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ORIGINAL ARTICLE

Influence of postnatal hydroureter in determining the need for voiding cystourethrogram in children with high-grade hydronephrosis

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KEYWORDS

Voiding cystourethrography;
Congenital hydronephrosis;
Vesico-ureteric reflux;
Pelvi-ureteric junction obstruction

ABBREVIATIONS

APD, antero-posterior diameter;
CI, confidence interval;
fUTI, febrile UTI;
OR, odds ratio;
PH, postnatal hydro-

Abstract ***Objective:*** To evaluate the utility of hydroureter (HU) to identify high-grade vesico-ureteric reflux (VUR) in patients with high-grade postnatal hydronephrosis (PH).

Patients and methods: We retrospectively reviewed patients' charts that had antenatal hydronephrosis from 2008 to 2014. Patients were excluded if they presented with febrile urinary tract infection (fUTI), neurogenic bladder, posterior urethral valve, multi-cystic dysplastic kidney, and multiple congenital malformations. We reviewed postnatal ultrasonography images and patients with Society of Fetal Urology (SFU) Grades 3 and 4 hydronephrosis with a renal pelvic antero-posterior diameter of $\geq$10 mm were included. The ureter was assessed and considered dilated if the ureteric diameter was $\geq$4 mm. The voiding cystourethrogram (VCUG) studies, fUTI incidence, and surgical reports were reviewed.

Results: Of the 654 patients reviewed, we included 148 patients (164 renal units) of whom 113 (76.4%) were male and 35 (23.6%) female. SFU Grade 3 PH was identified in 49% of the renal units, with the remaining 51% being SFU Grade 4. HU was found in 50/164 renal units and was not detected in the remaining 114 units. VUR was diagnosed in four units (3.5%) without HU (low-grade VUR); whilst it

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nephrosis;
NU, normal ureter;
HU, hydroureter;
HGH, high-grade postnatal hydronephrosis;
(N)(P)PV, (negative) (positive) predictive value;
SFU, Society for Fetal Urology;
PUJO, PUJ obstruction;
US, ultrasonography;
VCUG, voiding cystourethrogram

was detected in 19 units (38%) with HU (72.7% were high-grade VUR) ($P < 0.001$). VUR was diagnosed on the contralateral side in four/105 patients with PH without HU and diagnosed in 10/43 patients with PH with HU ($P < 0.001$). During a median follow-up of 25.9 months, none of the renal units that had VUR without HU developed UTI or had surgeries.

Conclusion: Low-grade uncomplicated VUR was diagnosed in 3.5% of renal units without HU. Our results support limiting the use of VCUG to renal units with PH if associated with HU.

Introduction

Antenatal hydronephrosis is one of the most common congenital anomalies being diagnosed in 1–5% of all pregnancies [1]. PUJ obstruction (PUJO) has been found to be the most common cause of high-grade postnatal hydronephrosis (HGH) [2]. When primary PUJO is associated with VUR, low-grade reflux predominates [3]. On the other hand, high-grade VUR associated with secondary PUJO is more often associated with dilated tortuous ureter [3,4].

Most available protocols for the management of HGH recommend a voiding cystourethrogram (VCUG) for all patients [1,5]. However, when VUR coexists with HGH without hydroureter (HU), it is of low-grade and tends to resolve spontaneously after surgery [3]. Hence, for better utilisation of resources, the re-evaluation of the role of VCUG in the evaluation of HGH is warranted.

Our hypothesis was that in HGH, the absence of HU on ultrasonography (US) excludes high-grade VUR in the vast majority of cases, thus precluding the need for VCUG in the primary assessment of these patients. Therefore, in the present study, we evaluated patients with HGH and correlated the findings of VCUG with the presence or absence of HU.

Patient and methods

Review of patients' charts was initiated after receiving the approval of the Local Review Board. We retrospectively reviewed all patients' data presented to our tertiary care institution with antenatal hydronephrosis from January 2008 to June 2014. We included only patients who had presented in the first year of life. Renal units with single renal system were only included. We excluded patients who presented initially with febrile UTI (fUTI), neurogenic bladder, posterior urethral valve, multi-cystic dysplastic kidney, and patients with multiple congenital malformations.

We collected patients' demographic data, side of hydronephrosis, and laterality. Postnatal renal US images were reviewed by a single investigator (A.H). All investigations were blindly reviewed in relation to the outcome. All abdominal US sessions within the first year of life were reviewed. Ureteric diameter and renal pelvic antero-posterior diameter (APD) were measured in every US. Findings with the highest values were recorded. We only included patients with Society of Fetal Urology (SFU) Grade 3 and 4 postnatal hydronephrosis (PH) with a renal pelvic antero-posterior diameter (APD) of $\geq$10 mm. Renal units with a renal pelvic APD of $\geq$10 mm were recruited, as the Society for Pediatric Urology (SPU) consensus considered postnatal renal pelvis dilatation of $>$10 mm to be more suggestive of PUJ pathology [6]. The renal pelvic APD was measured in the transverse plane of the kidney. SFU Grade 3 was defined as diffuse calyceal dilatation without parenchymal thinning and SFU Grade 4 was considered when calyceal dilatation was associated with parenchymal thinning [7]. Moreover, the status of the retro-vesical ureter was evaluated. The ureter was measured, if it could be visualised in any of the reviewed US images, in the transverse plane. When the ureter was not visualised, we considered its diameter to be 0 mm. The mean ureteric diameter up to the age of 3 years usually does not exceed 4 mm [8,9]. Hence, if the ureteric diameter was $\geq$4 mm with a full bladder, we considered it to be HU.

Cyclic VCUG was carried out in all patients, aiming to detect occult VUR that might not appear in standard VCUG [10]. Cyclic VCUG was performed with two consecutive fillings of contrast according to bladder capacity according to age. VUR was looked for during the filling and voiding phases then, if present, the grade of VUR was recorded. We graded VUR according to the International classification of VUR [11]. Surgical

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