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Emergency evaluation of the renourinary tract by ultrasonography in pediatric population

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Abstract

Ultrasonography (US) is a very useful technique in the imaging investigation of the renourinary tract. Compared with other imaging techniques, US offers the following advantages: it is non-invasive; there is no radiation exposure required; there is no need for contrast media administration; it is a bedside examination.

US is indicated in: renal colic, acute urinary tract infection, voiding dysfunction, renal vein thrombosis, abdominal mass, renal trauma.

The advantages of US in renal emergencies evaluation justify the present tendencies of formation of emergency medicine specialists with expertise in US exploration of the abdomen.

Keywords: ultrasound, emergency, urinary tract

Imaging investigations offer valuable information for the diagnosis of acute renourinary disease. The traditional investigation method, intravenous pyelography, has been more and more frequently replaced by the modern investigation techniques such as the helical CT. Within the different investigation methods, US has retained its value as the first investigation in emergency, because it is non-invasive, it can be performed at bedside and does not expose the patient to radiation or contrast media.

Standard US gives information about the anatomy of the renourinary tract and the rest of the abdominal organs, when differential diagnosis is required. US is non-invasive and does not need administration of contrast media which are nephrotoxic (and contraindicated in patients with renal failure) and may induce anaphylactic reaction.

The ultrasound machines that have Doppler technology allow the visualisation of the urinary flow. Unlike other imaging techniques US does not give information on the function of the kidneys.

There are a series of renourinary emergencies where the US exam is indicated: renal colic, acute urinary tract infection, renal trauma, acute urinary retention, renal failure, renal tumor, renal vein acute thrombosis.

Renal colic is caused by the obstruction and acute distension of the supravesical urinary tract and is manifested through intense lumbar pain irradiating towards the abdomen and external genital organs. Frequently it associates dispeptic symptoms like nausea and vomiting. The most

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frequent cause of renal colic is urinary lithiasis, but it may also be induced by a blood clot or by a ureteral spasm.

The first choice method for renal calculi visualisation is CT that offers also information about their size. US may show especially basinetal calculi, that produce acoustic shadow (fig.1). US is not as useful in finding very small calculi or those that have migrated into the ureter.

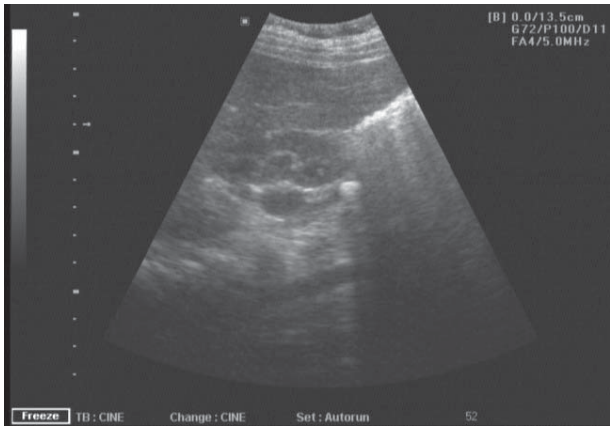


Fig.1. Lithiasis in the proximal right ureter (hyperechogenic image with acoustic shadow).

US shows the hydronephrosis, that is the consequence of the obstruction produced by the calculi (fig.2). In relation to the shape of the calices, the intensity of the hydronephrosis may be evaluated. In medium and severe forms of hydronephrosis the calices become "blunt" (they lose their cup shape). A study on the value of US in urinary lithiasis diagnosis, using as a diagnosis criteria, the visualisation of the calculus and/or unilateral hydronephrosis, demonstrated a sensitivity of the method of 85% and a specificity of 100% [1-2].

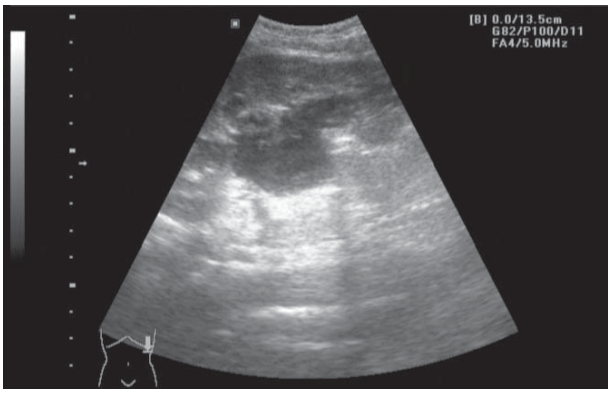


Fig.2. Left hydronephrosis due to ureteral lithiasis.

In children hospitalized in the emergency unit for **acute renal failure**, US represents one of the first imaging techniques because it does not require administration of contrast media. In acute renal failure of postrenal cause US shows dilatation of urinary tract. In intrinsec renal failure the small size of the kidneys and increased echogenicity indicates chronic nephropathy, while enlarged kidneys suggest an acute cause (infection, renal vein thrombosis).

In the majority of cases of acute **pyelonephritis**, US shows a normal appearance of the kidneys. Some times the kidneys may be enlarged, with a moderate increase of their echogenicity. Rarely, the kidneys may develop microabscesses that have the aspect of hypoechoic areas in the corticomedulary junction [3-5]. US may also reveal a pelvic and caliceal distension due to the presence of pus which creates an aspect of several echoes in the dilated collecting system (fig.3).

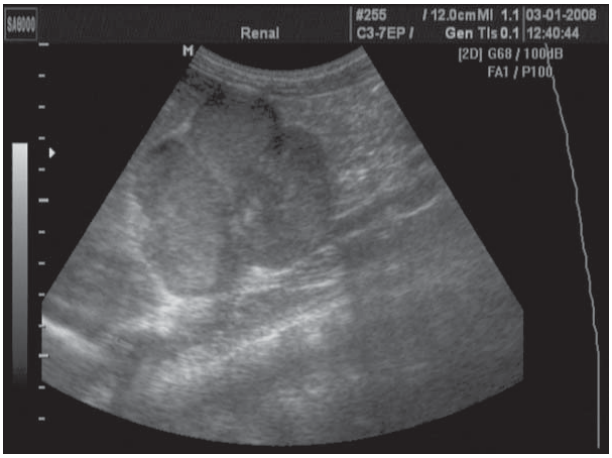


Fig.3. Right pyonephrosis. Echogenic material in a dilated collecting system.

In **renal or perirenal abscesses** US allows ultrasound guided puncturing and drain tube introduction.

Voiding dysfunction is manifested through urinary retention, voiding urge or incontinence. US can determine vesical volume (fig.4) which can than be reported to the normal vesical volume. The normal vesical volume related to age can be calculated by ultrasonography machine software.

Patients with **renal vein acute thrombosis** present intense lombar pain, arterial hypertension and proteinuria. It may develop in patients with transplantation, but also in those with nephrotic syndrome, infection, malignancies and trauma. The gold standard for diagnosis is represented by contrast CT scan or angiography. Doppler US shows absence of blood flow in the renal vein [6, 7].

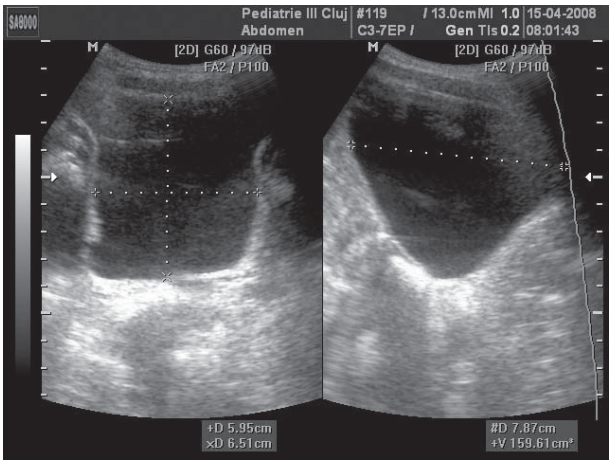


Fig.4. Calculation of the bladder volume.

Policystic kidney may cause sometimes lumbar pain, hematoma, hypertension or renal failure. US reveals in both kidneys multiple cysts that distort the normal kidney architecture (fig.5).

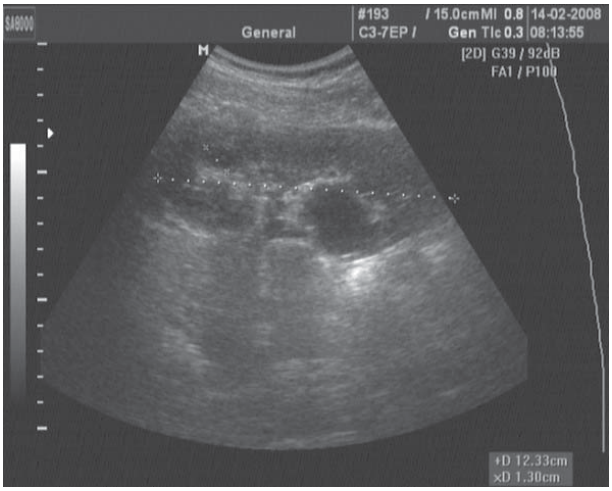


Fig.5. Multiple cystic structures in the right kidney without communication with the collecting system.

The kidney may be one of the organs involved in **trauma**. Many times renal trauma may be treated conservatively if the hemorrhage can be kept under control. US may find intraperitoneal liquid (blood, urine), may differentiate renal contusion from less severe lessions or reveal renal areas of hemorrhage and parenchymal edema that have the appearance of hypoechoic areas (fig.6). An anechoic line suggests renal fracture. Urinoma presents itself as an anechoic ring.

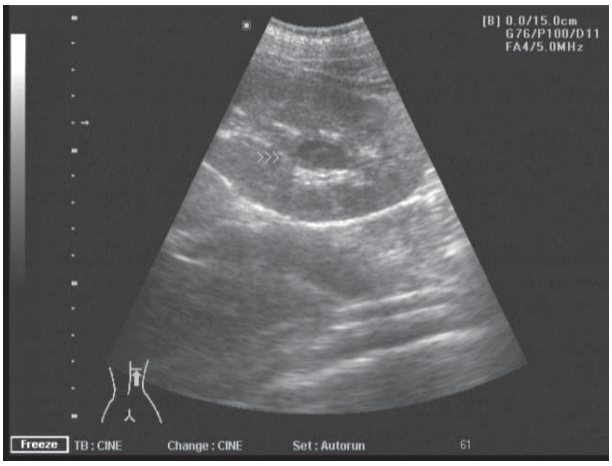


Fig.6. Hypoechogenic mass in the right kidney after renal biopsy.

Renal perfusion alterations produced by trauma may be evaluated through the Dopller technique.

The advantages of US in the assessment of renal emergencies justify the present tendencies of forming emergency medicine specialists with expertise in US exploration of the abdomen. This technique has many advantages, among which is its non invasive character and the possibility of bedside examination.

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