

ULTRASONIC ASSESSMENT OF RESIDUAL URINE VOLUME

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Key Words: Bladder volume determination, Ultrasound Residual urine volume

Anahtar Terimler: Mesane volüm ölçümü, Ultrasonografi, Rezidüel idrar volümü.

SUMMARY

In this clinical study, determination of residual bladder volume on 47 patients was done by ultrasonography using 3 one-dimensional measurement method as described in the literature (1).

The determination of residual volume by catheterisation though invasive is very accurate. However, side effects like urinary tract infections and/or urethral strictures might be problem. Ultrasonography has no side effects for the patients. This method is found to be significantly more accurate than previously reported techniques and is quick and easy to perform and presented.

ÖZET

Rezidüel idrar volümünün ultrasonografik olarak değerlendirilmesi.

Bu çalışmada literatürde tanımlandığı şekilde ultrasonla 3 tek boyutlu ölçüm yöntemi kullanılarak, 47 hasta üzerinde, rezidüel idrar volüm tayini yapıldı (1).

Rezidüel volüm tayininin kateterizasyon ile yapılması invaziv olmasına rağmen çok kesin olmaktadır. Bununla beraber, üriner enfeksiyon ve/veya üretral darlıklar gibi yan etkiler problem olabilmektedir. Ultrasonografinin ise, hiçbir yan etkisi yoktur. Bundan dolayı rutin klinik yaklaşımda daha önce tanımlanan tekniklere göre bariz, daha güvenilir, hızlı ve kolay uygulanabilir bir yöntem olduğu kanaatine varıldı ve sunuldu.

INTRODUCTION

The assessment of residual urine forms an essential part of the investigation of many urological patients, particularly those with suspected urinary outflow obstruction; the presence of residual urine may influence their management.

Generally, it is necessary to measure the volume of residual urine to assess bladder

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function. The advantages of establishing a simple non-invasive method to measure bladder volume have long been recognised. Various methods of assessing residual urinary volumes exist, including abdominal palpation, the use of postvoiding films from excretory urography and excretion tests using phenolsulphaphtalein or radiolabeled compounds. The most commonly used and accurate technique, catheterisation of the bladder, has the risk of introducing infection and traumatizing the urethra.

A method to assess residual urine that is simple, safe, easily repeatable, non-invasive and accurate would be considerable value in clinical practice.

In our study we compared the ultrasonically measured residual volumes measured by catheterisation. We describe an ultrasound method for the measurement of residual urine that is quick, easy to perform, accurate and causes no discomfort to the patient.

MATERIALS AND METHODS

Determination of the residual bladder volume was done by ultrasonography using 3 one-dimensional measurement method as described in the literature (1). Then we compared the assessed results with the urine volume quantification using the catheterisation method. We estimated the residual urine volume in 47 patients (Age 35-73 years) with various disease; 8 of the patients were females and the rest were males. 7 of the females had cystoceles and one had neurogenic bladder. 35 of the 39 males had prostatic hyperplasia, 4 had neurogenic bladders. 15 patients had indwelling catheter. They were all males. Before the residual urine determination by ultrasonic scanning all the catheters were removed. Then each patient was asked to drink water until the urge to pass urine became irresistible. They voided to complete their bladders. 12F catheter was immediately passed and spigotted, thus avoiding delay between scanning and subsequent catheter drainage of the bladder. With the patient supine an assessment of residual urine was made by using Siemens Sonoline SL-1 and AC machines with 3 and 5 MHz probes.

The residual urine volume estimation is based on 3 one - dimensional measurements (Figures 1,2,3 and 4).

L: Largest cranio-caudal distance in longitudinal scanning,
 W: Largest left-right distance in transversal scanning,
 H: Largest antero-posterior distance in transversal scanning.

Using those 3 distances in the patients for calculating the volume of an ellipsoid: $V = 1/6 \pi .L.W.H$, the residual volume was estimated and compared with the real residual volume that was found by catheterisation.

RESULTS

Volumes measured by ultrasonography ranged from 9 to 348 ml. The difference

between the two methods varied from 0 to 60 ml. Ultrasound volumes showed good correlation with catheter volumes. The results which we have obtained catheterisation showed that can be replaced with an ultrasonographic technique.

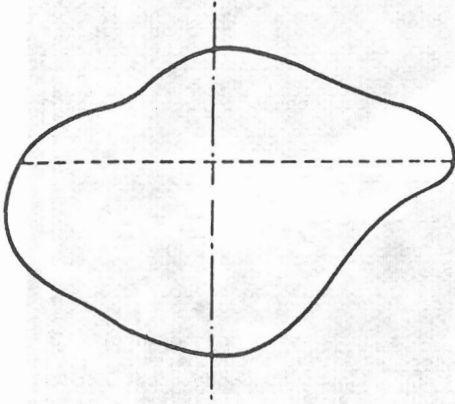


Fig.-1: Largest outlined section of the ultrasonic images representing the bladder wall in longitudinal direction
 - - - -: depth ($= D_l$)
 ———: length ($= L$)

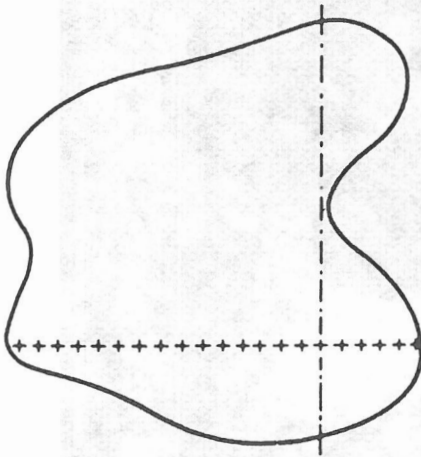


Fig.-2: Largest outlined section of the ultrasonic images representing the bladder wall in transversal direction
 - - - -: depth ($= D_t = H$)
 ++++++: width ($= W$)

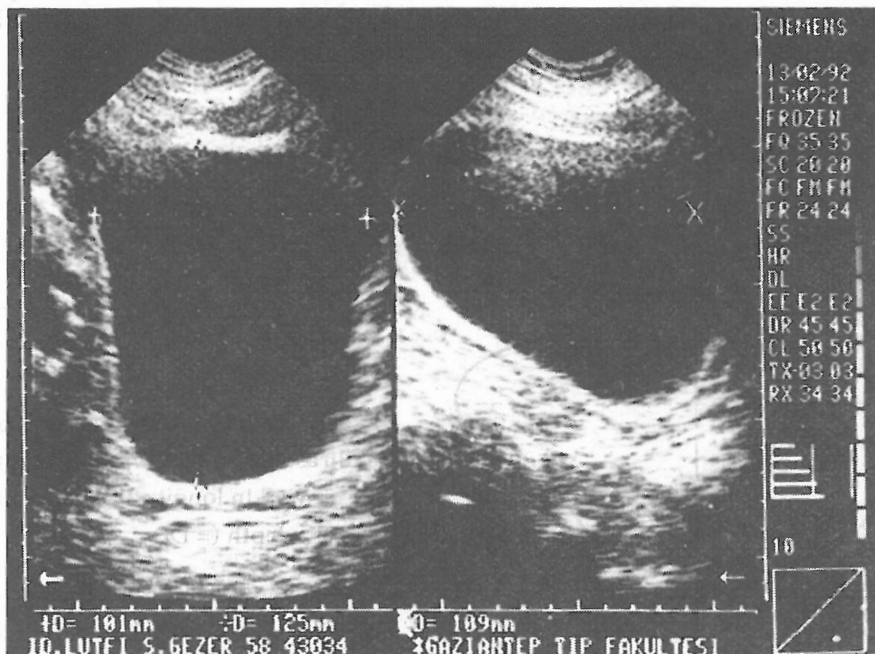


Fig. 3: Measurements of the greatest transverse (horizontal) and longitudinal (sagittal) areas of one of the patient before voiding.

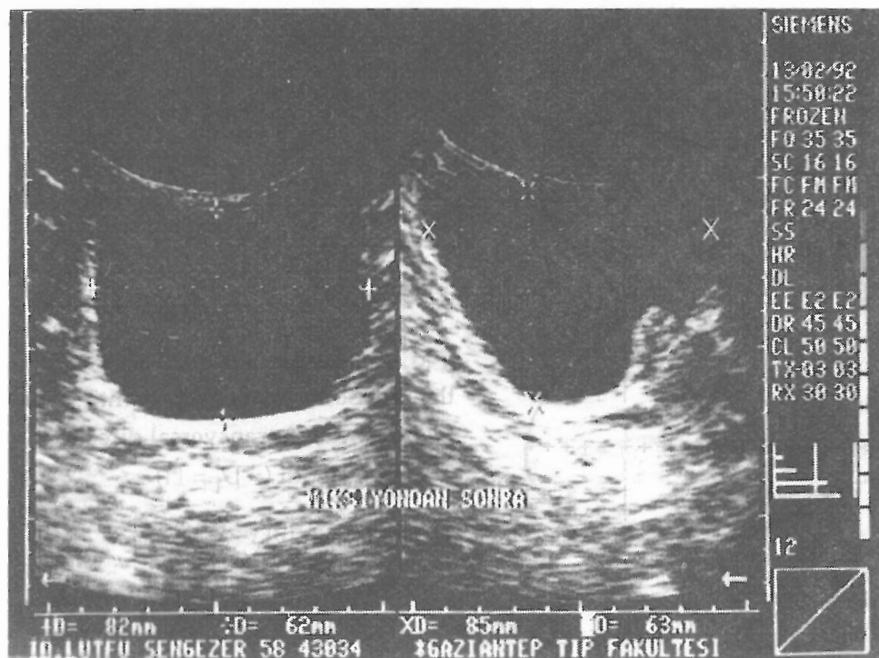


Fig. 4: Measurements of the greatest transverse (horizontal) and longitudinal (sagittal) areas of the same patient post-voiding.

The first of application of ultrasound in the evaluation of bladder diseases was the determine the volume of residual urine. However, the method did not become popular, undoubtedly because of the precision and widespread use of post-micturitional catheterisation. Although bladder residual volumes have always been measured by catheterisation or suprapubic aspiration, these methods cause difficulties and create considerable risks (2,7).

Previous studies have confirmed that ultrasound is a safe investigation for the measurement of residual urine volume. Many techniques have been described but the accuracy of the methods varies widely (1-5,8,9). Taking these limitations into account, the assessment of residual urine volume by ultrasound scan has several advantages, it is a non-invasive method and therefore atraumatic, with no risk of infection, and it requires only a few minutes to carry out.

Our ultrasound volumes showed good correlation with catheter volumes, the results which we have obtained catheterisation showed that can be replaced with an ultrasound technique.

In our opinion this approach can be recommended as a suitable method for routine clinical practice.

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