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Sonographic Assessment of Bladder Outlet Obstruction in Adult Males

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Abstract
Background: Bladder outlet obstruction in males may be a complex syndrome of either dynamic functional or fixed anatomic forces resulting in resistance to the flow of urine. Particularly in males, bladder outlet obstruction is a frequently encountered finding. From a diagnostic standpoint, the evaluation of bladder outlet obstruction relies heavily upon traditional methods. BOO may be induced by specific functional and anatomic causes. The resulting obstruction frequently produces lower urinary tract symptoms (LUTS). Categorizing and understanding these entities is crucial when proceeding with a LUTS evaluation as specific diagnostic modalities may then be used to delineate the degree of BOO and any secondary issues fully. Objective(s): The objective was to determine the sonographic assessment of bladder outlet obstruction in adult males Methodology: Ultrasonography for the diagnosis of BOO was done by a single operator using the Mindray Z5 and Toshiba xario 100 with convex transducer probe of 3- 6MHz machine in Mayo hospital Lahore, Allied hospital Faisalabad and Gillani ultrasound clinic, Lahore Pakistan. The duration of the study was from July to October. A total of 159 patients were examined through a convenient sampling technique. Statistical software for social sciences (SPSS version 22.0) is used for the analysis of data. Results: The study included 160 patients in total. Table 1 represents the age of the patients. The minimum age of the patients was 24, and the maximum age of the patients was 90. The mean age of the patients was 52. Table 2 represents the sonographic assessment of the patients. Out of 160 patients, 80(50%) had benign prostate hyperplasia, 30(18.8%) had bladder calculus, 22(13.8%) had bladder mass, 28(17.5%) had bladder wall growth. In table 3, 160 patients had a pre-void test. The minimum was 100, and the maximum was 400. The mean was 2.82. According to table 4, 160 patients had post void test. The minimum was 55, and the maximum was 170. The mean of the post-void test was 1.08. Conclusion(s): Ultrasound measurement of bladder wall thickness has been proposed as a useful diagnostic parameter in patients with bladder outlet obstruction and other voiding dysfunctions. The complete assessment of LUTS arising from BOO includes Ultrasonography to fully define the obstructive impact on the individual's urinary function and quality of life.

Keywords: Bladder outlet obstruction (BOO), lower urinary tract symptoms (LUTS), Ultrasonography

Introduction

In humans, the bladder is a hollow muscular organ situated at the base of the pelvis. Urine collects in the bladder, fed from the two ureters that connect the bladder with the kidneys. Urine leaves the bladder via

the urethra, a single muscular tube ending in an opening – the urinary meatus, where it exits the body (Frank, 2014). The human bladder is situated below the peritoneal cavity near the pelvic floor and behind the pubic symphysis. In men, it lies in front of the rectum, separated by the recto-vesical pouch, and is supported by fibers of the levator ani and of the prostate gland (Patel and Rickards, 2010). The urinary bladder was one of the first of the body's systems to be investigated by ultrasound. The bladder can be scanned by the suprapubic transabdominal route, whereas the perineal and the intravesical routes are rarely used. Ultrasonic visualization of the bladder and other pelvic structures necessitates a full bladder. The bladder must be examined when comfortably full. The full bladder on the transverse scan appears as a thin-walled (2–3 mm) smooth structure, almost rectangular in configuration. The shape is usually symmetrical, but the left lateral wall may be deformed by the sigmoid colon, particularly when filled with feces. On the sagittal section, the bladder is triangular in shape (Meire, 2001). Bladder outlet obstruction (BOO) is an underlying cause for Lower Urinary Tract Symptoms (LUTS) in a significant proportion of men presenting with these commons symptoms (Rosette et al., 1998). While pressure flow studies (PFS) are considered the gold standard for diagnosing and quantifying BOO, urologists in their routine clinical practice frequently rely on less invasive methods (such as urinary flow rate, post-void residual [PVR], and prostate volume) to assess BOO (Abrams et al., 2002). Bladder ultrasonography is used to assess the following: (1) bladder wall anatomy (thickness and focal abnormalities, presence of diverticula), (2) bladder capacity in milliliters, (3) anatomy of the bladder base, (4) distal ureteric anatomy, (5) post-micturition residual volume, and (6) intravesical filling defects (Cosgrove et.al, 2001). Supra-pubic transabdominal ultrasound with a 3.5–5 MHz transducer is ideal in all age groups. For neonates, 7.5 MHz transducers may be needed (Bala and Chou, 2010). Once the full bladder is scanned, and its volume measured, the patient voids into a standard flow rate machine, having been asked to void as normally as possible without superimposed abdominal straining. Immediately after voiding, the bladder is rescanned, and any residual volume is measured. If there is a large residual volume (≥100mL), the bladder should be rescanned after a second void and that residual urine volume assessed (Sofronievska et al., 2015). BOO in men has traditionally been linked to the prostate. Recent terminological changes have led to the use of benign prostatic obstruction/enlargement (BPO/BPE) as nomenclature to replace previously used eponyms such as benign prostatic hyperplasia (BPH). It is clear that LUTS, in both sexes, is at least partially due to a component of age-related detrusor dysfunction with the subsequent superimposition of other pathologies, most common of which in men is BPO. The appreciation that prostatic glandular and stromal hyper-plasia is not synonymous with BOO or LUTS has allowed a more advanced understanding of the dynamic factors involved in BOO in men (Blaivas and Groutz, 2000). We use ultrasound because it is a noninvasive, unexpansive, and first-line modality to evaluate the causes of BOO (El Din et al.,1996). Management of patients presenting to an outpatient clinic with lower urinary tract symptoms (LUTS) is a complex problem. A proportion of these patients suffer from obstructive benign prostatic hyperplasia. Men proved to have obstruction on the basis of pressure-flow measurements applied to a nomogram have better outcomes after transurethral resection of the prostate; hence, there is a growing need to accurately define bladder outlet obstruction (Florators, et al., 2000). Pressure-flow study is presently the gold standard for diagnosing bladder outlet obstruction, but it is invasive. Newer modalities of investigation are being tried and reported in the literature (Ozawa et al., 2000). Clinicians all over the globe have associated the presence of bladder wall thickness, with the presence of a significant obstruction in men with lower urinary tract symptoms (Hakenberg et al., 2000). Detrusor hypertrophy has been described in association with many different disorders of the lower urinary tract and is not specific for any disease. A significant association between bladder wall mass and outlet obstruction has been described in patients with urinary symptoms (Doubler, 2000). Measurement of bladder wall thickness by supra-pubic ultrasound appears to be a useful predictor of outlet obstruction with a diagnostic value exceeding free uroflowmetry, although it does not represent a substitution to invasive urodynamics (Muller et al., 2000). The bladder thickness index is a sensitive sonographic predictor of infra-vesical obstruction. Application of this index as a noninvasive screening tool for the patient with persistent voiding dysfunction may prove beneficial for identifying infra-vesical pathology (Kumar et al., 2000).

Bladder outlet obstruction (BOO) is known to be associated with a variety of morphological, contractile, and biochemical changes within the bladder (Greenland et al., 2000). The problem of lower urinary tract symptoms (LUTS) has gained global attention owing to its high prevalence among both men and women. The overall prevalence of overactive bladder (OAB) was 11.8%; the rates were similar in men and women and increased with age.[20] Before the age of 40 years, lower urinary tract symptoms are relatively uncommon, but the prevalence increases with age such that a large proportion of men and women aged >70 years may have them

(Coyne et al., 2009). In European Prospective Investigation into Cancer and Nutrition (EPIC), a large population-based study, the prevalence of at least one LUTS, using the 2002 International Continence Society (ICS) definitions, was found to be 62.5% in men and 66.6% in women aged ≥40 years (Boyle et al., 2003).

Results

The study included 160 patients in total. Table 1 represents the age of the patients. The minimum age of the patients was 24, and the maximum age of the patients was 90. The mean age of the patients was 52. Table 2 represents the sonographic assessment of the patients. Out of 160 patients, 80(50%) had benign prostate hyperplasia, 30(18.8%) had bladder calculus, 22(13.8%) had bladder mass, 28(17.5%) had bladder wall growth. In table 3, 160 patients had a pre-void test. The minimum was 100, and the maximum was 400. The mean was 282. According to table 4, 160 patients had post void test. The minimum was 55, and the maximum was 170. The mean of the post-void test was 108.

Table 1: Age distribution of patients presented with bladder outlet obstruction

	N	Minimum	Maximum	Mean	Std. Deviation
Age	160	24.00	90.00	51.9375	14.47257
Valid N (listwise)	160				

Table 2: Sonographic findings in patients presented with bladder outlet obstruction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Benign prostate hyperplasia	80	50.0	50.0	50.0
	Bladder calculus	30	18.8	18.8	68.8
	Bladder mass	22	13.8	13.8	82.5
	Bladder wall growth	28	17.5	17.5	100.0
	Total	160	100.0	100.0	

Table 3: Pre-void test in patients presented with bladder outlet obstruction

	N	Minimum	Maximum	Mean	Std. Deviation
prevoidinml	160	100.00	400.00	282	61.99641
Valid N (listwise)	160				

Descriptive Statistics

Table 4: Post void test of patients presented with bladder outlet obstruction

	N	Minimum	Maximum	Mean	Std. Deviation
postvoidinml	160	55.00	170.00	108	28.96478
Valid N (listwise)	160				

DISCUSSION

The current study was designed to determine the bladder outlet obstruction in males. The main reasons for bladder obstructions come out to be the masses and wall growth. Comparing to this, in a study, Bladder outlet obstruction was compared with dretursor wall thickness. A total of 50 men were included in the study. Men aged 50 or older presenting with lower urinary tract symptoms were evaluated for bladder outlet, obstruction using detrusor wall thickness (measured by a transabdominal 7.5 MHz ultrasound) and, other non-invasive tools (namely uroflowmetry, post-void residual, and prostate volume), and the results were compared to pressure-flow study. In my study, in 28 patients, bladder outlet wall thickness became the reason for bladder outlet obstruction. Despite a consensus on pressure-flow studies being the most reliable tool to establish BOO, the generalized use of PFS to diagnose BOO in men presenting with LUTS has been limited by factors such as invasiveness, cost, availability, and potential morbidity. In another study, conducted by Sachin Malde, a total of 42 studies recruiting 4444 patients were eligible for inclusion criteria, which assessed the diagnostic accuracy of nine noninvasive tests were studied. Where-as, in my study, pre-void, and post-void tests were also performed. The mean of the pre void test was 2.8, and that of the post-void test was 1.2. The main outcomes of my study were benign prostate hyperplasia, Bladder calculus, Bladder mass, and Bladder wall growth. Measurement of bladder wall thickness appears to be a useful predictor of outlet obstruction with a diagnostic value exceeding free uroflowmetry, although it does not represent a substitution to invasive urodynamics. These data support the hypothesis that the relationships between morphology and function are of clinical importance. Ultrasound measurement of bladder wall thickness has been proposed as a useful diagnostic parameter in patients with bladder outlet obstruction and other voiding dysfunctions. The complete assessment of LUTS arising from BOO includes Ultrasonography to fully define the obstructive impact on the individual's urinary function and quality of life

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