., Kogan Barry A.: Management of neonatal hydronephrosis, Early Human Development, 2006, 82, 9-14.
3. Duin L. K., Willekes C., Vossen M., Beckers M., Offermans J., Nijhuis J. G., Reproductibility of fetal renal pelvis volume measurement using three-dimensional ultrasound, Ultrasound Obstet Gynecol 2008; 31: 657-661.
4. Gussi Ilinca, Vlădăreanu Radu, Anomalii ale tractului urinar, in Anomalii fetale, diagnostic și conduită, Pelinescu Onciul Dimitrie, Vlădăreanu Radu, Editura Medicală Antaeus, București 2007, 241-260
5. Hajdu J., Pete B., Harmath A., Papp Z.: Lower Urinary Tract Obstruction, Donald School Journal of Ultrasound in Obstetrics and Gynecology, Jan-Mar 2007; 1(1): 40- 47.
6. Latin V., Kos M., Marton U., Torrents M., Carrera J.M., Astudillo F., Muñoz A., Genitourinary Tract Malformations, in Donald School - Atlas of Clinical Application of Ultrasound in Obstetrics & Gynecology, Carera J.M., Kurjak A., Jaypee Brothers Medical Publishers 2006, 198-211.
7. Mallik Meeta and Watson Alan R., Antenatally detected urinary tract abnormalities: more detection but less action, Pediatric Nephrology, Volume 23, Number 6/June, 2008, 897-904.
8. Mathews R. Antenatal hydronephrosis current evaluation and management. Indian J Urol 2006; 22: 10-4.
9. Nejat Aksu, Őnder Yavaşcan, Murat Kangın, Orhan D. Kara, Yahya Aydın, Hakan Erdoğan, Tuba Çerçi Tuncel, Ergün Çetinkaya, Erkan Özbay and Tahir G. Sandıkçıoğlu: Postnatal management of infants with anthenatally detected hydronephrosis, Paediatric Nephrology, 2005, 20/1253-1259.
10. Terinde R., Flock F., Anomalies and Diseases of the Kidneys and Urinary Tract, in Ultrasound in Obstetrics and Gynecology, vol I., Obstetrics , second edition, Merz Eberhard, 2005 Georg Thieme Verlag, 312-328.
11. Troyano J. M., Mercé L. T., Martinez-Cortez L., Urological Tract Diseases: Ultrasound „2D" vs „3D" and Biochemical Markers, in Donald School Atlas of Fetal Anomalies, Kurjak A., Chervenak F. A., Carera J.M., Jaypee Brothers Medical Publishers 2007, 195-214.
12. Troyano Luque Juan M., Clavijo Rodriguez Matilde T., Fetal Genitourinary Tract: Prenatal Diagnosis and Assesement of Nephrouropathies, in Donaid School Textbook of Ultrasound in Obstetrics and Gynecology, Kurjak A., Chervenak F.A., Jaypee Brothers Medical Publisher, 2004, 298 - 319.
13. Woodward M. and Frank D., Postnatal management of antenatal hydronephrosis, BJU International Volume 89, Issue 2, Pages 149-156, Published Online: 8 Apr 2002.
14. ***www.aap.org., Classification of antenatal hydronephrosis by American Academy of Pediatrics, 2008.