TRANSABDOMINAL ULTRASONOGRAPHIC ANALYSIS OF SUSPECTED BENIGN PROSTATIC HYPERPLASIA IN SOKOTO, NORTHWESTERN NIGERIA.

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ABSTRACT

Background: *This study was carried out to analyze the transabdominal ultrasonographic (TAUS) features of suspected benign prostatic hyperplasia (BPH) in 96 consecutive patients between June 2005 through June 2006 at Usmanu Danfodiyo University Teaching Hospital and Karaye Hospital, Sokoto.*

Methodology: *Prospective analysis of Various sonographic features including prostate size, volume, architecture and vesicoprostatic interface,residual urine volume as well as back pressure changes on both urinary bladder and kidneys were analyzed.*

Result: *The prostate sizes ranges between 40mm-135mm (mean 59mm, median = 57mm, SD = 12mm). While the smallest prostate volume was 45cm^3 with the largest measuring 387cm^3 (mean 128, median 128, SD = 68).*

Conclusion: *Transabdominal ultrasound is a useful screening test for the evaluation of the prostate. In addition to the size and volume, the assessment of the kidney and the urinary bladder makes assessment of degree of benign prostatic obstruction more reliable.*

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INTRODUCTION

Benign prostatic hyperplasia is a condition intimately related to age[1]. Although it is not life threatening, it's clinical manifestations as lower urinary tract symptoms (LUTS) reduce the patients quality of life.[2] Troublesome LUTS can occur in up to 30% of men older than 65yrs[3].

The prostate gland has traditionally been regarded as an organ that is histologically homogenous with a relatively simple anatomic structure. The prostate was first described by venetian anatomist Niccolo Massa in 1536 and illustrated by Flemish Andreas vesalias in 1538[4]. The normal prostate is roughly shaped, the concavity of the bean facing posteriorly.

The transitional and central zones have some intermediate echogenicity and are inseparable on ultrasound. Increase in volume and heterogeneity occur with advancing age in the transitional zone. The peripheral zone is seen as an echogenic layer lying posteriorly. It is the site of most prostatic cancer.

Normal prostatic dimensions in adult male are approximately 4cm in craniocaudal and transverse planes and 3cm in anterior posterior plane; with a maximum volume of 20-25mls[5]. The prostate can begin to enlarged in middle adulthood and continue growing until death or until growth stopped normally. Average growth estimates are 0.5g/year[5].

Until a decade ago, the occurrence and natural history of benign prostatic hyperplasia (BPH) were not well characterized. Epidemiologic data that had been published were often based on patients referred to urologic clinics or patients on surgical waiting lists. During the past decades, a plethora of scientific literature on the epidemiology of prostate disease including numerous review articles has been published[6-11].

A wealth of information has recently been published based on studies using community based sampling techniques. Such studies may be more representative of men in general allowing better assessment of the relationships among urologic measures and risk factors for long-term outcome in untreated men. These studies have been conducted in the United State[12-17], Scottland[18,19], the Netherland[20,21] and Japan[22,23]. This review will focus on the epidemiology of BPH with emphasis on the relationship among urologic measures and prediction of long-term outcomes based on recent findings from Olmsted County Study of Urinary Symptoms and Health Status Among Men[24-25].

The three component of benign prostatic disease, namely, prostate size, uroflow and symptoms overlaps to varying degrees in different patients[26]. It is well known that not all men with enlarged prostate have symptoms and that small prostate can cause obstructive symptoms[9]

Various methods are available for sonographic evaluation of prostate and among all the methods transrectal ultrasonography (TRUS) has received increasing attention recently, because of it's potential for early detection of prostatic cancer and also it provides greater detail of zonal anatomy of the prostate and echo pattern of the gland and it's various lesion. However, transrectal probe are very expensive and are not readily available in this part of the country. Secondly TRUS is very uncomfortable to the patient and the patients might require preparation before the scanning. Other methods are transperineal ultrasonography, Magnetic Resonance Imaging (MRI). MRI is more sensitive than TRUS but is very expensive and not readily available. Computed tomography (CT) involved the use of ionizing radiations.

In view of the above shortcomings of TRUS, transabdominal

ultrasonography (TAUS) is usually carried out in the evaluation of prostatic enlargement in this part of the world. This study was therefore carried out to evaluate suspected benign prostatic hypertrophy by transabdominal scan. To the author's knowledge there was no previous report on ultrasonographic analysis of BPH in this part of the country. However, few studies were carried on the prostate by Isyaku (2002)[27], Kuti (1995)[28] and Ahidjo (2001)[29].

MATERIALS AND METHODS

From June 2005 to June 2006, 96 consecutive patients (mean range = 67, median age 69, age range 48-100, (SD = 9.0) seen at Usmanu Danfodiyo University Teaching Hospital and Karaye Hospital Sokoto (a teaching hospital and a private clinic respectively) who were referred for transabdominal ultrasonography with clinical information suggestive of enlarged prostate were prospectively studied and underwent TAUS.

The study group consisted of patients referred from urology clinic, accident and emergency department or referred by other medical practitioners from the peripheral hospitals for TAUS. The exclusion criteria were patients with previous prostatectomy, prostate biopsies and patients with bladder outlets obstruction from other causes. Others are patient with suspected bladder mass and with confirmed increased vasculature following Doppler ultrasound.

TAUS was performed using a real time SIUI Apogee 800 plus and Siemens SL-1 Sonoline ultrasound machines. The frequency of the probes ranges from 3.5-5.0MHZ. The prostate gland was imaged through suprapubic approach with the subject in supine position. The transducer was tilted approximately 30-40^{o} caudad to reach the prostate behind the symphysis pubis. Full urinary bladder was obtained by drinking about 1.5 litres of water. The urinary bladder and both kidneys were examined in turn. If patients are on catheter (transurethral or suprapubic) the catheter was clamped for sometime to ensure that urinary bladder is filled with urine.

The prostate volume was calculated by measuring simpson's volume formular and the prostate volume was automatically computed by the ultrasound scanner, and the displayed values were recorded against the age of each subject. The data was collected and collated manually and entered into a computer for statistical analysis using SPSS Version 11.0

A color and pulsed Doppler examination of the enlarged prostates were carried out in some of the patients to exclude neovascularization and high or low resistance flow by pulsed Doppler wave form.

One hundred and seventeen ultrasonograms of the patients were all reported at the time of the scanning by a qualified radiologist. The ultrasound images were prospectively reviewed and the following features were recorded: Prostate size, volume, outline, architecture as well as the vesico-prostatic interface. Post micturation residual volume, bladder wall thickening, presence of calcification in the bladder, and the degree of back pressure changes on the kidneys were also recorded.

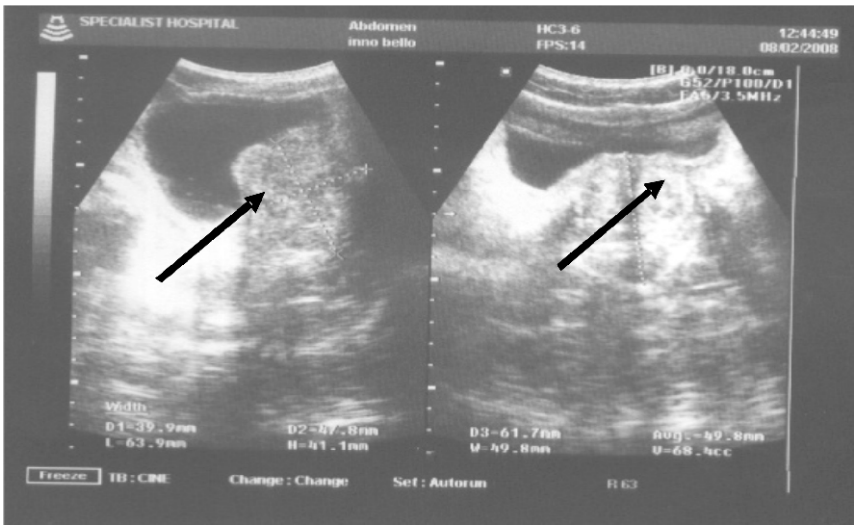
RESULTS

A total of 96 patients with enlarged prostate were detected. The commonest indication for TAUS was suspected benign prostatic hypertrophy accounting for 96 patients (82.1). The smallest prostate size diameter (craniocaudal) measured 40mm, while the largest measured 135mm (mean 60.6mm, median = 58mm, SD = 118mm). The smallest prostatic volume was 45cm^{3} with largest measuring 387cm^{3} (mean 128, mm median 118mm and SD of 68mm).

The enlarged prostate shows a heterogeneous parenchymal architecture in 92(95.8%) and homogenous architexture with 4(4.2%), (Fig.1a & 1b). The vesico-prostatic interface were preserved in 89(92.7%) and obliterated in 7(7.3%). The most common clinical information was difficulty in passing urine 32(33.3%) followed by frequency with 25(26.0%). Poor stream and heamaturia were seen in 22(22.9%) and 5(5.2%) of patients respectively, (Fig.2). Hydrocalicosis was seen in 32(33.3%) of patients while 64(66.7%) show normal appearances. (Figure 3a & b).

The prostate shows smooth outlines in 69(71.9%) and lobulated outline in 27(28.1%). Correlation between prostate volume and age was compared using variance (ANOVA). In this correlation a *p*-value of <0.001 was obtained. Similar values were obtained with correlation between prostate size and age. Pearson correlation was significant statistically

Figure *1a&b:Transverse and longitudinal transabdominal ultrasonography of two patients showing a heterogenous focus in the bladder base in keeping with large prostate glands. (Arrows)*



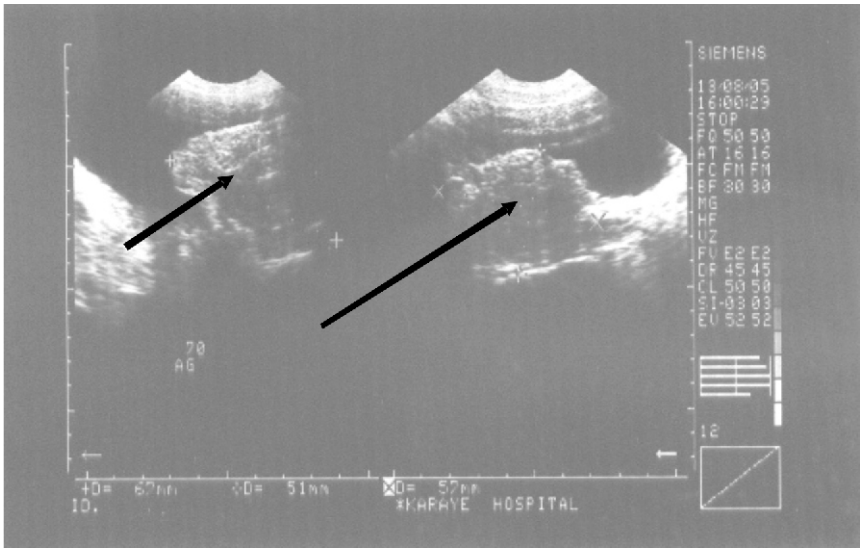


Figure 2: *Bar chart showing various clinical features*

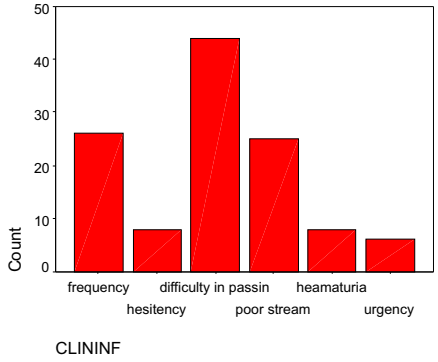


Fig 3a: *Pie chart sowing the degree of hydrocalicosis*

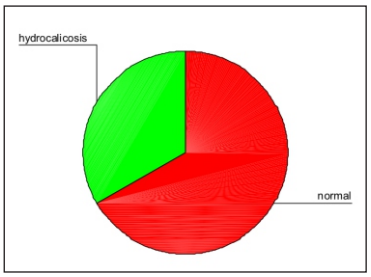


Figure 3b: *Longitudinal transabdominal scan showing moderate hydrocalicosis in the right kidney*

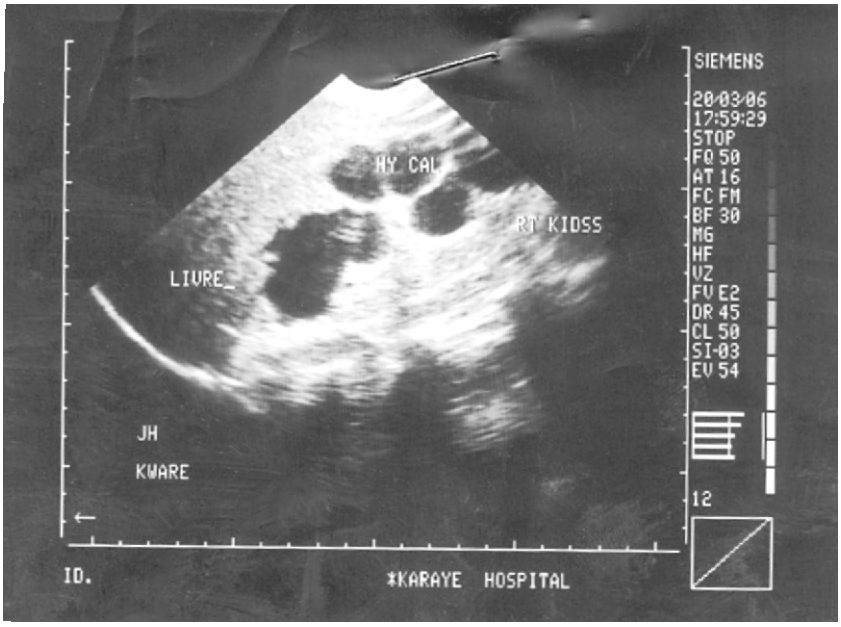
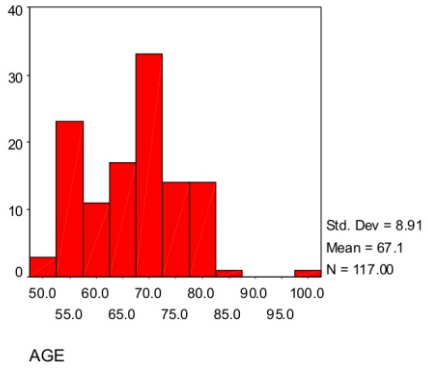


Figure 4: *Age frequency distribution of the117 subjects studied*



at the 0.05 levels 2(tailed) between the age and prostate volume. There was no significant statistical correlation among the ultrasound features.

DISCUSSION

The symptoms commonly associated with BPH are collectively called lower urinary tract symptoms (LUTS)[30]. It should be noted that BPH is not always the cause of these symptoms. An enlarged prostate may be accompanied by few symptoms, while severe LUTS may be present with normal or even small prostate and are more likely due to other conditions.

With the 'greying' of society and the promotion of men's health issues through the pages of the popular press, the increase in the number of men presenting with BPH seems set to continue.[30] Fortunately, we have recently seen the emergence of data that have continued to clarify the appropriate role of ultrasound imaging in the management of BPH[30].

This period has also witnessed an evolution in terms of the very definition of the disease. No longer do we talk of "prostatism", a non specific term applied to urinary symptoms in men, but a "true" or "clinical" BPH with resultant bladder outflow obstruction.

Until recently there has been a relative dearth of available evidence regarding the aetiology of BPH and its associated complications. However this situation has changed with publication of Olmsted county study of urinary symptoms and health status among men, a community-based study

involving 2115 men[22,23].

The severity of symptoms associated with BPH was shown to increase with time and were greatest in older men. Prostate size also increased with age, the overall rate being 0.6ml/yr. Importantly, men with larger prostates (>40ml) were nearly three times as likely to be worried by those symptoms and twice as likely to experience interference with daily activities than men with smaller prostate. Most of the patients in this study were aged people with age range between 50-100 years and the prostate volume was greater than 40ml in the majority.

Ultrasonography has become the fastest diagnostic imaging modality. Its versatility, portability, low costs and efficacy has made ultrasonography an indispensable diagnostic tool in modern patient care[31]. Transabdominal ultrasound (TAUS) is useful as a screening test for evaluating the prostate. In addition to the size of the prostate, the horizontal shape (H:W ratio) makes an assessment of benign prostatic obstruction more reliable[32]. TAUS prostatic volume estimation although inferior to transrectal method was demonstrated to have an accuracy of 97.5%[33]. TAUS has an advantage over the transrectal, in that complications of BPH can be evaluated by transabdominal ultrasonography being non traumatic and is well tolerated by patients. Some of the disadvantage of transrectal ultrasound include, non availability of rectal probes, the procedure is uncomfortable to the patient and in some cases feacal evacuation is needed before the procedure.

Magnetic resonance imaging (MRI) is more accurate than TRUS for determining the prostate volume. However, because TRUS is in expensive (when compared with MRI) and almost as accurate as MRI, it should be the preferred method for measuring the prostate volume[34].

Among patients, and unfortunately among many doctors, it is still believed that prostatism is due to an enlarged prostate and can be cured by reducing the size of the prostate. Prostate volume can roughly be determined by cystoscopy, but prostate size does not have significant bearing on obstruction. Barry and Colleques[35] show no correlation between prostate volume and any other parameter as seen in the current study.

Interestingly, nocturia is a symptom that is increasingly prevalent with age in men as well as in women[36]. A more recent study by Ezz el Din *et al* [37] also failed to demonstrate a correlation between prostate volume and overall symptoms score, but found a week correlation to urgency and week stream. In this present study there was no correlation between the prostate volume and the clinical symptoms. However, there was correlation between prostate volume and the age of the patient.

A common recommendation for BPH management is to measure post voidal residual urine volume[38]. Post voidal residual is a sign of bladder function abnormality rather than the result of bladder outlet obstruction[38]. Considerably increased post residual urine volume may be a sign of neurologic disease. Bruskewitz and Colleques in 1982[39] reported the considerable variability in post void residual urine and showed there was no correlation between post voidal residual urine and urinary tract infection in BPH patient. All the subjects in this study show variable post micturation residual urine. Still, residual urine is not a contraindication to watchful waiting or medical therapy. Because of large test-retest variability and lack of outcome studies, it is not possible to establish a post voidal residual "cut off" point for decision.

Imaging of the entire urinary tract (including the upper) particularly prior to surgery, has been an integral part of the diagnostic assessment of elderly men with LUTS, due to BPH during the past decades[40-41]. Data from several large-scale studies have led to doubts concerning the role of routine upper urinary tract imaging in patients with LUTS. Wilkinson and Wild[42] reported 175 patients with LUTS with no urinary retention and identified no abnormalities on renal ultrasound and IVU that would have altered the therapeutic approach. About 68(58.1%) of patients in this study show normal sonographic appearance of both kidneys. Similar data has been published by Koch *et al*, who performed renal ultrasound scans in consecutive series of 556 elderly men with LUTS; 14(2.5%) had hydrocalicosis[43]. This study revealed hydrocalicosis in 32(33.3%) while 64 (66.7%) had normal appearance.

There is no doubt that the presence of bladder stones can be assessed accurately by urethroscopy. Bladder stones are clear indicator of bladder outlet obstruction. While it is not always clear whether the obstruction is of an organic, anatomic or neurologic nature, the presence of stones in the bladder indicates an abnormality in the bladder emptying mechanism and is usually preceded by the presence of residual urine or recurrent urinary tract infection. Stones composed of poorly radio-opaque or radiolucent materials are seen very well by transabdominal sonography. About 4 (3.4%) of patients in this study had stone within the urinary bladder.

As it is almost impossible to obtain agreement on what defines a man with LUTS/BPH, it seems logical to say that progression cannot be defined in terms of transition from non-cases. Instead, progression must be measured by documenting deterioration in any number of physicological variables that we associate with the LUTS/BPH syndrome, traditionally these have included the following: Decrease in maximum flow rate, Increase in residual urine, Increase prostate size, Deterioration (increase) in symptoms score.

Considerable interest currently rest with prostate serum antigen (PSA). It appears to be a good predictor of progression as any of the variables mentioned above.

Although cut-off points in this study might have been provisional, we can at least conclude that transabdominal ultrasonography as a screening device gives us useful information about

prostatic obstruction. However, we should note that transabdominal ultrasonography showed limited ability to detect small prostate and it is not useful for evaluating the bladder outlet obstructions caused by bladder neck disease, destrusor sphincter dysynergia. etc. Recent studies have demonstrated that patients with bladder neck disease include a considerable number with functional and organic obstruction[44].

This study was able to demonstrate various sonographic features of benign prostatic hyperplasia and some of its complications. The information obtained might help in the managements of patients with suspected BPH.

A comprehensive pathological correlation with the various sonographic features is recommended as future study.

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