

ULTRASOUND EVALUATION OF RENAL SCARRING IN CHILDREN WITH VESICoureTRAL REFLUX

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ABSTRACT

Introduction: Renal damage and subsequent scarring constitute a significant problem in children with vesicoureteral reflux (VUR). Most studies have shown 99mTc dimercaptosuccinic acid (DMSA) scintigraphy to be the most sensitive method of detecting renal scarring. It has been widely accepted that ultrasound should be the initial investigation of urinary tract infection. The noninvasive nature of ultrasound, its lack of ionizing radiation and the ease with which investigations can be repeated are advantages of this method. Until now there are relatively few studies comparing DMSA scintigraphy and ultrasound. This study compares directly the ability of DMSA scintigraphy and ultrasound to detect renal scarring.

Material and Methods: We evaluated the charts of 88 patients who had undergone both ultrasound and DMSA scintigraphy for primary VUR. The ultrasounds were reviewed by one consultant radiologist and renal scars were deemed diffuse or focal. The data were analyzed to determine the sensitivity, specificity, positive and negative predictive value of the renal ultrasound in detecting focal and diffuse renal scars.

Results: Renal ultrasound detected focal or diffuse renal scarring in 41 patients. Ultrasound examination correlated with the DMSA study in 36 patients. On the other hand, of the 47 patients with normal ultrasonography, the DMSA study showed renal scars in 14 patients. The sensitivity, specificity, positive and negative predictive value were 66%, 84%, 87.5% and 61%, respectively. Of the focal scars, ultrasound examination correlated in only 8 patients (32%). On the other hand, of the 29 patients with diffuse scarring, ultrasound scanning demonstrated scars in 28 (96.5%).

Conclusion: This study suggests that a high-resolution ultrasound performed by experienced ultrasound technicians is able to accurately detect diffuse renal scarring. When focal scarring was present, the correlation was poor.

Key words: vesico-ureteral reflux; kidney; ultrasonography; DMSA renal scanning

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INTRODUCTION

The reflux nephropathy is one of the few causes of terminal renal disease which can be prevented through its diagnosis and adequate treatment of the vesicoureteral reflux (VUR). Renal scarring are the main lesions associated to VUR and they occur due to an association of reflux and urinary

infection (1). At the moment of the diagnosis 30 to 50% of the children presented renal scarring (2). The present treatment for VUR has the objective of preventing infectious episodes through clinical watchful and antibiotic prophylaxis, as the surgery is indicated just to selected cases (3,4).

The evaluation of the renal parenchyma through a scintigraphic study (dimercaptosuccinic acid – DMSA) proved to be better than excretory

urography and renal ultrasound for detection of renal scarring (5). Due to its low cost and feasibility, some authors have suggested the use of renal ultrasound as the examination of choice in children who have VUR, being excretory urography and DMSA performed only in selected cases.

The objective of this study is to analyze the accuracy of renal ultrasound in detecting renal scarring in patients who had VUR in our institution.

MATERIAL AND METHODS

The charts of 814 patients who had VUR treated in our institution in the period from July of 1968 to December 1999 were retrospectively evaluated. From these patients, 88 underwent renal ultrasound and DMSA at the moment of the diagnosis. The patients' age varied from 6 months to 12 years old (mean = 4.6 years). All patients were first submitted to clinical management with antibiotic prophylaxis.

All patients whose ultrasound and scintigraphic examinations were available to revision were included in this study. All patients included in the study had their exams reevaluated, and the images and reports revised by only one examiner (pediatric radiologist). The presence of renal scarring and their posterior classification in focal or diffuse was determined through the scintigraphic exam (DMSA). When the renal parenchyma presented more than 2 focal scarring, global lesions and/or differential function lower than 40%, the scarring was classified as diffuse (6).

The ultrasonographic findings were compared to the DMSA ones and it was determined the sensibility, specificity, positive and negative predictive value in detecting focal and diffuse renal scarring.

RESULTS

Considering the 88 studied patients, the VUR was grade I in 7 (7.9%), grade II in 14 (15.9%), grade III in 26 (29.5%), grade IV in 27 (30.7%) and grade V in 14 (15.9%). The VUR was unilateral in 34 patients (51%) and bilateral in 43 (49%); consequently, 131 renal units with reflux were studied. It was evident in the scintilographic examination (DMSA), 54 renal scarring (41.2%), being 25 focal and 29 diffuse. Table-1 demonstrates the presence of renal scarring according to the grade of VUR. Among the patients who presented focal scarring, we noticed correlation with the ultrasound examinations in only 8 cases (32%). On the other hand, from the 29 renal cases who presented diffuse scarring, there was a correlation with the ultrasound examination in 28 cases (96.5%).

From the 41 patients who presented high evidences of renal scarring in the ultrasound examination, there was confirmation of this finding through DMSA in 36 cases. On the other hand, DMSA examination detected renal scarring in 18 patients out of 47 patients who presented normal ultrasound examination. These results demonstrate that the ultrasound examination presents 66% of sensibility and 85.2% of specificity to detect renal scarring. The positive and negative predictive values of this examination are 87.8% and 61.7%, respectively.

Table 1 - Renal scars detected through DMSA stratified according to the vesicouretral reflux (VUR) grade.

VUR Grade	Focal Scars (%)	Diffuse Scars (%)
I (n = 7)	2 (28.5)	1 (14.2)
II (n = 14)	4 (28.5)	2 (14.2)
III (n = 26)	5 (19.2)	6 (23)
IV (n = 27)	9 (33.3)	13 (48.1)
V (n = 14)	5 (35.7)	7 (50)

DISCUSSION

Renal ultrasound examination has been playing an important role in the evaluation of urinary tract pathologies, mainly due to its feasibility, low cost, absence of morbidity, besides the high resolution of the most modern equipment. It is well known that the evaluation of renal parenchyma plays a fundamental role in patients with vesicouretral reflux, as the presence of renal scarring is determinant of worse prognosis and in more severe cases may lead to chronic renal failure. Excretory urogram for evaluating the renal parenchyma has been replaced in the last years by the scintigraphic study (DMSA). Several studies have stated the superiority of the DMSA in detection of renal scarring, and nowadays this method is considered the “gold standard” (7).

In our study we observed that ultrasound examination was not able to detect small scars, since for focal scars detected with the DMSA, there was correlation with ultrasound examination in only 32% of the cases. However, when the kidney presented scars classified as diffuse with DMSA, the ultrasound was able to detect 96.5% of the cases. Tasker et al. (8), in a study performed in 100 children with VUR, found scars in 19 cases. When these findings were correlated with the ultrasound examination, it was shown that this procedure was able to diagnose only 1 out of 12 patients with segmental scars, while it was able to diagnose all patients with diffuse scars (100%).

Examining the data related to sensibility, specificity, positive and negative predictive values of the ultrasound examination, we observed that they present high positive predictive values and specificity, while their negative predictive values and sensibility were low. That is, when the ultrasound shows a scar, it will probably be confirmed by the DMSA. On the other hand, when the ultrasound examination is normal, we can infer that probably it does not exist diffuse scars.

In spite of some limitations of this method, ultrasound examination plays an important role for patients with VUR. The current treatment for VUR consists of prevention of renal lesions, which in severe cases could lead to reflux nephropathy. Several

studies have suggested that clinical treatment with antibiotic prophylaxis presents high rates of spontaneous resolution, depending mainly on the grade of VUR and on the patient’s age at the time of the diagnosis (9). When these patients presented favorable evolution according to clinical treatment, the occurrence of new scars or even progression of the previous ones is rather rare. For this reason, some authors have shown that scintigraphic evaluation must be performed only in selected cases, and they suggest that the findings of this examination have presented less impact in the patients’ treatment, when compared to treatments that were initially considered (10). Despite the fact that the DMSA is the most accurate method to detect renal scars, these studies have stated that the detection of these lesions did not play a fundamental role in determining the procedures (10). Bellinger (11) observed that DMSA scanning would be better indicated for cases in which the ultrasound shows renal lesion, dysplasia, severe hydronephrosis or VUR of high grade level, before deciding between ureteral reimplantation or nephrectomy.

CONCLUSION

When the ultrasound examination is performed by an experienced operator with high resolution equipment, it presents good accuracy in detecting diffuse scars; however, it is not accurate to detect focal scars. Patients who have primary VUR of low level and with no recurrent infections, usually present no renal scars or only focal scars, not leading to progression. Consequently, in this group, ultrasound can be used for evaluation and follow up. Scintigraphic examination would be indicated for patients with alterations in ultrasound examination or when there is a higher possibility of detecting new renal scars, as for those patients with VUR of high grade, associated voiding disorders and recurrent urinary infections.

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