

Original Article

Comparison of Prostatic Volume Measured with Abdominal Ultrasound and Prostatic Weight Determined after Open Enucleation Performed in Gondar University Hospital, Ethiopia

G. Messele Getahun¹ and A. Getachew Kebede²

¹Departments of Surgery and ²Radiology, Gondar University Hospital, Gondar, Ethiopia

ABSTRACT

Objective: Benign prostatic hyperplasia (BPH) is a common surgical problem accounting for 20% of elective admissions in our surgical ward. Abdominal ultrasound has been reported as an accurate modality for the measurement of prostatic size. The aim of this study was to evaluate the accuracy of abdominal ultrasound measurement of prostatic size.

Patients and Methods: In this prospective study 53 patients with clinically diagnosed BPH scheduled for enucleation of the prostate underwent pre-operative measurement of the prostate by abdominal ultrasound. Enucleation of the prostate was done via the transvesical approach, and the enucleated tissue was weighed. The results of both measurements were compared using the Epi-Info 2000 software. For the determination of the correlation coefficient we used Fisher's exact test.

Results: The mean volume of the prostate gland measured by abdominal ultrasound was 68 ± 37.6 cc, while the mean weight of the resected gland was 49.4 ± 29.7 gm (correlation coefficient $r=0.72$; $p=0.001$).

Conclusion: There is a statistically significant correlation between the prostatic volume measured by abdominal ultrasound and prostatic weight determined at open surgery. Abdominal ultrasonography can be used for pre-operative assessment of prostatic size.

Keywords : Benign prostatic hyperplasia (BPH), ultrasound, measurement.

Corresponding Author: Dr. Gashaw Messele, Gondar University Hospital, P.O.Box 196, Gondar, Ethiopia, e-mail: messeleg@yahoo.com

Article Info: Date received : 7/3/2007

Date accepted (after revision): 31/3/2008

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a common surgical problem accounting for 20% of elective admissions in our surgical wards. The presenting symptoms vary from urinary tract infection to acute urinary retention. Although BPH is diagnosable at clinical examination, information about the gland volume or size, presence of nodules and calcification is important for selecting the appropriate management. The decision on whether the patient requires surgery and selection of the best surgical approach depends on the size of the prostate¹.

Transrectal ultrasound (TRUS) is recommended for assessment of prostatic volume, but it requires an ultrasound machine with a transrectal probe which is invasive and expensive, as well as uncomfortable for the patient. On the other hand, abdominal ultrasound examination has been reported as an accurate modality for the measurement of prostatic volume¹. The fact that abdominal ultrasound is non-invasive and does not require any additional equipment renders it a preferable method for the assessment of prostatic volume².

Table 1: Signs and symptoms of BPH in a study group of 53 patients

Symptoms	Number	Percentage
Acute retention	42	79.2%
Dribbling	50	94.3%
Dysuria	33	62.3%
Frequency (D/N)	47	88.7%
Hesitancy	45	84.9%
Urgency	53	100%
Palpable bladder	26	49.1%

The aim of this study was to evaluate the accuracy of abdominal ultrasound measurement of prostatic size.

PATIENTS AND METHODS

The study group included 53 consecutive patients scheduled for surgical enucleation of the prostate. All had clinically diagnosed BPH based on prostate symptoms and digital rectal examination. They underwent pre-operative abdominal ultrasound examination with a full bladder (200-300 ml urine)³ using the transducer in a 45° caudally angulated position.

A 3.5 MHz transducer was used to measure the width, height and length of the prostate, and the volume was calculated using the formula for a prolate ellipsoid (maximum width x height x length x $\pi / 6$). Since the specific gravity of prostatic tissue is approximately 1.05 gm/cc, the weight of the prostate is approximately the same as the volume.

Transvesical prostatectomy was carried out by a single surgeon in the majority of the patients, but the operative procedure used by all surgeons was similar. The enucleated prostate was weighed immediately after the operation and the data were entered into the EPI-Info 2000 computer software. For the determination of the correlation coefficient we used Fisher's exact test.

RESULTS

The clinical presentation of the patients is summarized in Table 1.

On abdominal ultrasonography the prostatic volume was <20 cc in 3 (5.7%), 20-40 cc in 12 (22.6%), 40-60 cc in 10 (18.9%), 60-80 cc in 10 (18.9%), 80-100 cc in 7 (13.2%) and above 100 cc in 11 (20.8%) patients (Table 2).

The weight of the enucleated prostate was <20 gm in 10 cases (18.9%), 20-40 gm in 16 (30.2%), 40-60 gm in 12 (22.6%), 60-80 gm in 6 (11.3%), 80-100 gm in 8 (15.1%) and above 100 gm in 1 (1.9%) patient(s) (Table 2). This means that in this series the weight of the prostate was less than 60 gm in the majority of cases (71.7%).

The mean weight of the enucleated prostate glands was 49.4 ± 29.7 gm, while the mean volume on abdominal ultrasound measurement was 68 ± 37.7 cc ($r = 0.72$, $p = 0.001$).

DISCUSSION

Assessment of prostatic size is an important factor in the management of BPH^{1,2}. Intravenous urography (IVU) and cystoscopy are not useful for determining the prostatic size or selecting the appropriate surgical approach⁵.

Table 2: Prostatic volume as measured by abdominal ultrasound and weight determined after prostate enucleation

Size (cc or gm)	Abdominal Ultrasound (cc)		Weight after enucleation (gm)	
	No. of Patients	%	No. of Patients	%
< 20	3	5.7%	10	18.9%
20-40	12	22.6%	16	30.2%
40-60	10	18.9%	12	22.6%
60-80	10	18.9%	6	11.3%
80-100	7	13.2%	8	15.1%
>100	11	20.8%	1	1.9%

According to Roehrborn et al. the best predictor of prostatic weight is abdominal ultrasound ($r = 0.975$)⁶. A very strong correlation was found between suprapubically and transrectally performed measurements of total prostatic volume ($r=0.948$, $p<0.001$)². The reliability of abdominal ultrasound in the measurement of prostatic volume was also confirmed by other studies^{7,8}.

In the present study BPH was associated with acute urinary retention in the majority of patients (79%) which represents a large burden on emergency services.

Comparison of the mean weight of the enucleated glands (49.4 ± 29.7 gm) and the mean volume measured by abdominal ultrasonography (68 ± 37.7 cc) indicates that ultrasound measurement overestimates smaller glands. The lower mean weight of the enucleated prostates may also partly be attributed to the operative procedure consisting of enucleation rather than radical prostatectomy. The fact that the majority of the enucleated glands weighed less than 60 gm (71.7%) suggests that the procedure of choice would have been transurethral resection of the prostate (TURP)^{9,10}.

The correlation coefficient in this series ($r=0.72$) shows a statistically significant correlation between prostatic volume measured on abdominal ultrasonography and the weight of the prostate removed at surgery, indicating that it is a useful tool for selecting the

appropriate surgical approach (TURP or open surgery). Other studies have shown a similar correlation. Styles et al. found that abdominal estimation of prostatic volume correlated well with the transrectal method and good inter-observer agreement was found with the use of both modalities⁹. Ishida et al. demonstrated that abdominal measurement of prostatic volume correlated well with the resected weight ($r=0.956$)^{11,12}.

The findings of this study support the use of abdominal ultrasound evaluation of BPH for selecting the surgical approach. Despite some studies advocating transrectal ultrasound measurement as the gold standard¹³, abdominal ultrasound is reliable in the pre-operative assessment of prostatic size. Abdominal ultrasound is a less expensive, non-invasive, better tolerated and simple procedure to perform in experienced hands and therefore recommended for pre-operative assessment of the prostate size, especially in a resource-limited environment.

REFERENCES

1. Watanabe T, Miyagawa I. New simple method of transabdominal ultrasound to assess the degree of benign prostatic obstruction: Size and horizontal shape of the prostate. *Int.J.Urol.* 2002; Apr;9(4):204-9.
2. Prassopoulos P, Charoulakis N, Anezinis P, Daskalopoulos G, Cranidis A, Gourtsoyiannis N. Suprapubic versus transrectal ultrasonography in assessing the volume of the prostate and the transition zone in patients with benign prostatic hyperplasia. *Abdom.Imaging.* 1996; Jan-Feb;21(1):75-7.

3. Yuen JS, Ngiap JT, Cheng CW, Foo KT. Effects of bladder volume on transabdominal ultrasound measurements of intravesical prostatic protrusion and volume. *Int.J.Urol.* 2002; Apr;9(4):225-9.
4. Knonagel H, Jaeger P. Die suprasymphysare Ultraschalluntersuchung als einfache Methode zur Größenbestimmung des Prostataadenoms. [Suprasymphyseal ultrasound study as a simple method for determining the size of prostatic adenoma. Results in over 100 open prostatectomies]. *Urologe A.* 1987; Nov;26(6):339-42.
5. Thumann RC Jr. Estimation of the weight of the hyperplastic prostate from the cystourethrogram. *Am.J.Roentgenol.Radium.Ther.Nucl.Med.* 1951; Apr;65(4):593-4.
6. Roehrborn CG, Chinn HK, Fulgham PF, Simpkins KL, Peters PC. The role of transabdominal ultrasound in the preoperative evaluation of patients with benign prostatic hypertrophy. *J.Urol.* 1986; Jun;135(6):1190-3.
7. Rathaus V, Richter S, Nissenkorn I, Goldberg E. Transperineal ultrasound examination in the evaluation of prostatic size. *Clin.Radiol.* 1991; Dec;44(6):383-5.
8. Bartsch G, Egender G, Hubscher H, Rohr H. Sonometrics of the prostate. *J.Urol.* 1982; Jun;127(6):1119-21.
9. Styles RA, Neal DE, Powell PH. Reproducibility of measurement of prostatic volume by ultrasound. Comparison of transrectal and transabdominal methods. *Eur.Urol.* 1988;14(4):266-9.
10. Vilmann P, Hancke S, Strange Vogensen HH, Nielsen K, Sorensen SM. The reliability of transabdominal ultrasound scanning in the determination of prostatic volume. An autopsy study. *Scand.J.Urol.Nephrol.* 1987;21(1):5-7.
11. Smith HJ, Haveland H. Pre-operative and post-operative volumetry of the prostate by transabdominal ultrasonography. *Br.J.Urol.* 1982; Oct;54(5):531-5.
12. Ishida N, Tsurumaki O, Igarashi S, Maezawa H, Yamamoto R, Hosoi Y, et al. [The evaluation of simple estimation method of prostate size by transabdominal ultrasound]. *Nippon Hinyokika Gakkai Zasshi.* 1989; Jun;80(6):832-7.
13. Blanc M, Sacrini A, Avogadro A, Gattamorta M, Lazzarini F, Gattoni F, et al. Volumetria prostatica: Confronto tra studio ecografico soprapubico e transrettale nel controllo dell'iperplasia prostatica benigna. [Prostatic volume: Suprapubic versus transrectal ultrasonography in the control of benign prostatic hyperplasia]. *Radiol. Med.(Torino).* 1998; Mar;95(3):182-7.