The Prognostic Value of Normal Amniotic Fluid Volume in Severe Fetal Renal Anomalies

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Background

Amniotic fluid (AF) volume is an important indicator for fetal renal function. While oligohydramnios may indicate impaired fetal renal function, the prognostic value of normal AF volume in severe fetal renal anomalies (RA) is uncertain.

Study Objective

To determine the association between normal AF volume and postnatal renal outcome in fetuses with severe renal anomalies identified during pregnancy.

Materials & Methods

- A single center retrospective observational study based on medical records of women referred for a prenatal nephro-genetic consultation due to findings of severe bilateral fetal renal anomalies, between 1997– 2018.
- Severe renal anomalies included: bilateral findings of echogenic kidneys, cystic kidneys, hypoplastic kidneys, bilateral hydronephrosis >15mm in each side, suspected posterior urethral valves (PUV).
- Cases with associated GI malformations or without post-natal follow-up were excluded.
- Severe Renal outcome was defined by: renal autopsy findings indicating severe bilateral renal damage, post-natal sonographic findings (echogenic/ cystic/ hypoplastic kidneys, bilateral hydronephrosis>15mm), diagnosis of PUV or abnormal serum creatinine results.

Statistical Analysis

Student T-Test was performed for continuous variables and a Chi square for categorical variables, or Mann Whitney test if an a-parametric test was required. The relationship between amniotic fluid volume (normal / abnormal) and renal outcomes (severe/ non severe) was tested by Chi square test. A logistic regression where the renal outcome is dependent and dichotomous variable (severe/ non severe) was made and the exposure variables were inserted. Alpha of 0.05 was considered as a significant result for all tests.

Results

Figure 1: Research Cohort Selection Process

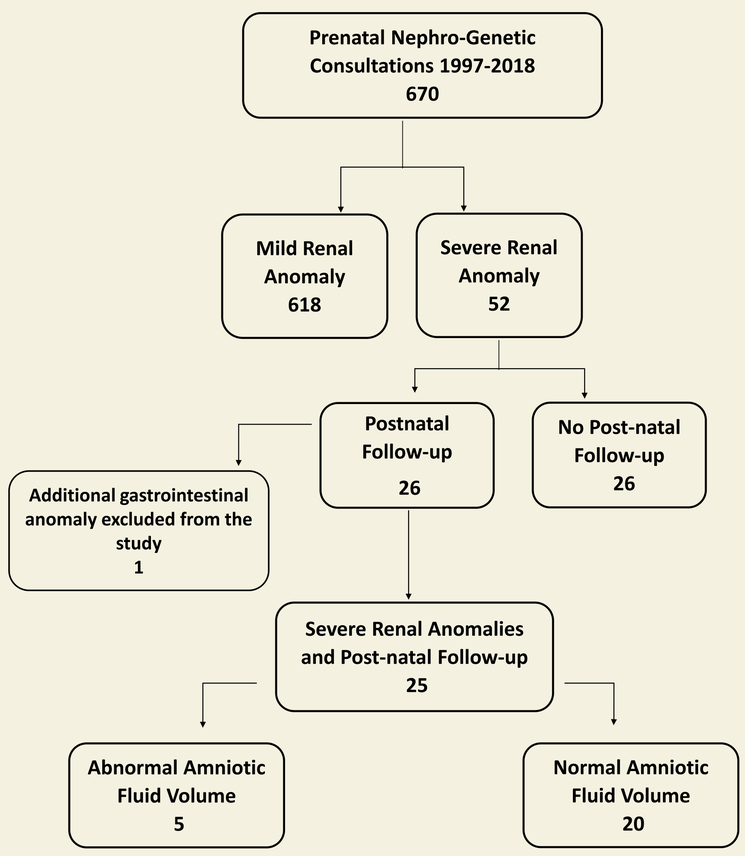

Table 1 - Demographics and Clinical Characteristics of the Study Cohort

	Total (N=25)	Normal AF volume (N=20)	Abnormal AF volume (N=5)	P- value*
Maternal age, years, mean [SD]	29.70 [5.97]	29.95 [6.3]	28.50 [4.36]	**0.35**
Maternal ethnicity, N (%)				
Jewish	12 (48)	10 (50)	2 (40)	**0.69**
Arab	10 (40)	9 (45)	1 (20)	**0.31**
Druze	2(8)	0 (0)	2 (40)	***0.003**
Christian	1(4)	1 (5)	0 (0)	**0.61**
Maternal renal disease, N (%)	1 (4)	1 (5)	0 (0)	**0.61**
Maternal family renal disease, N (%)	3 (12)	2 (10)	1 (20)	**0.54**
Paternal family renal disease , N (%)	3 (12)	3 (15)	0 (0)	**0.36**
Consanguinity, N (%)	4 (16)	3 (15)	1 (20)	**0.79**

AF- amniotic fluid, N- number of cases, SD – Std. deviation

Table 2 - Pregnancy Follow-up and Outcome

	Total (N=25)	Normal AF volume (N=20)	Abnormal AF volume (N=5)	P- value*
Male neonates, N (%)	13 (52)	11 (55)	2 (40)	**0. 55**
Amniocentesis, N	8	7	1	
• Abnormal karyotype	0	0	0	
• Abnormal genetic chip (CMA)	2	1	1	
Type of Severe fetal renal anomaly, N (%)				
• Bilateral hydronephrosis	11(44)	11 (55)	0	***0.027**
• **Bilateral echogenic kidneys**	**10 (40)**	**6 (30)**	**4 (80)**	***0.041**
• Bilateral hypoplastic kidneys	1 (4)	1 (5)	0	**0.61**
• Bilateral cystic kidneys	7 (28)	5 (25)	2 (40)	**0.50**
Non urogenital fetal anomalies , N (%)	7 (28)	4 (20)	3 (60)	**0.075**
Pregnancy termination , N (%)	8 (32)	4 (20)	4 (80)	***0.01**
• Planned	7	4	3	
• IUFD	1	0	1	
• PM autopsy, N	7	4	3	
Birth weight grams, mean [SD]	3308.22 [710.55]	3434.75 [642.14]	2296	

AF- amniotic fluid, N- number of cases, SD- standart deviation, IUFD- intrauterine fetal death, PM- postmortem, CMA – chromosomal microarray

Table 3 - Renal Outcomes

	Total (N=25)	Normal AF volume (N=20)	Abnormal AF volume (N=5)	P- value*
Severe renal outcome, N(%)	**12 (48)**	**7 (35)**	**5 (100)**	***0.009**
Type of Severe Renal Outcome:				
• Severe Bilateral hydronephrosis	2	1	1	
• Bilateral cystic kidneys	1	1	0	
• Bilateral echogenic kidneys	1	0	1	
• Bilateral hypoplastic kidneys	1	1	0	
• Bilateral dysplastic kidneys	4	2	2	
• Posterior Urethral Valves	2	2	0	
• Renal tubular dysgenesis	1	0	1	
Abnormal serum creatinine in newborn, N (%)	2 (11.76)	2 (12.5)	0	
Urologic intervention, N (%)	5 (29.41)	5 (31.25)	0	
Dialysis and renal transplantation , N	1	1	0	

AF- amniotic fluid, N- number of cases

Additional Findings:

1. Fetal echogenic kidneys:
   - Abnormal AF volume was detected in 4/10 cases while 6/10 had normal AF volume.
   - Among fetuses with echogenic kidneys and normal AF volume 50% had severe renal outcome (in autopsy).
   - All fetuses with echogenic kidneys and abnormal AF had severe renal outcome.
2. Prenatal severe bilateral hydronephrosis was diagnosed in 55% of the fetuses with normal AF volume and in none of those with abnormal AF volume.

Study Strengths

- Our cohort is one of the largest in the literature comp
- Our data is comprehensive and include the post-natal follow-up up as well as autopsy results.

Study limitations:

- Due to the retrospective nature of the study, part of the data is missing or incomplete.
- Ultrasound is a subjective examination and can be interpreted differently.
- The size of our cohort is small due to the rarity of the described conditions.

Conclusions

- Normal AF volume is not a protective prognostic factor in cases of severe renal anomalies, as we detected a 35% chance for severe renal outcome in these cases.
- Fetuses with echogenic kidneys and normal AF volume have a 50% chance for severe renal outcome.

References:

1. Mashiach R, Davidovits M, Eisenstein B, et al. Fetal hyperechogenic kidney with normal amniotic fluid volume: a diagnostic dilemma. Prenatal Diagnosis 2005;25:553-8.
2. Carr MC, Benacerraf BR, Estroff JA, Mandell J. Prenatally diagnosed bilateral hyperechoic kidneys with normal amniotic fluid: postnatal outcome. The Journal of Urology 1995;153:442-4.