CONGENITAL ANOMALIES OF THE KIDNEY AND URINARY TRACT (CAKUT) IN CHILDREN BORN SMALL FOR GESTATIONAL AGE (SGA) - OUR EXPERIENCES

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No conflict of interests.

Introduction

- Congenital anomalies of kidney and urinary tract (CAKUT) might occur in 1 of 500 live newborns.
- An acronym/entity CAKUT covers wide range of renal and urinary tract anomalies with various degree of severity and may be presented as a complete renal agenesis as the most severe, to renal hypo-dysplasia, multicystic kidney dysplasia, duplex renal collecting system, ureteropelvic junction obstruction (UPJO), megaureter, posterior urethral valves (PUV), and vesicoureteral reflux (VUR).
- Small for gestational age (SGA) is a potential risk factor which may have an influence in increasing the prevalence of congenital kidney and urinary tract anomalies in children and the progression of CKD.
- **The aim of this study -** our experiences with detected CAKUT in a relatively small cohort of SGA born children in Macedonia. We followed established criteria for diagnose of CAKUT in children and their further follow up.

Abstract

Introduction: Congenital anomalies of the kidney and urinary tract (CAKUT) represent several types of malformations with occurrence of 1 in about 500 live births.

Objective: Small for gestation age (SGA) may influence prevalence of CAKUT and progression of chronic kidney disease (CKD) in children. The aim of this study was to elaborate prevalence, clinical features and outcome of SGA born children with associated CAKUT.

Methods: Our cohort consisted of 100 SGA born children investigated for associated congenital anomalies of urinary tract. We analyzed anthropometric and clinical birth data in these children with diagnosed CAKUT and estimated a stage and time of onset of chronic kidney disease by biochemical and imaging technics.

Results: We revealed that 7 (7.0 %) SGA born children had associated CAKUT. Their mean birth weight was very low (1855gr/-3.93 SDS) and birth length (45.57cm/-2.17 SDS), as well. A significant growth failure with reduced weight and BMI were noticed at the time of diagnosis. A diagnosis of CAKUT in 4/7 of them was established in the first few months of life, but in others 3 later in early childhood. Two of three children diagnosed with unilateral kidney agenesis had normal glomerular filtration rate (GFR). Two children with hypo-dysplastic kidneys and 1 child with vesicoureteral reflux grade 2 had Stage 2 CKD (GFR 60-90 ml/min/1.73m^2). Another patient with vesicoureteral reflux grade 3 was staged 3 CKD at GFR 47.2 ml/min/1.73m^2. One child with stage 5 CKD needed kidney transplantation.

Conclusions: Herein we presented 7 SGA born children with CAKUT from Macedonia. Early recognition, assessment and treatment of these anomalies might improve the quality of life of these children.

Key words: small for gestational age, congenital anomalies of the kidney and urinary tract, glomerular filtration rate, chronic kidney disease

Methods

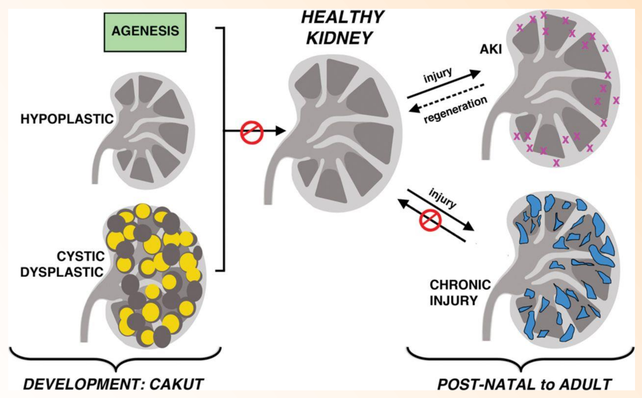
- A group of **100 SGA born children** from Macedonia was evaluated for associated congenital anomalies of urinary tract.
- An **anthropometric and clinical birth data** were analyzed in children with diagnosed CAKUT and **estimated a time of onset and stage of chronic kidney disease** by biochemical and imaging technics.
- **Anthropometrical data were**:

✓ chronological age, gender, height (centimeters), weight (kilograms) and body mass index (BMI in kg/m²).

- **Clinical birth data was evaluated by**:

✓ birth length (BL), birth weight (BW), BL standard deviation score (SDS) and BW SDS.

- **Diagnose of CAKUT was established by biochemical and imaging technics.**



No	BW gr	BW SDS	BL cm	BL SDS	CA y	Gender -	H cm	H SDS	W kg	W SDS	GFR ml/min x 1,73 m^2	PRD -	BMI kg/m^2	BMI SDS
1	1300	-6,4	47	-2	12	M	123,50	-3,30	23,00	-3,51	97,2	agenesio renis	15,08	-1,41
2	1350	-6	40	-5,6	0,1	F	41,00	-6,71	1,85	-7,85	9	agenesio	11,00	-3,76
3	2370	-2,7	47	-1,6	5,2	F	113,00	0,94	25,00	1,98	101,2	agenesio	19,60	2,18
4	1590	-3,7	45	-1,7	4,3	M	92,00	-3,10	12,00	-3,38	88	hypodysplasio	14,81	-0,66
5	2300	-2,5	47	-1,3	0,3	F	59,00	-0,48	4,60	-2,75	61	multicistic dysplastic	13,21	-3,15
6	2130	-3,2	46	-2,1	0,2	M	56,00	-0,90	4,56	-1,57	81,1	VURgr2	14,54	-0,90
7	1950	-3	47	-0,9	0	F	47,00	-3,00	2,00	-4,00	47,2	VUR3	9,05	-4,33
Average	1.855,71	-3,93	45,57	-2,17	3,18		75,93	-2,36	10,43	-3,01	69,24	-	13,90	-1,72

Results

✓ **Seven (7.0 %) SGA born children were diagnosed with CAKUT, 4 girls and 3 boys;**

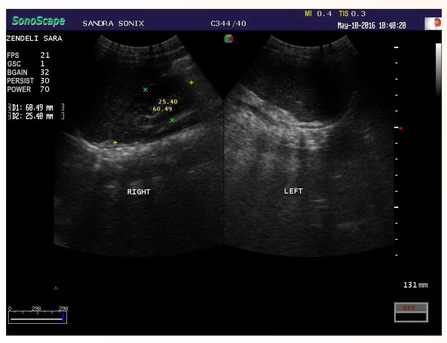
✓ **Very low birth parameters, mean birth weight (1855gr/-3.93 SDS) and birth length (45.57cm/-2.17 SDS);**

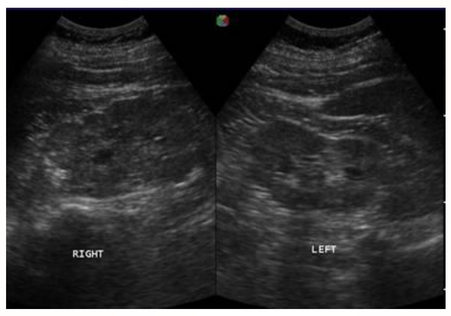
✓ **Growth failure (-2,36 SDS) with reduced weight (-3,01 SDS) and BMI (-1,72 SDS) at the time of diagnosis establishment;**

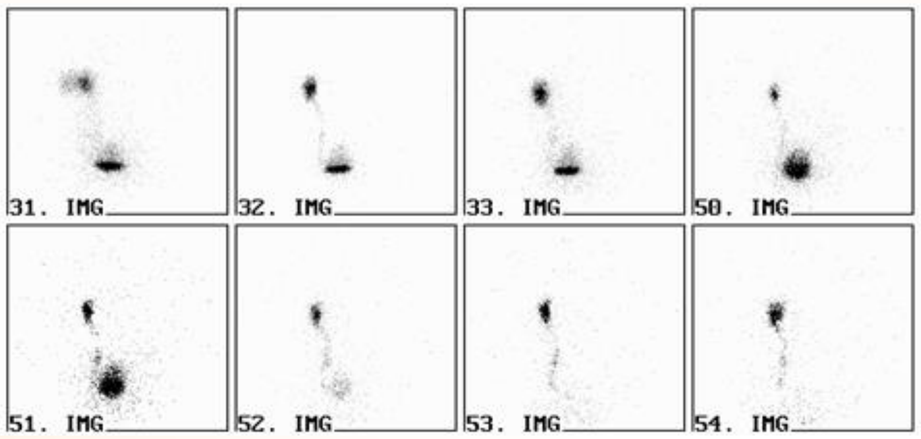
✓ **Time of diagnosed: 4/7 children - in the first few months of life, others 3/7 - later in early childhood;**

✓ **Stage of chronic kidney disease (CKD):**

- **Normal glomerular filtration rate (GFR) – 2/3 children diagnosed with unilateral kidney agenesis;**
- **Stage 2 CKD (GFR 60-90 ml/min/1.73m^2) - 2 children with hypo-dysplastic kidneys and 1 child with vesicoureteral reflux grade 2;**
- **Stage 3 CKD at GFR 47.2 ml/min/1.73m^2 - 1 child with vesicoureteral reflux grade 3;**
- **Stage 4 CKD – none;**
- **Stage 5 CKD (GFR 9 ml/min/1,73 m^2) - one patient and needed kidney transplantation;**







Discussion

✓ Nephrogenesis finishes around 36 week of gestation;

✓ If a child is born very premature or with intrauterine growth retardation (IUGR) is more likely to develop a renal disease due to reduced nephron number;

✓ Brenner's hyper filtration theory (1);

✓ Several studies implicate the influence of urinary tract anomalies on birth weight and length and growth spurt during childhood;

✓ 33% patients with CAKUT are born premature, and 28% with low birth parameters (2);

✓ More often episodes of hypertension and/or microalbuminuria and lower GFR in young boys older than 20yr born IUGR/SGA with mainly normal renal function (2);

✓ Karlberg et al. found that all detected patients with CKD were born with reduced BW and BL SDS by 1 SDS (3):

✓ Franke et al. in their study showed significantly elevated rate of SGA and prematurity in children with congenital CKD (4);

✓ Lower birth weight corresponds with greater growth failure and more significant kidney and urinary tract malformation (5);

Conclusions

SGA born children are at risk for developing obesity, hypertension, insulin resistance, diabetes, cardiovascular diseases and renal failure in adulthood.

Seven SGA born children with CAKUT from Macedonia were presented in this study.

Our hope is with an early diagnose and adequate treatment of anomalies will improve their outcome.

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DOI: 10.3252/pso.eu.55ESPE.2016

Poster presented at: ESPE 2016 PARIS 10-13 SEPTEMBER