Point of care kidney ultrasonography and its role in the diagnosis of urinary obstruction: a case report

Ultrassonografia urinária "*Point of Care*" e o seu papel no diagnóstico da obstrução urinária: um relato de caso

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Abstract

Introduction: Ultrasonography (US) is a rapid, non-invasive and safe procedure that allows the nephrologist to obtain vital information to the bedside, as well as allows to guide the procedures for nephrology practice. **Case report:** Male patient, elderly with hypertension, *diabetes mellitus* and chronic kidney disease presents with infraumbilical protrusion that the Point of Care US (POCUS), performed by the nephrologist, proved to be a large bladder with a diverticulum. In addition, the US enabled the nephrologist to diagnose bilateral hydronephrosis, preservation of the cortico-medullary differentiation and echotexture of the right kidney, post-voiding urinary retention, urinary catheter placement and functional and morphological monitoring of the urinary tract after surgical correction of the infravesical obstruction. **Conclusion:** POCUS assessment of the renal tract may become the new standard of care among nephrologists by enabling the expansion of clinical information in a timely fashion, allowing faster resolution of cases and permitting the monitoring of the treatment done.

Keywords: *diabetes mellitus;* diverticulum; hydronephrosis; hypertension; renal insufficiency, chronic; ultrasonography.

Resumo

Introdução: A ultrassonografia (US) é um procedimento rápido, não invasivo e seguro que possibilita ao nefrologista obter informação vital à beira do leito, assim como permite guiar os procedimentos necessários à prática nefrológica. **Relato do caso:** Paciente masculino, idoso, com hipertensão arterial, *diabetes mellitus* e doença renal crônica apresenta-se com abaulamento infraumbilical que a *Point of Care US* (POCUS), realizada pelo nefrologista, mostrou ser um quadro de retenção urinária acompanhado de divertículo vesical. Adicionalmente, a POCUS possibilitou ao nefrologista diagnosticar hidronefrose bilateral, preservação da diferenciação córtico-medular e da ecotextura do rim direito, retenção urinária pós-miccional, correto posicionamento do cateter vesical pós-drenagem e acompanhar funcionalmente e morfologicamente as alterações do trato urinário após a correção da obstrução infravesical. **Conclusão:** A avaliação do trato urinário na ótica da POCUS eleva a prática nefrológica a um patamar mais alto, ao possibilitar a ampliação de informações clínicas imediatas e à beira do leito, proporcionar maior rapidez na resolução dos casos e permitir o monitoramento do tratamento instituído.

Palavras-chave: *diabetes mellitus*; divertículo; hidronefrose; hipertensão; insuficiência renal crônica; ultrassonografia.

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Introduction

The use of point-of-care ultrasound (POCUS), i.e., ultrasound examination as an extension of physical examination and a tool used to guide procedures, has increased considerably in recent years and gained significant attention from the medical and academic communities.[1] Improvements in the quality of ultrasound images along with equipment portability enhancements have allowed POCUS to be used in different scenarios by non-radiologists stationed at different points of care, such as emergency and intensive care units.[2-5]

Differently from conventional X-ray, computed tomography, magnetic resonance, radioisotope scintigraphy, and ultrasound imaging, traditional physical examination does not allow one to see "under the patient's skin". The acceptance and use of US has grown steadily. This non-invasive imaging method does not use ionizing radiation, allows for dynamic examination, and can be used to guide procedures, making it an extension of physical examination with significant potential uses in daily clinical practice.[6,7]

This report describes the case of a 70-year-old patient diagnosed with high blood pressure, *diabetes mellitus* type 2, and chronic kidney disease presenting an asymptomatic infraumbilical lump, and illustrates the value of POCUS in patient diagnosis, management, and follow-up.

Case report

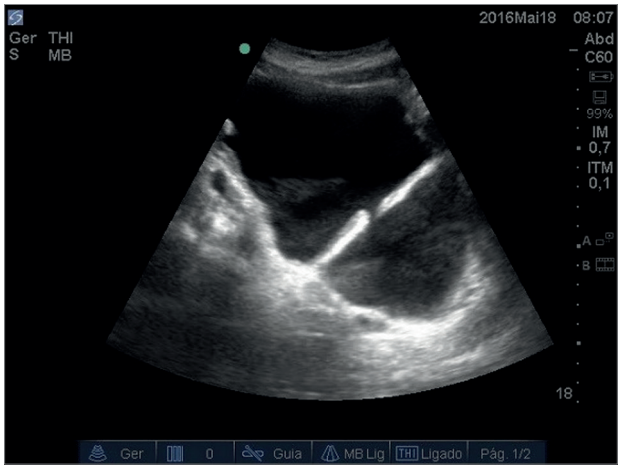
A.D.G., 70, male, black, born and residing in Juiz de Fora, MG. The patient had been previously diagnosed with systemic hypertension, *diabetes mellitus* type 2, and chronic kidney disease. He was being followed in our clinic.

In April 2016, during a study enrollment interview, a palpable painless lump was seen in the patient's hypogastric region (Figure 1). POCUS of the kidneys and urinary tract revealed his bladder was significantly distended, with an estimated volume of 1.8 liter and a large bladder diverticulum (Figure 2). The patient also had bilateral hydronephrosis; the cortex of his right kidney was preserved, and the left kidney was decreased in size (Figure 3). He said that he fell when he was young, and that since then his left kidney was "compromised," in the words of the physician who saw him at the time.

The urology team assessed the patient, and the assisting physicians performed a second ultrasound examination. The diagnostic hypothesis veered toward long-term infravesical obstruction. Total prostate-specific antigen was within the normal range; digital examination showed that his prostate had a normal size (approximately 20 g and no nodules); and an indwelling urinary catheter drained two liters of urine. POCUS performed after the bladder had been drained allowed the accurate placement of a Foley catheter and the observation of a thickened bladder wall and a decreased volume of urine in the diverticulum (Figure 4).

Figure 1. Asymptomatic infraumbilical lump.

Figure 2. Bladder ultrasound image showing increased volume and a large bladder diverticulum.



The patient was asymptomatic ten days after the placement of the indwelling urinary catheter, but his preoperative urine culture showed *Staphylococcus aureus*. The infection was treated with ciprofloxacin. During surgery (transurethral resection of the prostate), the patient was diagnosed with primary contracture of the bladder neck.

Ultrasound examination performed a week after surgery by a nephrologist revealed the patient's

Figure 3. A - Hydronephrotic right kidney with preserved parenchymal thickness. B - Reduced size hydronephrotic left kidney.

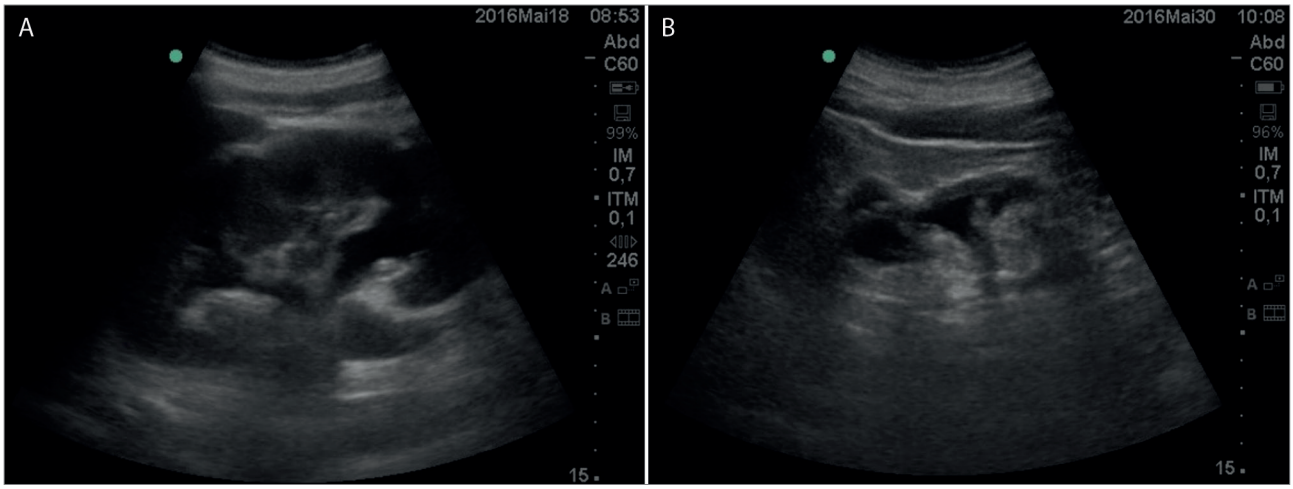
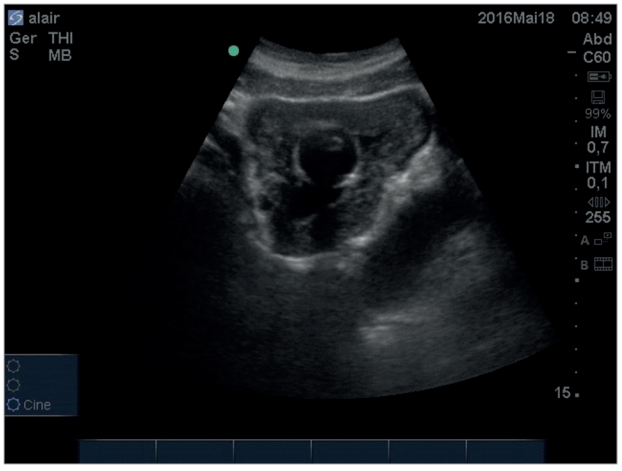


Figure 4. Intravesical Foley catheter.



bladder capacity before voiding was 189 mL and 100 mL after voiding. Thickening of the bladder wall and the diverticulum were still present, but bilateral hydronephrosis disappeared. Renal function improved (estimated glomerular filtration rates before and after surgery of 20 mL/min/1.73 m^2 and 25 mL/min/1.73 m^2, respectively).

Discussion

Interest in US by non-radiologists has significantly increased in recent years, as ultrasound examination is employed in virtually every area of medical practice.[1,8] In nephrology and urology, focused ultrasound and POCUS have been used principally to assess patients suspected for hydronephrosis and urinary obstruction (pre and post-voiding bladder capacity).[1,9,10]

This case report exemplifies these indications and how quickly a solution was reached for the patient with the aid of POCUS performed by the assisting physician. The patient was suspected for bladder distension during physical examination. POCUS performed by a nephrologist immediately confirmed the diagnosis and further identified a large diverticulum in the bladder, bilateral hydronephrosis, good preservation of corticomedullary differentiation and echotexture of the right kidney, and a reduced size left kidney.

In addition, US examination performed after the placement of the urinary catheter confirmed the accurate positioning of the catheter and found the bladder wall was thickened, as often seen in cases of long-term urinary obstruction caused by bladder neck contracture, the latter found during surgery. Finally, POCUS performed by a nephrologist after surgery allowed the assessment of infravesical obstruction after surgical repair.

Training on US examination is provided on limited bases to nephrologists, possibly because of the low availability and high cost of ultrasound equipment and the little experience and lack of interest from nephrology residency preceptors. However, the recent launch of applications that allow one to perform US examination using smartphones and the possibility of developing renal imaging skills after little US training[11] indicate POCUS will soon be widely disseminated in nephrology care.

Conclusion

In conclusion, this case illustrated the importance of using focused US during physical examination and

showed how POCUS increases diagnostic specificity, enhances the knowledge over the condition afflicting the patient, speeds up the diagnostic process, and helps monitor the effects of administered treatments. Since it is a non-invasive method that does not use ionizing radiation, POCUS should be used by nephrologists as an extension of physical examination, particularly in the treatment of elderly male patients with kidney disease, as infravesical obstruction is an important and reversible cause of nitrogen retention.

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