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Ultrasound evaluation of prognosis in fetuses with posterior urethral valves

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Abstract

Purpose: The aim of this study was to evaluate the ability of prenatal ultrasound markers to predict postnatal renal prognosis in fetuses with posterior urethral valves.

Methods: Medical files on fetuses with prenatal diagnosis of posterior urethral valves from 2000 to 2006 were reviewed retrospectively. Data from prenatal follow-up included gestational age at diagnosis, ultrasound renal parenchyma evaluation, and presence and time of oligohydramnios onset. Prenatal parameters studied were correlated to postnatal renal function.

Results: Thirty-one male fetuses were included. Six pregnancies were terminated. Of the remaining 25 pregnancies that were continued, 4 children had abnormal creatine and 21 normal creatinine levels at follow-up. Presence and time of oligohydramnios onset did not differ between groups (P = .43). Ultrasound detected bilateral renal abnormalities in 3 fetuses (75%) with altered renal function, and 10 fetuses (55%) with normal creatinine, at follow-up.

Conclusions: None of the ultrasound parameters evaluated were able to reliably predict postnatal renal function.

1. Background

Posterior urethral valves (PUV) are the main cause of end-stage renal failure in male children [1-4]. In cases with prenatal suspicion of PUV, ultrasound assessment of prognosis is important to guide parents' counseling and indicate invasive evaluation of renal function [5-10]. Furthermore, if intrauterine procedures such as vesicoamniotic shunts are considered, the evaluation of renal function may help to adequately select patients eligible for the procedure [11]. Several ultrasound parameters have been proposed as predictors of long-term renal function, such as amniotic fluid index and renal parenchyma evaluation [6,8,12-22]. However, previous studies have

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been inconclusive concerning the optimal ultrasound parameters for predicting long-term renal function. Furthermore, most previous studies have included multiple causes of low urinary tract obstruction (LUTO) in evaluation, confounding prenatal evaluations. Finally, ultrasound equipment used in these studies was heterogeneous, and most of these investigations were performed more than 10 years ago. The quality of renal parenchyma imaging has improved dramatically in recent years with the use of modern techniques such as high frequency probes and harmonic imaging. These improvements should provide a more accurate ultrasound evaluation of renal function.

Complementary to ultrasound evaluation, some centers suggest the use of fetal biomarkers of renal impairment in selected cases. Biochemical evaluation of fetal renal function (urinary sodium and β_2-microglobulin, serum β_2-microglobulin) may be performed when ultrasound markers suggest renal impairment. However, controversies over biochemical analysis, as well as the optimal cutoff for each marker, are common in the literature [16,23,24]. Therefore, many centers choose not to perform invasive procedures to obtain blood and urine samples for biochemistry evaluation. Instead, centers rely exclusively on ultrasound markers for prognostic evaluation and counseling.

For this reason, we aimed to evaluate the ability of ultrasound alone to predict renal failure in early childhood in children with prenatally detected PUV. A secondary objective was to describe survival and renal outcome for these fetuses.

2. Methods

Records of all fetuses followed up in our prenatal care center between 2000 and 2006 for PUV were reviewed retrospectively. When PUV was suspected, careful follow-up was initiated, and ultrasound evaluation of renal function was performed. Our protocol was to perform biochemical urine or blood evaluation (sodium and β_2-microglobulin in urine and β_2-microglobulin alone in blood) whenever ultrasound markers suggested renal impairment. Termination of pregnancy was considered in those cases displaying abnormal results on ultrasound and biochemical evaluations.

Ultrasound was performed using a Voluson 730 ultrasound machine (Kretztechnik, Zipf, Austria), with a 4- to 8-MHz transducer. Data used for prenatal evaluation were gestational age (GA) at diagnosis, renal parenchyma evaluation (echogenicity and differentiation), presence and GA at oligohydramnios and anamnios onset, and presence of urinary ascites or urinoma.

Kidneys were considered hyperechogenic if cortical echogenicity was higher than the echogenicity of the adjacent liver (Fig. 1). Kidneys were considered to lack corticomedullary differentiation if there was no difference between the echogenicity of the cortex and of the medulla (Fig. 2).

Fig. 1 Longitudinal view of a kidney showing renal hyperechogenicity with normal corticomedullary differentiation. Small arrows indicate kidney delimitation; big arrow, liver.

Oligohydramnios was defined as an amniotic fluid index of less than 5 cm. Anamnios was defined as the absence of amniotic fluid on ultrasound examination.

Prenatal vesicoamniotic shunts for management of PUV are not routinely performed at our center. The option of peritoneoamniotic shunt was discussed with parents if the fetus had urinary ascites and oligohydramnios.

Termination of pregnancy was acceptable according to French law in the event of oligohydramnios or anamnios where both ultrasound and biochemical evaluations showed fetal renal failure [25,26]. When parents chose to terminate pregnancy, the corresponding autopsy data were recorded.

Data considered for the postnatal evaluation were age at surgery, number of surgeries, first-month creatinine level, creatinine level between 1 and 2 years, creatinine level at last follow-up, and need for antihypertensive drugs.

Children who had a 1-year creatinine level lower than 50 μmol/L (0.57 mg/dL) were considered to have normal

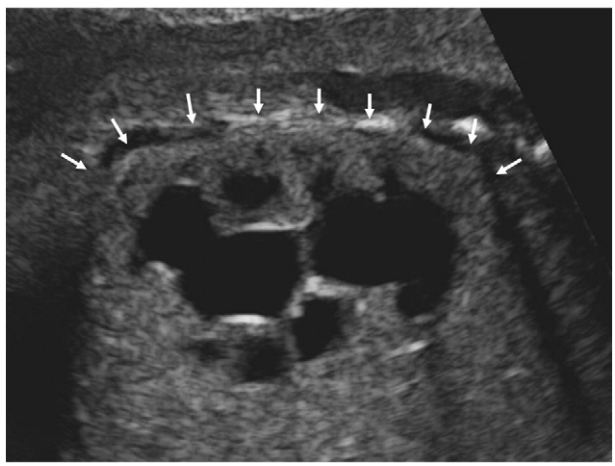

Fig. 2 Longitudinal view of a kidney showing lack of differentiation with normal echogenicity. Arrows indicate kidney delimitation.