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Original Research

Relationship between Age, Hypertension, and Type-2 Diabetes Mellitus in Benign Prostatic Hyperplasia Patients with Erectile Dysfunction

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Abstract

Based on epidemiological data, the prevelance of Erectile Dysfunction (ED) and Benign prostate hyperplasia (BPH) increases with the same risk factors, such as age, metabolic disease, and others. This study aimed to determine the prevalence of ED and its relationship to age and the presence of hypertension (HT) and type-2 diabetes mellitus (T2DM) comorbid in BPH patients. This is a cross-sectional study conducted at RSUD Dr. Saiful Anwar and Hermina Hospital Tangku-banprahu Malang utilizes two questionnaires, including the translated version of The International Index of Erectile Function (IIEF-5) and Erectile Hardness Score (EHS) in Indonesian. There were 44 research subjects with only 21 respondents to the IIEF-5 questionnaire, while the EHS questionnaire was given to all subjects. The prevalence of ED was found to reach 100.0% at the age of 70-79 years through the IIEF-5 questionnaire and aged ≥ 80 years through the EHS questionnaire. The prevalence of ED in BPH patients with HT was found to be higher than non-HT patients through both questionnaires. The prevalence of ED in BPH patients with T2DM was found to be higher through the IIEF-5 questionnaire and slightly lower through the EHS questionnaire than non-T2DM patients. Age had a significant relationship with ED through the EHS questionnaire ($p = 0.006$), while no significant relationship was found through the IIEF-5 questionnaire ($p = 1.000$). HT and T2DM did not have a significant relationship with ED (IIEF-5: $p = 0.229$ and 0.526; EHS: $p = 0.518$ and 1.000). The prevalence of ED in BPH patients increases with age and the presence of comorbid HT and T2DM. Even so, there was no significant relationship between HT and T2DM with ED in BPH patients. A significant relationship between age and ED was only found in the EHS questionnaire but not in the IIEF-5 questionnaire.

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1. Introduction

Benign Prostatic Hyperplasia (BPH) is a benign histopathological change in the prostate which causes an increase in prostate volume. In Indonesia, data from the Cipto Mangunkusumo Hospital (RSCM) stated that there were 3.804 cases of BPH in 1994 – 2013, with an average age of 66.61 years. The incidence of BPH reaches 70% at the age of 60 and reaches 90% at the age of over 80 years. A meta-analysis finds that the prevalence of BPH globally increases with age. The highest prevalence was in the age group ≥70 years, with a median prevalence of 25.2% (19 – 37.9%).[1,2]

Erectile dysfunction (ED) is the recurrent and persistent inability, partial or complete, to obtain and maintain a firm erection for satisfactory sexual activity accompanied by appropriate erotic stimulation.[3] Through research conducted in Jakarta, the prevalence of ED was 6.5% at the ages of 20 – 29 years and reached 88.0% in respondents aged 60 years and over.[4] The National Health and Wellness Surveys study conducted in 2015 – 2016 found that the prevalence of ED varied in each country. In Brazil, the prevalence of ED was 42.1% at the age of 40 – 70 years and 38.6% in patients with BPH.[5]

Epidemiological data show a close relationship between ED and BPH or Lower urinary tract symptoms (LUTS). Erectile dysfunction and LUTS/BPH are increased by some of the same risk factors, such as metabolic disease, hormonal status, smoking activity, and psychiatric status.[6,7] Several pathophysiological mechanisms have been defined as the basis for the occurrence of ED in LUTS/BPH patients.[8,9]

2. Methods

This study was carried out with a cross-sectional study design to determine the prevalence of erectile dysfunction and its relationship to age and the presence of hypertension (HT) and type-2 diabetes mellitus (T2DM) in BPH patients.

The study was conducted on patients with BPH who visited the urology outpatient at RSUD Dr. Saiful Anwar Malang and Hermina Tangkubanprahu Hospital Malang from September 2022-February 2023. The sampling method used was purposive sampling. The inclusion criteria for this study were BPH patients aged 40 years and over. This study excluded BPH patients with a history of prostate surgery, prostate cancer, patients with complications of urinary retention, and when the subject withdrew.

This study used questionnaires instrument to collect sample data for the study. Identification of erectile dysfunction (ED) was carried out using two questionnaires: the International Index of Erectile Function-5 (IIEF-5) and the Erectile Hardness Score (EHS) in the Indonesian version. Answer scores on the IIEF-5 questionnaire were categorized into: severe ED (5–7), moderate ED (8–11), mild to moderate ED (12–16), mild ED (17–21), no ED (22–25); so that a person will be said to suffer from erectile dysfunction if the questionnaire score is <22.[3,4] The EHS questionnaire can assess erection hardness on a 5-point scale with just one question. An EHS score of ≤2 indicates an ED of.[10]

Descriptive analysis was conducted to determine the frequency distribution and prevalence of ED in BPH patients. Bivariate analysis was carried out using IBM SPSS 27.0 Statistical tool to determine the relationship between age, presence of HT, and T2DM as a comorbid in BPH patients with ED. Statistical analysis was conducted using the Fisher's exact test method with a specified significance level of $P < 0.05$.

3. Results

The demographic characteristics of the subjects are summarized in Table 1. Out of 44 subjects, only 21 respondents were obtained from the IIEF-5 questionnaire (having a history of sexual activity in the last six months).

The frequency distribution of ED through the IIEF-5 questionnaire obtained the highest ED frequency according to age, HT status, and T2DM status in patients with BPH were mild ED, with each having a percentage of 19.0% in the age category 70-79 years, 23.9% in non-HT subjects, and 23.9% in non-T2DM subjects (Table 2). In the EHS questionnaire, the highest frequency score obtained according to age, HT status, and T2DM status in patients with BPH were EHS 2 with a respective percentage of 22.7% in the age category 70-79 years, 20.5% in subjects with HT, and 29.5% in subjects without T2DM (Table 3).

Through the IIEF-5 questionnaire, the prevalence of ED based on the age of BPH patients was found to be 80.0% in the 50 – 59 years age group and reached 100.0% in the 70 – 79 years age group (Figure 1). Whereas in the results of the EHS questionnaire, the prevalence of ED was found to

be 16.7% at the age of 50 – 59 years and reached 100% at 80 years and over (Figure 2).

The prevalence of ED based on HT status was found to be 100.0% in BPH patients with HT and 75,0% in non-HT patients through the IIEF-5 questionnaire. Meanwhile, in the EHS questionnaire, ED prevalence in BPH patients with HT was 76.3% and 65.3% in non-HT patients.

Through the IIEF-5 questionnaire, the prevalence of ED in BPH patients with T2DM was found to be 100.0% and 80.0% in non-T2DM patients, while through the EHS questionnaire, the prevalence of ED was 70.0% in T2DM patients and 70.6% in non-T2DM patients.

Table 1. Demographics of Research Subjects

Variable	N (%)
Age	
a. 40 – 49	0 (0.0)
b. 50 – 59	6 (13.6)
c. 60 – 69	15 (34.1)
d. 70 – 79	18 (40.9)
e. ≥80	5 (11.4)
Educational Status	
a. No Formal Education	0 (0.0)
b. Primary Education	2 (4.5)
c. Junior High Education	5 (11.4)
d. Senior High Education	13 (29.5)
e. Diploma	7 (15.9)
f. Bachelor	12 (27.3)
g. Master / Doctoral	5 (11.4)
Job Status	
a. Actively working	11 (25.0)
b. Retired	33 (75.0)
Marital Status	
a. Married / Divorced	41 (93.2)
b. Single	3 (6.8)
Sexual Activity	
a. Sexually active	15 (34.1)
b. Inactive for 1-6 months ago	6 (13.6)
c. Inactive for 6-12 months ago	1 (2.3)
d. Inactive for more than one year ago	22 (50.0)
Comorbid Status	
a. Hypertension	21 (47.7)
b. Type-2 Diabetes mellitus	10 (22.7)

In statistical analysis, the age categories were simplified to <60 years and ≥60 years, and erectile function status was divided into ED and non-ED on the results of both questionnaires. There was no significant relationship ($p > 0.05$) between age, HT, and T2DM in BPH patients with the occurrence of ED based on the results of the IIEF-5 questionnaire ($p = 1.000$, 0.229, and 0.526) (Table 4).

Meanwhile, through the results of the EHS questionnaire, a significant relationship was found between the age factor and the occurrence of ED ($p = 0.006$ (<0.05)). However, there was no significant relationship between HT and T2DM with the occurrence of ED ($p = 0.518$ and 1.000) (Table 6).

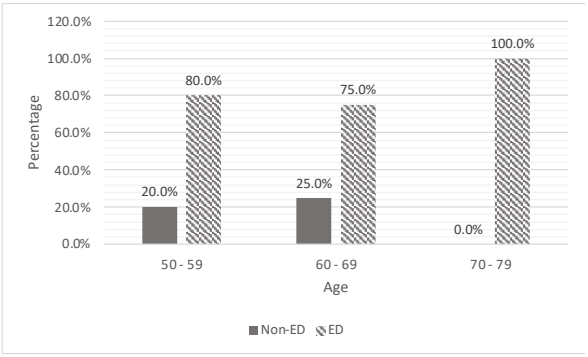

Figure 1. Prevalence of Erectile Dysfunction by Age through the IIEF-5 Questionnaire

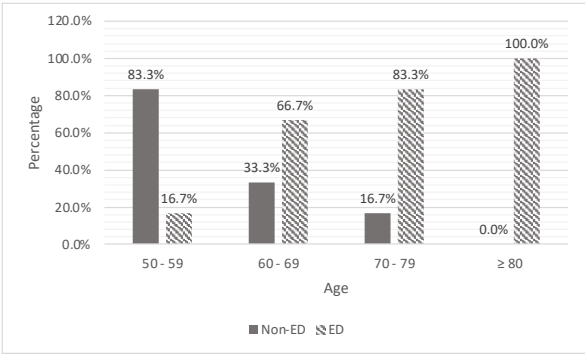

Figure 2. Prevalence of Erectile Dysfunction by Age through the EHS Questionnaire

Table 2. IEIF-5 Scores Based on Age, History of Hypertension and Diabetes Mellitus in BPH Patients

Variable	International Index of Erectile Function-5					Total
	No ED (22-25)	Mild ED (17-21)	Mild-Moderate ED (12-16)	Moderate ED (8-11)	Severe ED (1-17)	
Age						
40 – 49	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50 – 59	4.8%	9.5%	9.5%	0.0%	0.0%	23.8%
60 – 69	9.5%	14.3%	4.8%	9.5%	0.0%	38.1%
70 – 79	0.0%	19.0%	14.3%	4.8%	0.0%	38.1%
≥ 80	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Hypertension status						
HT	0.0%	19.0%	19.0%	4.8%	0.0%	42.8%
Non-HT	14.3%	23.9%	9.5%	9.5%	0.0%	57.2%
Type-2 Diabetes mellitus status						
T2DM	0.0%	19.0%	9.5%	0.0%	0.0%	28.5%
Non-T2DM	14.3%	23.9%	19.0%	14.3%	0.0%	71.5%

Table 3. EHS Scores Based on Age, History of Hypertension and Diabetes Mellitus in BPH Patients

Variable	Erectile Hardness Score					Total
	EHS 4	EHS 3	EHS 2	EHS 1	EHS 0	
Age						
40 – 49	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50 – 59	4.5%	6.8%	2.3%	0.0%	0.0%	13.6%
60 – 69	4.5%	6.8%	6.8%	9.1%	6.8%	34.0%
70 – 79	0.0%	6.8%	22.7%	11.5%	0.0%	41.0%
≥ 80	0.0%	0.0%	6.8%	2.3%	2.3%	11.4%
Hypertension status						
HT	2.3%	9.1%	20.5%	13.6%	2.3%	47.8%
Non-HT	6.8%	11.5%	18.0%	9.1%	6.8%	52.2%
Type-2 Diabetes mellitus status						
T2DM	0.0%	6.8%	9.1%	4.5%	2.3%	22.7%
Non-T2DM	9.1%	13.9%	29.5%	18.0%	6.8%	77.3%

Table 4. Relationship between Age, Hypertension and Type-2 Diabetes Mellitus with Erectile Dysfunction in BPH Patients assessed by IIEF-5

Variable	International Index of Erectile Function-5		Total	*p*-value
	Non-ED	ED		
	n (%)	n (%)	n (%)	
Age				
<60	1 (4.8)	4 (19.0)	5 (23.8)	1.000
≥60	2 (9.5)	14 (66.7)	16 (76.2)	
Hypertension status				
HT	0 (0,0)	9 (42.9)	9 (42.9)	0.229
Non-HT	3 (14.3)	9 (42.9)	12 (57.1)	
Diabetes mellitus tipe-2 status				
DM	0 (0.0)	6 (28.6)	6 (28.6)	0.526
Non-DM	3 (14.3)	12 (57.1)	15 (71.4)	

Table 5. Relationship between Age, Hypertension and Type-2 Diabetes Mellitus with Erectile Dysfunction in BPH Patients assessed by EHS

Variable	Erectile Hardness Score		Total	*p*-value
	Non-ED	ED		
	n (%)	n (%)	n (%)	
Age				
<60	5 (11.4)	1 (2.3)	6 (13.6)	0.006
≥60	8 (18.2)	30 (68.2)	38 (86.4)	
Hypertension status				
HT	5 (11.4)	16 (36.4)	21 (47.7)	0.518
Non-HT	8 (18.2)	15 (34.1)	23 (52.3)	
Diabetes mellitus tipe-2 status				
DM	3 (6.8)	7 (15.9)	10 (22.7)	1.000
Non-DM	10 (22.7)	24 (54.5)	34 (77.3)	

4. Discussion

Benign Prostatic Hyperplasia (BPH) or Lower Urinary Tract Symptoms (LUTS) can affect erectile function. Enlargement of the prostate has a role in developing erectile dysfunction (ED). [11] The mechanisms underlying the occurrence of ED in BPH patients include disturbances in the nitric oxide synthase (NOS/NO) and Rho-kinase activation pathways, autonomic hyperactivity, pelvic ischemia and dysfunction microvascular, inflammatory, sex hormones, and psychological factors. [9] These factors lead to decreased nerve and endothelial function, changes in smooth muscle tone, arterial insufficiency, decreased blood flow and tissue damage due to hypoxia, increased proliferation of smooth muscle cells in the prostate, and bladder hypertrophy. [7]

Men with severe BPH will experience a significantly reduced libido, so they may experience more difficulty achieving erections and lower levels of sexual satisfaction compared to men with milder forms of BPH. [12]

This study found that the prevalence of ED increased at a higher age through both questionnaires. Research at the RSCM revealed that the prevalence of ED increased at a high age of 71.4% at the age of 50 – 59 years and reached 88.0% in the age group ≥60 years. [4] Another study at the Yokohama Shin-midori Hospital in Japan obtained an EHS score ≤2 increases at a higher age, namely by 50.0% at the age of 60 – 69 years and reached 55.3% at the age of 70 – 79 years. [10]

From the statistical analysis of the results of the IIEF-5 questionnaire, no significant relationship was found between the age factor of BPH sufferers and the occurrence of ED. This result aligns with research conducted at Al-Ihsan Hospital, Bandung Regency, which found no significant relationship between age and ED in BPH sufferers. The incidence of erectile dysfunction increases until the age of 61 – 70 years but decreases again after age 71 years.[13] Another study conducted in Yogyakarta also stated that the incidence of ED was increasingly found in the older age group. However, age and the IIEF-5 score had no statistically significant relationship.[14]

The small number of samples of the IIEF-5 questionnaire and the difference in the distribution of the sample data may cause differences in the statistical analysis results between the instruments of the IIEF-5 questionnaire and the EHS. The number of respondents to the IIEF-5 questionnaire actively having sex in the last six months was only 21 people, while the EHS questionnaire could be given to all 44 subjects. In the IIEF-5 questionnaire, there were no respondents aged ≥80 years and no respondents with severe ED. Sample data obtained from the IIEF-5 questionnaire showed that the number of ED events in BPH patients at 60 – 69 years decreased from the previous age category and increased again in the 70 – 79 years category. Meanwhile, through the EHS questionnaire, it was found that the incidence of ED continued to increase with age.

The IIEF-5 questionnaire instrument assumes that the respondent is sexually active, so the assessment of subjects who are not sexually active will have little significance.[16] Meanwhile, although the EHS questionnaire is more straightforward in assessing erectile function, limited choices of values selected by the patient may affect its accuracy and sensitivity to subtler changes. Although erectile hardness is an underlying component of erectile function, other essential factors that the EHS does not capture can also affect erection quality.[17]

The relationship between the increasing prevalence of ED and increasing age has been seen in many studies. Various physiological processes

during ageing mediate vascular changes in the penis [18,19]. Disruption of endothelial function and hormonal changes resulting in low testosterone levels play a role in the development of erectile dysfunction [18]. Testosterone hormone production will decrease with age resulting in an increase in Sex Hormone Binding Globulin (SHBG) and a decrease in 5α-reduced steroid production in organ reproduction [20]. Production of Growth Hormone (GH) will also decrease due to degenerative processes and impact on decreased libido, which will interfere with the erectile ability of erectile tissue in the corpus cavenosum.[21]

This study found that the prevalence of ED in BPH patients with comorbid HT was higher than in non-HT BPH patients. Research conducted in Pakistan found the prevalence of ED in hypertensive patients was 61.79%.[22] Another study conducted in Japan using the EHS questionnaire stated that the prevalence of low EHS scores (≤2) was significantly higher in subjects with hypertension.[23]

A significant relationship was not found between the presence of HT comorbidities in BPH patients and ED, based on the results of the IIEF-5 and EHS questionnaires. Research conducted on populations similar to this study, namely BPH sufferers, in the city of Denpasar also found the same thing.[20] Another study in Yogyakarta found that hypertension sufferers were 1.2 times more likely to suffer from erectile dysfunction. However, this study did not find a statistically significant relationship between HT and ED.[24]

In contrast to a study conducted in Jakarta, this study found a significant relationship between HT and ED [4]. Meanwhile, a study in Japan found a significant relationship between hypertension and a decrease in the level of erectile hardness.[10]

The erectile function of the penis is based on vascular networks. Structural or functional abnormalities of the penile blood vessels can interfere with a person's ability to get and maintain optimal erections. Hypertension is related to endothelial dysfunction, which causes the endothelium to inhibit NO production. This condition can then lead to erectile dysfunction. In addition, hypertension can also cause secondary stenotic lesions due to atherosclerosis, hypertrophy of the smooth muscle of the cavernosal arteries, and impaired blood flow in the penile vessels.[25] Endothelial dysfunction can weaken the arteries and arterioles' ability to dilate, decreasing the ability to relax.[22]

In this study, the prevalence of ED in BPH patients with T2DM was higher than in BPH patients without T2DM. Research in the cities of Sumbawa and Dompu, West Nusa Tenggara, found the prevalence of ED in type-2 DM patients was 84.4% from the results of the IIEF-5 questionnaire and 80.9% from the results of the EHS questionnaire.[26] Another study at the Tlogosari Health Center Kulon Semarang revealed that, through the IIEF-5 questionnaire, the prevalence of ED in DM patients was 84.4%.[27]

In this study, there was no significant relationship between the presence of T2DM in BPH patients and ED either through the IIEF-5 or EHS questionnaires. Research with a similar population, namely BPH sufferers in Denpasar, Bali, also stated that no significant relationship exists between diabetes mellitus in BPH sufferers and the incidence of erectile dysfunction.[20] Another study in Antonius General Hospital Pontianak stated no significant relationship between HbA1c levels and ED.[28]

Different results were obtained in web-based research conducted at RSCM. The IIEF-5 questionnaire found a significant relationship between diabetes mellitus and ED.[4] Other studies conducted in the cities of Dompu and Sumbawa also stated a negative correlation between the glucose index and the severity of ED, both through the IIEF-5 and EHS questionnaires.[26]

A person suffering from diabetes mellitus (DM) is in a state of hyperglycemia which causes oxidative stress. This condition will damage the endothelium of blood vessels and nerves, reducing the production of NO. NO plays a role in vasodilatation of the blood vessels of the erectile tissue, which underlies penile erection.[20] A high glucose level can cause a decrease in nerve conduction and changes in vascular reactivity, worsening the erectile hardness score [26]. Diabetes mellitus is a strong and independent predictor of the incidence of ED because it is associated with microvascular changes, peripheral neuropathy, and endothelial dysfunction.[4] Hypogonadism which often occurs in DM patients, can also underlie the occurrence of ED.[29]

The lack of data obtained can cause a difference in the results of this study with other literature. This research was conducted only using 44 data samples. On the other hand, Ishikawa et al. conducted research with 548 samples. This study only excluded patients with a history of prostate cancer, history of prostate surgery, and urinary retention. Although Brodjonegoro et al. conducted

a study with only one more subject than the current study, the study excluded patients with various previous medical histories, such as spinal cord injury (SCI), Parkinson's, stroke, and major psychiatric diseases.

In this study, there was a decrease in the number of subjects in the ≥80 years age category, which decreased from the previous categsory. The survival rate factor can cause a decrease in the number of subjects in the high-age group. At the age of over 70 years, the survival rate will decrease, causing the incidence of BPH to decrease.[13] In addition, the potential for bias in filling out the IIEF-5 and EHS questionnaires can also affect the results of this study. This bias can occur because of the socio-cultural influences of the local community, who consider things that have a sexual nature to be taboo, so they tend to cover up their sexual activity.[24] Other variables not evaluated in this study were medication history, smoking history, the intensity of daily physical activity, and psychological conditions that can also affect erectile function.[7,30–36]

5. Conclusion

It can be concluded that the prevalence of erectile dysfunction in BPH patients increases with age and the presence of comorbid metabolic diseases, including hypertension and diabetes mellitus. There is no significant relationship between hypertension and type-2 diabetes mellitus with erectile dysfunction in BPH patients. A significant relationship between age and erectile dysfunction was only found in the EHS questionnaire but not in the IIEF-5 questionnaire. Further research needs to be carried out using a larger sample size and considering other confounding variables affecting a person's erectile function.

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Author's Contribution

All authors have contributed to the final manuscript. The contribution of each author as follow: collected the data, drafted the manuscript and designed the figures, devised the main conceptual ideas and critical revision of the article. All authors discussed the results and contributed to the final manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest.

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Ethics Approval

The protocol has received approval with ethical number 400/279/K.3/102.7/2022.

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