

Pre- and Post-Prostatectomy Detrusor Wall Thickness and the Symptom Profile in Patients with Benign Prostatic Enlargement: A Prospective Review in Nigerian Men

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ABSTRACT

The urinary bladder undergoes morphological and functional changes in patients with symptomatic benign prostatic enlargement (BPE). These detrusor changes reflect chronically increased intravesical pressure as a result of outlet obstruction. This study aims to determine the relationship between the Pre- and Post-op detrusor wall thickness (DWT), international prostate symptom score (IPSS) and duration of lower urinary tract symptoms (LUTS) in patients who had open simple prostatectomy (OSP). **Method:** This was a prospective study of a cohort of patients who had OSP for symptomatic BPE. The IPSS and symptom duration for each patient was noted. Each patient also had abdominal ultrasound scan with measurement of their DWT. Retropubic OSP was done for each patient. The detrusor wall thickness measured was also measured 12 weeks after the prostatectomy. **Results:** Fifty-two patients completed the study; mean age was 66.37 ± 8.09 years. The median pre-operative IPSS was 28 (IQR = 13.75), and the median duration of symptoms was 24months (IQR = 37 months). The mean pre-operative DWT was $4.41 \pm 1.38\text{mm}$ while the mean post-operative DWT was $2.16 \pm 0.98\text{mm}$. The pre-operative IPSS ($p = 0.833$) and duration of symptoms ($p = 0.375$) did not significantly correlate with the pre-operative DWT. There was significant reduction in the mean DWT ($p < 0.001$) and IPSS ($p < 0.001$) following prostatectomy. **Conclusion:** DWT appears not to be significantly influenced by the severity or duration of LUTS. However, it reduced significantly following OSP with corresponding improvement in urinary symptoms.

Key Words: Benign prostatic enlargement, detrusor wall thickness, international prostate symptom score, open simple prostatectomy

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INTRODUCTION

Benign prostatic enlargement (BPE) is a common urological condition, and a leading cause of Bladder outlet obstruction (BOO) in middle aged and elderly men¹⁻³. Open simple prostatectomy (OSP) is still a common surgical treatment for BOO from BPE in developing countries⁴. The urinary bladder undergoes certain changes due to its increased workload in bladder outlet obstruction⁵. These structural and functional compensatory changes are aimed at overcoming the increased resistance at the bladder outlet⁶. They result from alteration in the cellular composition and metabolism of the bladder wall⁷. These detrusor changes depend on the severity and duration of obstruction; and they include detrusor hypertrophy, detrusor instability and reduced detrusor contractility^{6,8}. Structural bladder wall changes that may also occur include trabeculations, sacculation and diverticula formation⁹⁻¹¹. Detrusor hypertrophy results from increased collagen deposition and can still adversely affect bladder function even after relief of obstruction.

Measurement of detrusor wall thickness (DWT) is done during abdominal ultrasound scan, with the use of high frequency probes. The detrusor appears hypoechoic and is seen in between the hyperechoic outer serosa layer and the hyperechoic inner mucosa/submucosa layers of the bladder^{1,12}. The DWT depends on the level of distension of the bladder and is considered accurate when the bladder volume reaches 250mls¹³. Kessler et al.¹ reported a median DWT of 1.7mm for unobstructed; 1.8mm for equivocal and 2.7mm for obstructed patients. Detrusor hypertrophy may be completely reversed within twelve weeks of surgical treatment for BOO⁸.

OBJECTIVES

This study determined the relationship between the pre- and post-op DWT and symptom profile in patients with symptomatic BPE who underwent OSP. The symptom profile was assessed using the international prostate symptom score (IPSS) and the duration of lower urinary tract symptoms.

PATIENTS AND METHOD

This was a prospective hospital-based study of a cohort of patients who had OSP on account of symptomatic BPE at the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) from January 2018 to December 2019. The minimum sample size for the study was estimated to be 35 patients using Leslie-Fischer's formula, and 52 patients were recruited into the study. The IPSS and duration of LUTS were determined. A Toshiba real time ultrasound scanner model TUS-F30 equipped with ultrasound transducer 7.5MHz (Year of manufacture 2010) was used to measure the DWT, which was taken as the hypoechoic middle bladder layer of the anterior bladder wall. The DWT was measured at three points on the anterior bladder wall and the average value was used for this study. Open retropubic prostatectomy was done for all the patients. DWT was also measured 12 weeks after prostatectomy. All bladder ultra-sound scans were performed by a single radiologist to prevent inter-observer variability.

The exclusion criteria include patients with neurogenic bladder, uncontrolled diabetes mellitus, history of previous bladder surgery (such as suprapubic cystostomy) which might affect the thickness of the anterior bladder wall, gross structural bladder wall abnormality (such as bladder diverticula), as well as those on prolonged urethral catheterization with continuous bladder drainage for more than 3 months duration. Informed consent was obtained from each patient. Ethical approval was obtained from the Ethics and Research Committee of OAUTHC (IRB/IEC/0004553), and the study was performed in accordance with the ethical standards. The data obtained was analysed using the Statistical Package for Social Sciences (SPSS) software for windows version 20. Correlations of IPSS and duration of symptoms with pre-operative DWT was determined using Pearson coefficient. The association between pre- and post-operative DWT was determined using paired sample T-test. For all statistical tests, $P < 0.05$ was considered significant

RESULTS

Fifty-two patients participated and completed the study and were included for analysis. The age distribution of the patients ranged from 49 - 89 years, with a mean of 66.37 ± 8.09 years and a peak in the 7th decade. The symptom profile comprised the pre-operative IPSS and quality of life, as well as the duration of symptoms. The median pre-operative IPSS was 28 (IQR = 13.75). Three-quarters of the patients had severe symptoms (Fig. 1) and felt mostly dissatisfied with their symptoms (Table 1).

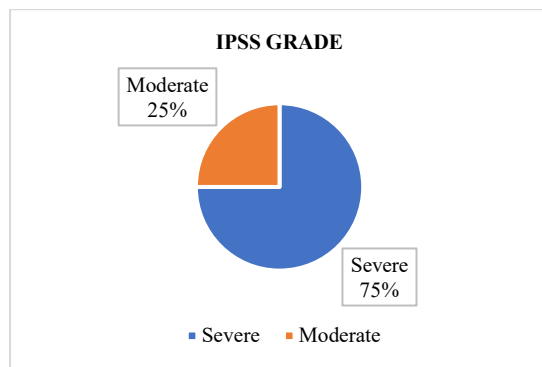


Figure 1: Severity of Symptoms

Table 1: Quality of life

Quality of Life	Frequency	Percentage (%)
3	12	23.1
4	19	36.5
5	16	30.8
6	5	9.6
Total	52	100

The median duration of symptom was 24 months (IQR = 37). Most patients presented after one year of onset of symptoms. The median prostate volume of the patients was 86.45 cm^3 (IQR = 72.05 cm^3), and the most common indication for surgery was failed medical therapy.

The Pre-op DWT ranged from 1.8 – 7.3mm, with a mean of $4.41 \pm 1.38\text{mm}$; while the Post-op DWT at 12 weeks ranged from 0.8 – 6.3mm with a mean of

$2.16 \pm 0.98\text{mm}$. There was a 50% reduction in the DWT (Fig. 2).

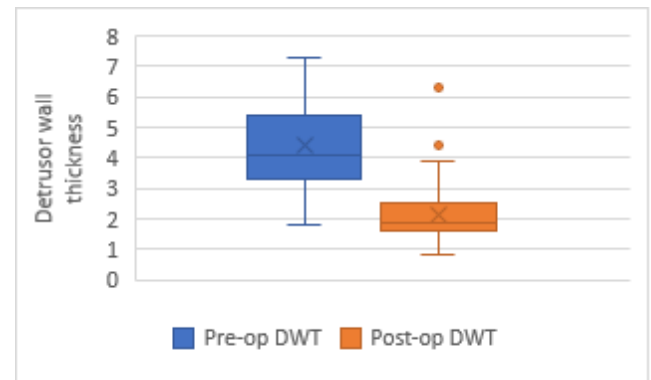


Figure 2: Detrusor wall thickness

The relationship between symptom profile and pre-operative detrusor wall thickness was examined using Pearson correlation. There was no significant correlation between pre-operative IPSS and the pre-operative DWT ($p = 0.833$; Fig. 3). There was also no significant correlation between the duration of LUTS and pre-operative DWT ($p = 0.375$; Fig. 4).

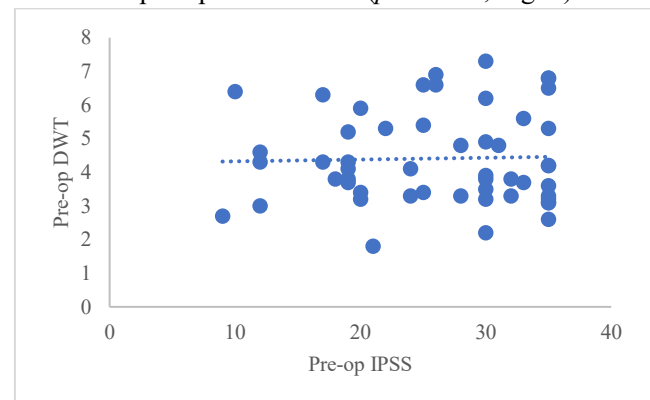


Figure 3: DWT and pre-op IPSS

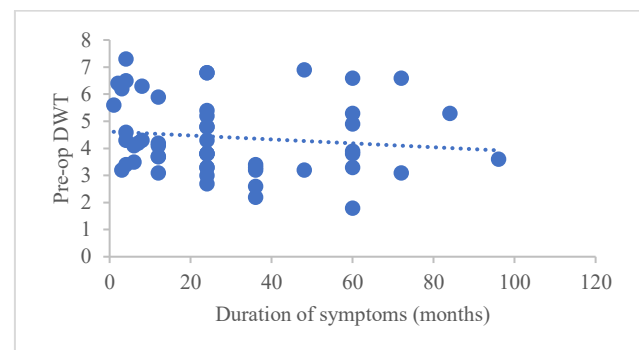


Figure 4: DWT and duration of symptoms

The relationship between pre-operative and post-operative detrusor wall thickness was determined using the Paired Sample T-test. There was a significant reduction in the mean DWT from a pre-op value of 4.41mm to a post-op value of 2.16mm ($p < 0.001$; Fig. 5). The pre- and post-operative IPSS scores were also compared, and there was significant reduction in the median IPSS value from 28 to 2 ($P < 0.001$; Fig. 6), and the patients were mostly satisfied with their voiding.

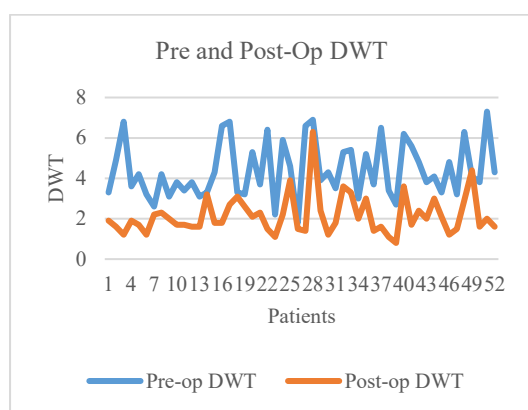


Figure 5: Relationship between pre- and post-op DWT ($P < 0.001$)

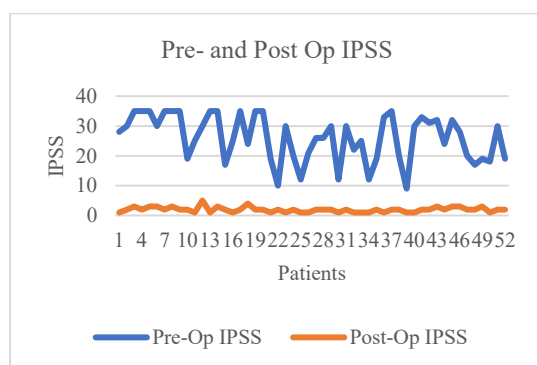


Figure 6: Relationship between Pre- and Post-Op IPSS ($P < 0.001$)

DISCUSSION

The age distribution of the patients in this study conforms with that from other studies^{14–17}. BPE is regarded as a disease of middle aged and elderly men, and this is clearly depicted by the age range of participants in this study, with a peak incidence in the 7th decade. Individuals in this age group are prone to several comorbidities and age-related

changes in the various organs of the body, one of which is the enlargement of the prostate gland. The cumulative effect of these changes is gross impairment in the quality of life of these senior citizens, many of whom have retired from active service.

Many patients in this study had their symptoms for a year or more with no form of treatment, pointing to the fact that they waited until they could no longer cope with their symptoms before they presented to the hospital. This shows that much still needs to be done in terms of public awareness and advocacy for early presentation and prompt treatment of BPE in our environment. This finding is similar to that by Salako et al⁴, in a review of 337 patients who had open prostatectomy for BPE. They reported that 56.3% of the patients presented after one year of onset. Adegun et al¹⁶ in their study of 96 patients who had open prostatectomy also noted that only 20% of their subject presented within 6 months of onset of symptoms. While this study did not evaluate reasons for delayed presentation, some authors have attributed this to various factors such as lack of knowledge of the symptoms of BPE, preference for alternative therapy and lack of quality health care system¹⁶.

Given the delay in presentation, it is not surprising that most patients had severe symptoms and were mostly dissatisfied. The predominance of severe symptoms in this study may be explained by the inclusion of only patients who were scheduled for prostatectomy. This automatically excludes patients on medical treatment, many of whom might have had mild or moderate symptoms. Many studies which evaluated non-selected population of patients reported a predominance of moderate symptoms in their cohorts^{17–20}. Lu et al.¹⁹ in their study of 122 elderly men, reported that 56.6% of patients with BPH had moderate symptoms. Eze et al.¹⁷ in their study of 101 men with BPH, noted that most of the patients (60.4%) had moderate symptoms.

Detrusor wall hypertrophy is a known anatomical change following bladder outlet obstruction. Its measurement is considered an objective way of assessing detrusor response to BOO. Normal

detrusor wall thickness has been reported to range from 1.7mm to 2mm in healthy men^{1,12}. This study revealed a mean detrusor wall thickness of 4.4mm in the study population. This far exceeds the threshold of the normal range^{12,21} and also exceeds what other authors have observed among patients with BOO^{1,22}. Kessler et al¹ reported a detrusor wall thickness of 2.7mm in men with BOO. This difference in the detrusor wall thickness among patients with BOO may be explained by the racial differences, considering that blacks are known to have larger prostate sizes^{4,23}. While the figures may vary, detrusor wall thickness has been clearly documented to be higher in patients with BOO across several studies^{9,19}.

The duration of symptoms of the study population did not also have a relationship with the pre-operative DWT. Since most of the patients had their symptoms for more than one year, it may also be possible that the detrusor has reached its limit of collagen deposition and growth⁷.

While prostatectomy is expected to address the symptoms of BPE which it often does, it is not uncommon for storage urinary symptoms to persist even after prostatectomy. Although various factors may account for this, alteration in the configuration of the detrusor wall has been implicated as one of the possible reasons why patients may have storage symptoms post prostatectomy⁷. Patients with irreversible damage to the detrusor muscle following BPE tend to have poorer outcomes in terms of symptom resolution and quality of life. It is comforting however, that despite the marked thickness in the detrusor wall in this cohort, there was a significant reduction following prostatectomy with the mean post-operative DWT being almost half of the pre-operative DWT value. The reduction in DWT is due to the relief of bladder outlet resistance and the ease of bladder emptying, without need for very high intra-vesical pressures. The reduction in DWT was irrespective of the pre-operative value, as it was noted in most patients, and this corresponded to improvement in symptoms in these patients. Two patients whose DWT did not reduce were as a result of post-operative bladder neck stenosis. They were treated with bladder neck

dilatation using metallic dilators. These findings agree with other studies which demonstrated significant changes in DWT with corresponding improvement in LUTS^{8,9}.

Following open prostatectomy, there was improvement of LUTS, with a significant drop in the IPSS scores of the patients from a median pre-op value of 28 to a median post-operative IPSS score of 2. The resolution of symptoms post prostatectomy reflects its effectiveness in the treatment of patients with BOO secondary to BPE in our environment. Other studies have also demonstrated similar relief in symptoms following open prostatectomy^{4,24,25}.

CONCLUSION

This study did not show any significant relationship between IPSS, duration of LUTS and detrusor wall thickness. However, it clearly demonstrates the impact of prostatectomy, not only on the improvement of symptoms, but also in the reduction of the thickness of the detrusor wall, to about half the pre-operative values. DWT may therefore be used as one of the outcome measures for effective relief of obstruction post-prostatectomy.

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