P-ISSN: 3025-6518
E-ISSN: 3025-0501

Almakki Health Informatics Journal

Correlation between Prostate Volume and Intravesical Prostate Protrusion to Bladder Detrusor Muscle Thickness in Patients with Benign Prostate Enlargement by Transabdominal Ultrasound Examination in Banjar Jagatamu, Meliling, Kerambitan, Tabanan 2024

Ni Made Putri Suastari[1], Ni Made Widya Mahayani[2], Dewa Komang Agung Hersya Paritranaya Dinata[3]
Faculty of Medicine Lecturer, Universitas Mahasarawati Denpasar, Indonesia[1,2]
Faculty of Medicine Student, Universitas Mahasarawati Denpasar, Indonesia[3]
E-mail: suastari@unmas.ac.id

KEYWORDS

benign prostate enlargement; bladder detrusor muscle thickness; intravesical prostatic protrusion; prostate volume.

ABSTRACT

Benign prostate enlargement (BPE) is a common degenerative condition in elderly men, often leading to lower urinary tract symptoms (LUTS) such as urgency, frequent urination, and incomplete bladder emptying. This study investigates the correlation between prostate volume, intravesical prostate protrusion (IPP), and bladder detrusor muscle thickness in patients with BPE using transabdominal ultrasonography. Conducted in Banjar Jagatamu, Meliling Village, Tabanan Regency, the study employed a cross-sectional design with 71 participants aged 60 years and older. Inclusion criteria required an International Prostate Symptom Score (IPSS) ≥ 8 or prostate volume > 20 mL. The results revealed a significant correlation between prostate volume and bladder detrusor muscle thickness ($r = 0.665$, $p < 0.001$) and between IPP and detrusor thickness ($r = 0.806$, $p < 0.001$). These findings highlight the utility of ultrasonography in assessing structural changes caused by chronic urinary obstruction. The study provides valuable insights into the role of prostate volume and IPP as predictive markers for bladder remodeling in BPE patients. By focusing on a rural population, this research emphasizes the need for accessible diagnostic tools to improve early detection and management of BPE, ultimately enhancing patient outcomes in underserved communities.

INTRODCUTION

One of the common degenerative diseases in men is benign prostatic hyperplasia. Based on World Health Organization (WHO) data, the incidence of benign prostate enlargement is 0.5 - 1.5/100,000 world population with very rare mortality. At the age of 50-60 years, it is found that 50% of men have pathologic evidence of an enlarged prostate and more than 80% at the age of over 80 years. (Vuichoud & Loughlin, 2015; Zhang et al., 2019) In 1994-2013, data from Cipto Mangunkusumo Hospital showed a total of 3,804 cases of benign prostate enlargement disease.(Pradiptha et al., 2019)Meanwhile, data from Sanglah Hospital in Denpasar in 2013 showed that 103 patients with benign prostate enlargement underwent transurethral resection of the prostate (TURP) surgery out of a total of 1161 urological surgeries. (Wijaya et al., n.d.)

This disease causes narrowing of the urethral canal which results in lower urinary tract syndrome. Symptoms include urgency, increased frequency, nocturia, incomplete urination and weak urine flow. If left untreated, complications such as urinary retention and impaired renal function can arise, as well as decreased quality of life and increased healthcare costs. (Krisna et al., 2017; Wijaya et al., n.d.) Chronic obstruction of the lower urinary tract can cause structural changes in the bladder such as trabeculation, increased thickness of the bladder detrusor muscle depending on the severity and duration of the obstruction. There are several previous studies that have shown an increase in bladder detrusor muscle thickness in patients with obstruction to urine flow.(Bright et al., 2010; Güzel et al., 2015)Currently, the diagnosis of benign prostate enlargement or lower urinary tract obstruction is made by history taking, physical examination, and supporting examination. One of the supporting examinations used to assess prostate enlargement is transabdominal ultrasonography (USG) which is non-invasive, relatively safe, contains no radiation, is available in many places, and is relatively cost-effective. (Wijaya et al., n.d.) Currently, the reporting of benign prostate enlargement cases only includes prostate volume. There is no reporting standard for the intravesical prostate protrusion component and bladder detrusor muscle wall thickness due to benign prostate enlargement. This study aims to assess the correlation between prostate volume and intravesical prostate protrusion to bladder detrusor muscle thickness in patients with benign prostate enlargement by transabdominal ultrasonography examination.

Benign Prostatic Hyperplasia (BPH) is a common condition in elderly men, characterized by the enlargement of the prostate gland. This condition can lead to urinary flow obstruction and lower urinary tract symptoms (LUTS) such as frequent urination, urgency, and nocturia. Studies indicate that the prevalence of BPH increases with age, significantly impacting the quality of life of those affected (Phua, 2021).

The management of BPH includes medical and surgical approaches, depending on the severity of symptoms and the response to initial therapy. The American Urological Association (AUA) guidelines recommend the use of 5-alpha reductase inhibitors and alpha-blockers as first-line therapy to reduce symptoms and slow disease progression. Additionally, minimally invasive procedures such as water vapor therapy have demonstrated effectiveness in reducing symptoms with lower risks of complications compared to conventional surgery (Doe et al., 2012)

Several studies have investigated the relationship between prostate volume, intravesical prostate protrusion (IPP), and bladder detrusor muscle thickness in patients with benign prostate enlargement (BPE). Gandhi et al. (2018) highlighted the clinical significance of IPP as a predictor of bladder outlet obstruction, correlating it with structural changes in the bladder wall. Research by Güzel et al. (2015) emphasized the use of bladder wall thickness as a non-invasive diagnostic marker for obstruction severity in BPE patients. Additionally, Rusdiono (2013) identified a strong correlation between detrusor wall thickness and IPP length in transabdominal ultrasonography, providing insights into the pathophysiological mechanisms of chronic urinary obstruction. These findings collectively underscore the utility of imaging techniques in assessing disease progression and guiding management strategies for BPE.

While prior studies have established the correlation between prostate volume, IPP, and bladder detrusor muscle thickness, they often lack comprehensive analysis of these variables in specific populations, particularly in rural settings. Furthermore, most research has focused on individual correlations without examining their combined implications for disease management and prognosis. This study aims to address these gaps by analyzing the combined impact of prostate volume and IPP on detrusor muscle thickness using transabdominal ultrasonography in a localized setting, providing a holistic perspective on structural bladder changes.

The novelty of this study lies in its localized focus on the rural population of Banjar Jagatamu, exploring unique demographic and environmental factors influencing the relationship between prostate volume, IPP, and detrusor muscle thickness. By integrating advanced imaging techniques with a population-specific approach, this research provides new insights into the pathophysiology and diagnostic utility of these parameters in managing BPE.

This study aims to evaluate the correlation between prostate volume, IPP, and bladder detrusor muscle thickness in patients with BPE using transabdominal ultrasonography. The findings are expected to enhance diagnostic accuracy, facilitate early intervention, and inform tailored management strategies for BPE patients. By addressing healthcare needs in underserved rural areas, this research also contributes to equitable healthcare access and improved patient outcomes.

RESEARCH METHOD

This research is an analytic observational with a cross-sectional study. The research location was Banjar Jagatamu, Meliling Village, Kerambitan District, Tabanan Regency in November 2024 with a total sample of 71 people. The sample was elderly patients with benign prostate enlargement from the reachable population who met the inclusion and exclusion criteria, so that eligible subjects were obtained, then taken consecutively until the sample size was met. Inclusion criteria were patient age ≥ 60 years and willing to participate after signing informed consent, while exclusion criteria were patients with a history of surgery on the urinary tract, lower urinary tract stones, prostate cancer and neurological disorders, pelvic trauma or diabetes. Patients completed the informed consent and then history taking, IPSS questionnaire was completed and prostate ultrasonography was performed to assess prostate volume, intravesical prostate protrusion and bladder detrusor muscle thickness. Patients with IPSS score ≥ 8 or prostate volume > 20 mL were included in the sample and assessed for inclusion and exclusion criteria. Data were tabulated and analyzed with SPSS version 29.

RESULT AND DISCUSSION

A total of 71 samples were included in the study. Demographic characteristics and measurement results are summarized in Table 1. Correlation between prostate volume and intravesical prostate protrusion with bladder detrusor muscle thickness was analyzed using the Spearman test. The p-value for prostate volume with bladder detrusor muscle thickness and intravesical prostate protrusion with bladder detrusor muscle thickness was <0.001.

Besides p-value, the study also assessed r-value. The r-value for prostate volume with bladder detrusor muscle thickness was 0.665 and intravesical prostate protrusion with bladder detrusor muscle thickness was 0.806. The results are shown in Table 2. Figure 1 and 2 represent scatterplot graphs for prostate volume and intravesical prostate protrusion with bladder detrusor muscle thickness.

Table 1. Characteristics of The Study Subjects

Variable	**Min**	**Median**	**Max**	**N (%)**
Age (year)	60	65	75	
Prostate volume (ml)	26.29	44.47	73.55	
Intravesical prostate protrusion (mm)	4.00	11.60	25.30	
Intravesical prostate protrusion grade				
Grade I				10 (14.1%)
Grade II				8 (11.3%)
Grade III				53 (74.6%)
Bladder detrusor muscle thickness (mm)	1.00	2.30	3.20	

Table 2. p-value and r-value of Prostat Volume dan Intravesical Prostate Protrusion with Bladder Detrusor Muscle Thickness

Correlation	**p-value**	**r-value**
Prostate volume with bladder detrusor muscle thickness	< 0.001	0.665
Intravesical prostate protrusion with bladder detrusor muscle thickness	< 0.001	0.806

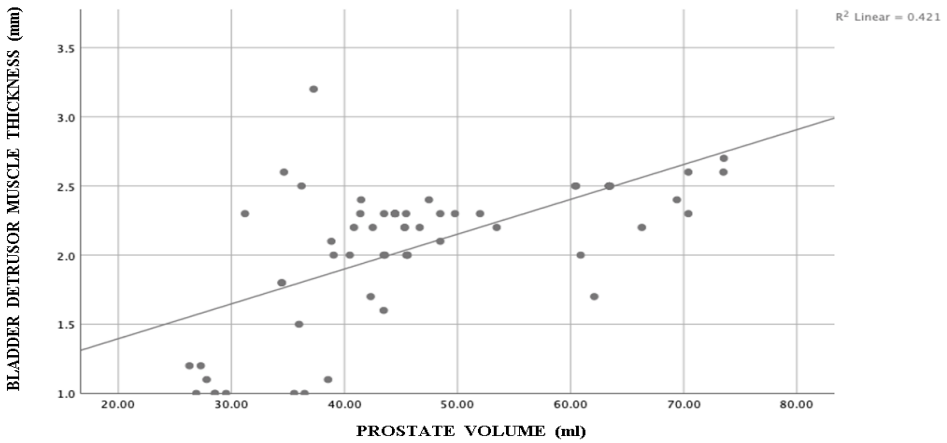

Figure 1. Scatterplot graph of Prostate Volume with Bladder Detrusor Muscle Thickness

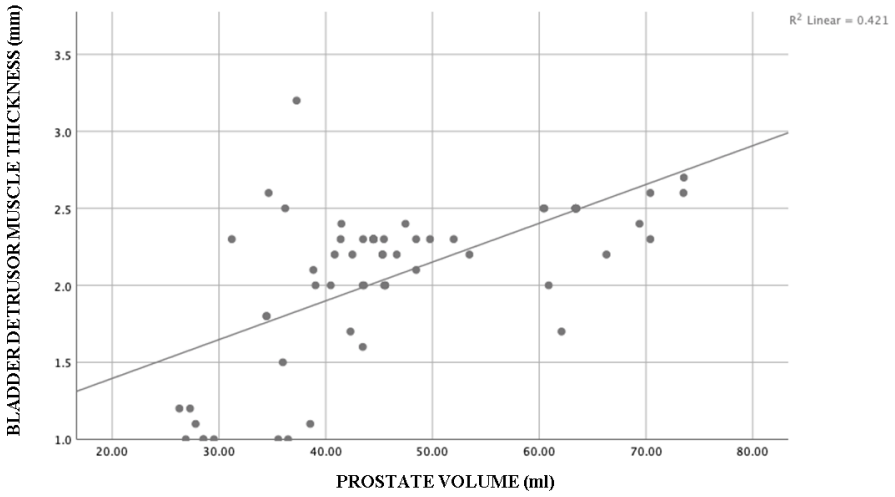

Figure 2. Scatterplot graph of Intravesical Prostate Protrusion with Bladder Detrusor Muscle Thickness

DISCUSSION

The research subjects are 71 patients with benign prostate enlargement. The median value of their age was 65 years old. This finding follows the study of (Gandhi et al., 2018)that mentioned that most men in their fifth and sixth decade have benign prostate enlargement.(Gandhi et al., 2018)

The median value of prostate volume and intravesical prostate protrusion was 44.47 ml and 11.6 mm, respectively. Mostly (74.6%) of intravesical prostate protrusion were categorized as grade III, 14.1% as grade 1, and the rest (11.3%) were grade 2. The median value for bladder detrusor muscle thickness was 2.30 mm. These results are supported by Wiratama et al, 2018 where most (42.2%) of intravesical prostate protrusion were categorized as grade III. (Wiratama, 2018)

Bivariate analysis of prostate volume with bladder detrusor muscle thickness and intravesical prostate protrusion with bladder detrusor muscle thickness revealed p-value < 0.001, meaning there are statistical correlation between those variables. The dots are dominant distributed in the center on the scatterplot graph of prostate volume with bladder detrusor muscle thickness and intravesical prostate protrusion with bladder detrusor muscle thickness, forming a straight line and showed correlation. The r-value for prostate volume with bladder detrusor muscle thickness was 0.665 which is a strong correlation between these two variables. Meanwhile, the r-value of intravesical prostate protrusion with bladder detrusor muscle thickness was 0.806, there is a very strong correlation. These results support with the literature, which states that chronic bladder obstruction will result in structural changes such as thickening of the bladder detrusor muscle.(Oelke et al., 2002)

The results of this study are supported by (Hadiyanti & Prasetio, 2020)sdwhich is the detrusor wall thickness had a significant positive correlation with prostatic protrusion length and prostate volume (p< 0,05).(Rusdiono, 2013)Besides that, results of this study are supported by Gurning et al, 2023. The study stated that there was strong correlation between

the length of intravesical prostatic protrusion with detrusor wall thickness obtained correlation coefficient 0.54 (p= 0.015).(Gurning J, Murna IW, Arief C, 2013)

This study has limitations, only took the samples in only one small area “banjar” so that it did not describe representative results in the elderly population in general.

CONCLUSION

There is strong correlation between prostate volume and intravesical prostate protrusion with bladder detrusor muscle thickness.

REFERENCES

Bright, E., Oelke, M., Tubaro, A., & Abrams, P. (2010). Ultrasound estimated bladder weight and measurement of bladder wall thickness—useful noninvasive methods for assessing the lower urinary tract? *The Journal of Urology*, *184*(5), 1847–1854.

Doe, J., DOE, J., & ROE, P. (2012). UNITED STATES DISTRICT COURT NORTHERN DISTRICT OF CALIFORNIA SAN FRANCISCO DIVISION. *ARGUMENT*, *25*(26), 27.

Gandhi, J., Weissbart, S. J., Kim, A. N., Joshi, G., Kaplan, S. A., & Khan, S. A. (2018). Clinical considerations for intravesical prostatic protrusion in the evaluation and management of bladder outlet obstruction secondary to benign prostatic hyperplasia. *Current Urology*, *12*(1), 6–12.

Gurning J, Murna IW, Arief C, P. J. (2013). *Relationship Between Intravesical Prostate Protrusion Length and Detrusor Muscle Thickness in Patients with Benign Prostate Hyperplasia Measured by Transabdominal Ultrasonography. Jakarta: Faculty of Medicine Universitas Indonesia,*.

Güzel, Ö., Aslan, Y., Balcı, M., Tuncel, A., Keten, T., Erkan, A., & Atan, A. (2015). Can bladder wall thickness measurement be used for detecting bladder outlet obstruction? *Urology*, *86*(3), 439–444.

Hadiyanti, I. K., & Prasetio, A. P. (2020). Pengaruh Persepsi Dukungan Organisasi dan Kepuasan Kerja Terhadap Turnover Intention Karyawan Pt . Kereta Api Indonesia (Persero) Daop 3 Cirebon. *E-Proceeding of Management*, *7*(2), 2447–2454.

Krisna, D. M., Maulana, A., & Kresnoadi, E. (2017). Correlation between Prostate-Specific-Antigen (PSA) Level and Prostate Volume in Benign Prostatic Hyperplasia at Bhayangkara Hospital Mataram. *Journal of Medicine and Health*, *1*(6).

Oelke, M., Höfner, K., Wiese, B., Grünewald, V., & Jonas, U. (2002). Increase in detrusor wall thickness indicates bladder outlet obstruction (BOO) in men. *World Journal of Urology*, *19*, 443–452.

Phua, T. J. (2021). The etiology and pathophysiology genesis of benign prostatic hyperplasia and prostate cancer: a new perspective. *Medicines*, *8*(6), 30.

Pradiptha, N. T., Duarsa, G. W. K., & Mahadewa, T. G. B. (2019). *Prospective cohort study comparison of bipolar and monopolar transurethral resection of prostate for benign prostatic hyperplasia: haemoglobin, sodium levels, and urethral catheter traction application*.

Rusdiono, R. (2013). *KORELASI ANTARA KETEBALAN OTOT DETRUSOR KANDUNG KEMIH DENGAN PANJANG PROTRUSI PROSTAT PADA PEMERIKSAAN ULTRASONOGRAFI TRANSABDOMINAL PASIEN PEMBESARAN PROSTAT JINAK*. Universitas Gadjah Mada.

Vuichoud, C., & Loughlin, K. R. (2015). Benign prostatic hyperplasia: epidemiology, economics and evaluation. *Can J Urol*, *22*(Suppl 1), 1–6.

Wijaya, A. T., Laksminingsih, N. S., Dwijaputra, I. M., Widiana, I. G. R., Duarsa, G. W. K., Asih, M. W., & Sitanggang, F. P. (n.d.). *Correlation of Prostate Volume and Intravesical Prostatic Protrusion with Detrusor Wall Thickness using Transabdominal Ultrasonography in Benign Prostate Enlargement: A Preliminary Study*.

Wiratama, M. A. (2018). Hubungan volume prostat dan protrusi prostat intravesika dengan kejadian retensi urin akut pada pasien benign prostatic hyperplasia di RSUD Buleleng bulan Mei-Agustus tahun 2017. *Medicina*, *49*(2).

Zhang, W., Zhang, X., Li, H., Wu, F., Wang, H., Zhao, M., Hu, H., & Xu, K. (2019). Prevalence of lower urinary tract symptoms suggestive of benign prostatic hyperplasia (LUTS/BPH) in China: results from the China Health and Retirement Longitudinal Study. *BMJ Open*, *9*(6), e022792.