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Potter syndrome, a rare entity with high recurrence risk in women with renal malformations ā case report and a review of the literature

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ABSTRACT

Potter syndrome represents an association between a specific phenotype and pulmonary hypoplasia as a result of oligohydramnios that can appear in different pathological conditions. Thus, Potter syndrome type 1 or autosomal recessive polycystic renal disease is a relatively rare pathology and with poor prognosis when it is diagnosed during the intrauterine life. We present the case of a 24-year-old female with an evolving pregnancy, 22/23 gestational weeks, in which the fetal ultrasound revealed oligohydramnios, polycystic renal dysplasia and pulmonary hypoplasia. The personal pathological history revealed the fact that 2 years before this pregnancy, the patient presented a therapeutic abortion at 16 gestational weeks for the same reasons. The maternal ultrasound showed unilateral maternal renal agenesis. Due to the fact that the identified fetal malformation was incompatible with life, we decided to induce the therapeutic abortion. The particularity of the case consists in diagnosing Potter syndrome in two successive pregnancies in a 24-year-old female, without any significant family history, but who is diagnosed with unilateral renal agenesis.

Keywords: Potter syndrome, autosomal recessive polycystic renal disease, oligohydramnios

Abbreviations:
ARPKD: autosomal recessive polycystic kidney disease
Hb: hemoglobin
Leu: leukocytes
Neu: neutrophils

INTRODUCTION

Renal development anomalies represent a very frequent category of congenital malformations, approximately 20-30% of all developmental structural defects leading in many cases to end stage chronic kidney disease (1).

Autosomal recessive polycystic kidney disease (ARPKD) is a relatively rare pathology presenting an incidence of approximately 1 in 20,000 live newborns, characterized by the abnormal elongation of collector tubes that transform into multiple small renal cysts (2). The transmission of this pathology is realized after the autosomal recessive pattern, and the most frequent gene that was incriminated to be involved in its etiology is PKHD1 (3). Nevertheless, due to the fact that a small part of these children survive the neonatal period without presenting severe symptomatology, it was hypothesized that there would also exist mutations in other genes that could lead to ARPKD (4). The cystic dilation of the tubes appears especially in the medullary due to their physiological lack within the cortex, being of different sized (2). The intrauterine diagnosis is established in most of the cases during the 2nd trimester of pregnancy, and the most fre-

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quent ultrasound aspect is of very increases size kidneys, hyperechoic, without corticomedullary differentiation. This aspect can be associated with pulmonary hypoplasia and oligohydramnios, case in which the prognosis is extremely poor leading in most of the cases to fetal or neonatal death (2). The synonyms for ARPKD are infantile polycystic kidney disease or Potter type 1 (2).

Potter syndrome, also called Potter or oligohydramnios sequence implies the association between certain phenotypic features and pulmonary hypoplasia as a direct result of oligohydramnios and compression during intrauterine life (5). The syndrome was named after the pathologist Edith Potter, who described for the first time, in 1946, the characteristic facial features associated to bilateral renal agenesis, but there are also other causes that can lead to oligohydramnios such as: obstructive uropathy, kidney polycystic disease, renal hypoplasia and premature membrane rupture (5). Thus, the classical Potter syndrome involves bilateral renal agenesis, but there are also another 4 subcategories of Potter syndrome that develop as a result of other clinical entities, thus: type 1 Potter syndrome or ARPKD, type 2 Potter syndrome or renal dysplasia, type 3 Potter syndrome or autosomal dominant polycystic kidney disease and type 4 Potter syndrome or obstructive uropathy (either at the level of ureter, either at the level of kidney) (6).

The prognosis of patients with type 1 Potter syndrome depends mostly on the time of diagnosis, thus the prognosis is as severe as sooner the renal microcysts develop, and in case these patients survive the neonatal period, the prognosis improves considerably (2).

CASE REPORT

We present the case of a 24-year-old female with an evolving pregnancy, 22/23 gestational weeks, whose fetus was discovered with an incompatible with life renal malformation at the routine fetal ultrasound, therefore being admitted in our clinic in order to induce a therapeutic abortion. The family history did not point out any significant pathological elements, but the personal one revealed the fact that the patient presented another pregnancy approximately 2 years before for which she also underwent a therapeutic abortion at 16 gestational weeks due to the fact that the fetus was diagnosed with Potter syndrome intrauterine.

Both the clinical exam and the local one were in normal limits at the moment of admission. The laboratory tests were relatively normal, with minor modifications, such as: mild anemia (Hb 11.3 g/dL), minor leukocytosis with neutrophilia (Leu 12,200/μL, Neu 10,200/μ), but the inflammatory biomarkers were in normal ranges. We also assessed the maternal hepatic and renal functions, and the single pathological element identified was a mildly increased value of urea (44.62 mg/dL), but the value of creatinine was within normal ranges.

The fetal ultrasound revealed the following elements: the fetal biometry adequate for a gestational age of 22/23 gestational weeks, alive fetus in uncomplete pelvic position, buttocks pattern, absent amniotic fluid by lack of production, both fetal kidneys with polycystic dysplasia, deformed fetal thorax, with cardiac surface >50% and obvious pulmonary hypoplasia, therefore establishing the diagnosis of Potter syndrome (Fig 1, 2, 3, 4).

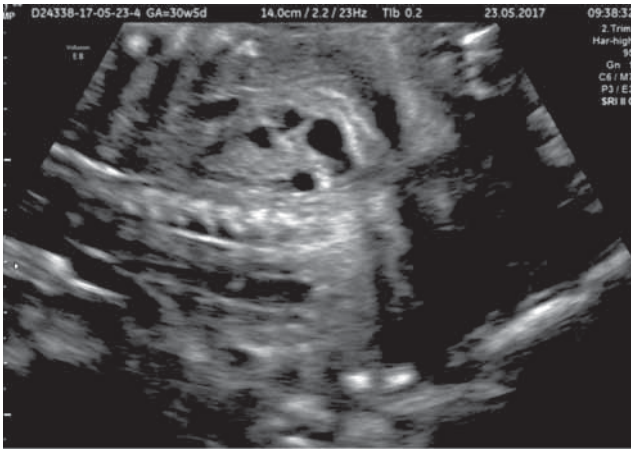

FIGURE 1. *Right fetal kidney (sagittal section)*

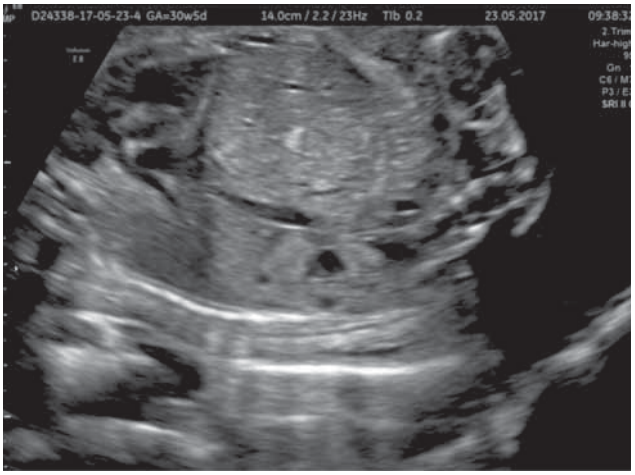

FIGURE 2. *Left fetal kidney (sagittal section)*

We also assessed the maternal kidneys by ultrasound and we identified a single maternal kidney with moderate pelvic-calyces dilation, but with normal function. Based on these facts and the recurrence of Potter syndrome we raised the suspicion of a hereditary genetic mutation, the patient being referred for genetic counseling.

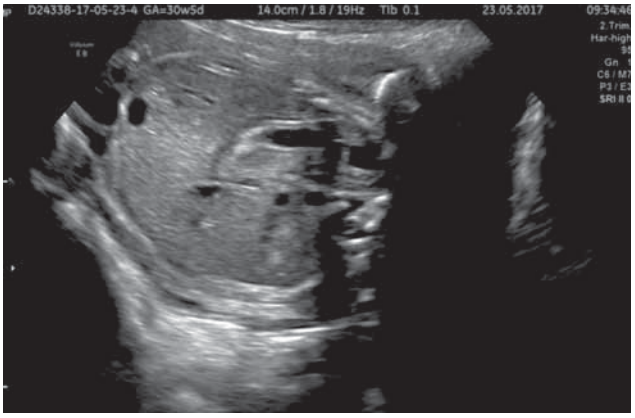

FIGURE 3. *Lumbar transversal section with both kidneys polycystic*

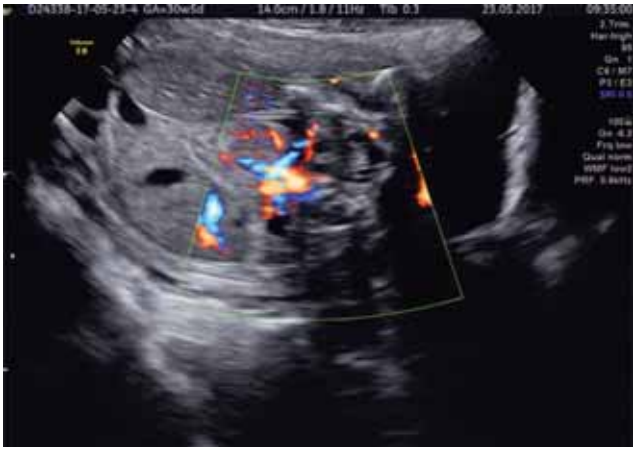

FIGURE 4. *Renal arteries and veins in fetal transversal section*

Due to the fact that Potter syndrome comprised multiple severe malformations, being incompatible with life, we decided to induce a therapeutic abortion.

The particularity of the case consists in diagnosing Potter syndrome in two successive pregnancies in a 24-year-old female, without any significant family history, but who is diagnosed with unilateral renal agenesis.

DISCUSSIONS

Potter syndrome is a relatively rare pathology, whose incidence varies between 1:2000 and 1:5000 cases (7), being the direct result of oligohydramnios that can develop under certain pathological conditions. This syndrome appears more frequently in males (8). Adequate renal development is essential for the production of amniotic fluid therefore any renal malformation that leads to the impossibility of urine production or elimination will lead to oligohydramnios or even anhydramnios. For example, in case of classical Potter syndrome or that associated to bilateral renal agenesis, the most severe form of Potter syndrome, the metanephros will not result into kidneys development (9). Oligohydramnios causes restrictions of mobility and growth leading to different physical deformities, thus the Potter characteristic phenotype can be associated to any urogenital malformation that is responsible for intrauterine fetal micturition (10, 11). Among the classical phenotypical anomalies of Potter syndrome can be encountered: jaw hypoplasia, inferior limbs contracture or hypoplasia, bilateral renal dysgenesis, pulmonary hypoplasia etc. (12-14).

After the age of 16 gestational weeks, the quantity of amniotic fluid is directly dependent on the production of fetal urine that is essential for both the pulmonary development by providing the hydrodynamic pressure required for the alveolar distention, and for lung maturation by providing proline, an aminoacid required for this process (12). Therefore in the lack of an adequate production of urine, pulmonary hypoplasia will develop. Similarly, in our case, the fetus also presented pulmonary hypoplasia. Even though there do not exist any prevention methods for this pathology, a screening ultrasound is recommended for oligohydramnios and urogenital malformation between 16 and 18 gestational weeks (15). There are also studies that sustain that morphological ultrasound for identifying fetal anomalies is essential between 20 and 22 gestational weeks (16).

The recurrence risk for Potter syndrome is between 3 and 6% (8), fact that sustains the major importance of genetic counseling in case of pregnant women whose fetus is diagnosed with this syndrome. Similarly, in the above presented case, the patient had two consecutive pregnancies with therapeutic abortion for the intrauterine diagnosis of Potter syndrome. It is important to mention that by performing a maternal ultrasound, we noticed that the patient presented unilateral renal agenesis raising the suspicion of a hereditary genetic condition. The involvement of the geneticist in the management of this type of cases in order to provide an adequate genetic counseling for the couple is essential (16). The recurrence risk is much higher in case of consanguine marriages, being described cases of recurrent Potter syndrome even since 20th century in case of consanguinity (17). In our case, none of the two pregnancies resulted from consanguinity.

Even though type 1 Potter syndrome or ARPKD presents an increased mortality rate in the first month of life, without benefiting from any prophylactic or therapeutic effective method until the present moment, except for renal transplantation, the

novel molecular technologies together with the classical genetic ones try to identify targeted and individualized therapeutic methods in this aim.

CONCLUSIONS

Potter syndrome is a rare pathology, with recurrence risk that represents the association between a particular characteristic aspect, different renal malformation and pulmonary hypoplasia as a direct result of oligohydramnios. The prognosis is as poorer as the complications develop earlier. In case of intrauterine diagnosis, in most of the cases, therapeutic abortion is the preferred approach due to its incompatibility with life. Genetic counseling is essential in the adequate management of these cases.

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