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The impact of open benign prostatic hyperplasia surgery on erectile function in patients with benign prostatic hyperplasia, Northeast Ethiopia, 2023

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Abstract

It was believed that surgical treatments for benign prostatic hyperplasia could improve erectile function due to the relief of symptoms they were also reported to harm erectile function as heating or injury effect. The objective of this study was to assess the impact of benign prostatic hyperplasia surgery on erectile function in patients with benign prostatic hyperplasia, in Northeast Ethiopia. 2023. Institution-based retrospective cohort study was conducted from September 2021 to July 2023. 225 calculated sample size was needed in this study with consecutive sampling. A structured questionnaire adapted from the international index of erectile function was administered to collect data. Two hundred ten known benign prostatic hyperplasia (BPH) patients who underwent benign prostatic hyperplasia surgery were included in this study with a response rate of 93.3 %. Around 52.4% of patients who got BPH treatment by surgery had different forms of erectile dysfunctions ranging from mild to severe after BPH surgery. The mean ($\pm$ SD) International Index of Erectile Function (IIEF) score before BPH surgery was found to be 18.04 ($\pm$ 5.80), but the mean ($\pm$ SD) IIEF score after BPH surgery was found to be 17.63($\pm$ 5.78 and did not show significant difference. By running multiple logistic regressions, we found that higher the International Prostate Symptom Score (IPSS) score before surgery, general anesthesia, IIEF score before surgery, and duration of catheterization for more than a week before surgery were significantly associated with erectile dysfunction. The proportion of erectile dysfunction after benign prostatic hyperplasia surgery was higher. Open benign prostatic hyperplasia surgery has no significant impact on erectile function. To reduce the burden of erectile dysfunction secondary to open BPH surgery, erectile function should be assessed preoperatively.

Keywords: Benign prostatic hyperplasia, erectile function, surgery, Ethiopia

Introduction

Benign prostatic hyperplasia (BPH) is a histologic diagnosis that refers to the proliferation of stromal and epithelial cells within the prostatic transition zone process that is influenced by inflammation and sex hormones like androgen and testosterone [1-3]. Commonly, BPH is characterized by lower urinary tract symptoms (LUTS) and sometimes even sexual dysfunctions

can happen [4]. LUTS caused by BPH are common in adult men and can impair erectile function (EF) [5].

It was believed that surgical treatments for this illness can improve EF due to the relief of bothersome symptoms they were also reported to harm EF as heating or vascular and nerve injury effects [5]. Anatomical and nerve distribution studies have found that nerves responsible for erection concentrated

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around the five and seven o'clock position on the prostate apex are only a few centimeters from the prostate capsule which makes them at risk for damage during operation [6]. Extravasation of irrigation fluid at the inner layer of adenomatous tissue between the resecting loops and erectile nerves might predispose erectile nerve damage and might increase the risk of erectile dysfunction. Surgery involving capsular perforation can further increase post-operative erectile dysfunction risk [7].

All accepted therapy regimens for LUTS caused by BPH can impact some aspects of sexual health [8]. Leaving prostate surgery a complicated problem on EF, it is suggested that improvement of LUTS can also improve EF [9]. Indeed, EF was reported not to change in 84%, improve in 3% to 14%, and deteriorate in 0% to 16% after BPH surgery [9,10]. Others assumed that the operation technique or heating effect would damage the corpus cavernosum nerve outside the prostate capsule and harm EF [11].

Although the risk of worsening erectile dysfunction exists post-surgically, an important percentage of ED patients will improve, but age was related to worsening erectile dysfunction [5,12]. In addition to surgery, several factors like: vascular diseases, metabolic diseases, neurologic diseases, and medications can affect erection function [12]. Today the percentage of the aged population is increasing even though Coronavirus disease 2019 (COVID-19) is particularly affecting this age group. Global and national aging population growth will contribute to the rise of BPH, BPH surgery, and BPH surgery-related erectile dysfunction. Although some studies reported that BPH surgery may cause ED the association is not well established [5]. Therefore, this study aimed to assess the impact of benign prostatic hyperplasia surgery on erectile function in patients with benign prostatic hyperplasia, in Northeast Ethiopia.

Material and Methods

Study Area and Design

The study was conducted in Dessie Comprehensive Specialized Hospital, Kemisse General Hospital, and Akesta General Hospital, North East Ethiopia from September 2021 to July 2023. A hospital-based retrospective cohort study was conducted.

Population

All BPH patients who underwent open BPH surgical treatment in each hospital were the Source population but particularly all BPH patients who underwent BPH surgical treatment during the study period in each hospital were the Study population.

Inclusion criteria: Must be diagnosed with BPH and underwent surgical treatments and patients who have sufficient data for

analyses were included in this study.

Exclusion criteria: Patients whose pathological evaluation showed they have incidental prostate carcinoma; patients who are less than 6 weeks after BPH surgery; patients with a confirmed diagnosis of urethral stricture, type II diabetes mellitus, heart failure prostatitis, prostate cancer, or bladder cancer and the patient who is unable to give response due to severe illness either physically or mentally were excluded from this study.

Sample Size and Sampling procedures

Sample size determination

Baseline data collected from the three hospitals showed that there have been around 225 BPH surgeries done over the past three years. So we have taken all as study samples and then the final sample size was determined to be 225.

Sampling technique and procedure

First each patient card number was taken from Operation room registration and the patient card was taken from the card room. Then charts were reviewed to determine inclusion and exclusion criteria. Proportional sampling distribution was made in each hospital. After that, all who fulfilled the inclusion criteria were sampled consecutively.

Data Collection Tools

A structured questionnaire adapted from The International Index of Erectile Function (IIEF) questionnaire was administered mainly targeted baseline before the advancement of LUTS and after six weeks of BPH surgery. A score of 0-5 is awarded to each of the 15 questions that examine the 4 main domains of male sexual function targeting erectile function. After getting oral consent from the participants, data was collected by patient interview, patient chart reviewing, and interviewing the attending surgeon using 3 BSc nurses and 3 physicians trained for two days and who have experience in data collection. The responsibility of data collectors was to fill out the structured questionnaire. The consistency and completeness of data were checked by 3 MSc supervisors, and by the PI principal investigator) daily.

Study Variables

Dependent variables: Erectile function.

Independent variables: Socio-demographic characteristics, educational status, marital status, employment, sex and residence.

Clinical and other variables: Other BPH surgery complications, low mean IIEF score before surgery, types of anesthesia, types of surgery (RPP/TVP), surgeon experience, duration of symptoms, IPSS, and cauterization history.

Operational Definition

Benign prostatic hyperplasia (BPH): Patients presented with demonstrated prostatic volume enlargement >30gm or PSA>1.5ng/dl or palpable prostate enlargement on direct rectal examination [2].

The severity of ED was evaluated using IIEF-5 and was classified into 4 levels based on the scores: severe (5–7), moderate (8–11), mild to moderate (12–16), and mild (17–21) While those who scored 22–25 were reported as not having ED.

Data Quality Assurance

For all study time, 6 data collectors and 3 supervisors who can communicate in the Amharic language were recruited. The training was given to them for two days on the objectives, relevance, and confidentiality of the study, respondent’s rights, and data collection process. At the end of the day filled questionnaires were checked for completeness and consistency of information by the supervisor and principal investigator and errors were manually edited. Any ambiguity and other problems of data collectors were addressed. The interviewed patients’ question chart was given a unique identification number to revisit in case of incomplete and inconsistent responses based on the given number of the code.

Data Analysis Procedures

Data was coded and entered into the computer using Epi Data Manager version 4.4.1 software. Then the data was exported to the Statistical Package for the Social Science (SPSS) version

25 for further analysis. The data was tested for normality. Data was reported as mean and standard deviation (SD) for continuous variables, and percentages for categorical variables. IIEF scores before and after BPH surgery were compared using an independent t-test. Logistic regression was conducted to identify risk factors. A p-value less than 0.05 was considered statistically significant. Finally, results were summarized and presented using tables, frequencies, and texts. Ethical clearance was obtained from the Institutional Review Board of Wollo University College of Medicine and Health Science (Reference no: CMHS 1521/24/14, Date: 15.10.2014). Appropriate consent was obtained from study participants and confidentiality was strictly maintained in handling patient records.

Results

Two hundred ten known patients who underwent benign prostatic hyperplasia surgery were included in this study with a response rate of 93.3%. Fifteen respondents were not considered for the analysis because of missing responses for the outcome variable. The result includes socio-demographic characteristics; Treatment-related related factors, clinical factors, and erectile function measurement using IIEF and associated factors.

Socio-Demographic Characteristics of BPH patients

All respondents were male and married. Of all respondents, 170 (81%) came from urban. More than half (59.5%) were aged above 60 years. The mean (±SD) age of the respondents was found to be 62.67 (±7.304) years with a minimum of 45 and a maximum of 80 (Table 1).

Table 1. Socio-demographic characteristics of the study participants Northeast Ethiopia July 2023 (N=210)

Variable	Category	Total	
		N°	%
Educational status	No formal schooling	135	64.2
	Primary school completed	20	9.5
	Secondary school completed	25	11.9
	College and above	30	14.28
Residence	Urban	40	19
	Rural	170	81
Occupation	Farmer	135	64.2
	Government employed	30	14.28
	Private employed	10	4.7
	Merchant	25	11.9
	Retired	10	4.7
Age	60 and below	125	59.5
	Above 60	85	40.5

BPH Surgery-Related Characteristics of BPH Patients

The majority of the patients underwent trans-vesical prostatectomy (TVP) surgery (71.4%) and most of the patients

have taken spinal anesthesia (81%) and transurethral catheters were inserted before surgery (94.3%). When we see, the size of the prostate half of them had less than 60cm³ (52.4%) (Table 2).

Table 2. BPH surgery related characteristics of BPH patients Northeast Ethiopia July 2023 (N=210)

Variable	Category	Total	
		N°	%
Types of surgery	TVP	150	71.4
	RPP	60	28.6
Use of electro cautery	Yes	38	18.1
	No	172	81.9
Post prostatectomy complication	Yes	44	21
	No	166	79.0
Transurethral catheter inserted before surgery	Yes	198	94.3
	No	12	5.7
Duration of catheterization after surgery	100 minute and above	150	71.4
	Below 100 minute	60	28.6
Duration catheter after surgery	Up to 8 days	88	41.9
	More than 8 days	122	58.1
Duration of hospital admission	Up to 8 days	58	27.6
	More than 8 days	152	72.4
Surgeon experience	Up to 5 years	90	42.9
	Above 5 years	120	57.1
Size of prostate	Less than 60gm	110	52.4
	60gm and above	100	47.6
International prostate symptom score before operation	19-19 (moderate)	16	7.6
	20-35 (severe)	194	92.4
Prostate symptom duration	Less than one year	104	49.5
	One year and above	106	50.5
Types of anesthesia	Spinal	172	81.9
	General	38	18.1
Comorbid illness	Yes	38	18.1
	No	166	79.0
Medication use	Yes	40	19.0
	No	170	81.0

TVP: trans-vesical prostatectomy, RPP: radical perineal prostatectomy'

Descriptive Statistics of Main Clinical Parameters of Study Participants

The mean duration of symptoms in a month was 10.98 ($\pm$ 3.98)

and the mean the International Prostate Symptom Score (IPSS) (pre-operative) was 27.7 ($\pm$ 4.44). Duration of surgery (minutes) has a range of 60 up to 150 minutes (Table 3).

Table 3. Descriptive Statistics of main clinical parameters of study participants Northeast Ethiopia July 2023 (N=210)

Variable	N=210					
	Range	Minim um	Maximu m	Mean	Std. Deviation	Variance
Duration of symptoms in month	22	2	24	10.98	5.83	33.95
IPSS (pre-operative)	19	16	35	27.74	4.44	19.77
IPSS (post-operative)	15	12	27	21.2	4.1	15.2
Weight of the prostate	32	48	62	58.24	5.56	12.97
Duration of catheterization in days	29	1	30	11.49	7.21	52.09
Surgeon experience in year/ month	53	1	54	7.56	7.450	55.50
Duration of hospital stay after operation	5	5	10	8.10	1.19	1.41
Duration of catheterization after surgery in days	5	5	10	7.62	1.06	1.14
Duration of surgery (minutes)	90	60	150	103.33	15.87	251.99

IPSS: international prostate symptom score

Erectile Dysfunction After BPH Surgery Among BPH Patients

Around 52.4% (95% CI: 43.5, 59.0) of patients who got BPH treatment by BPH surgery had different forms of erectile dysfunctions ranging from mild to severe after BPH surgery. However, the rest nearly half (47.6%, 95% CI: 41, 56.5) of patients have normal erectile function.

The Impact of BPH Surgery on Erectile Function

This study compared erectile function before and after BPH surgery. The mean ($\pm$ SD) IIEF score before BPH surgery was found to be 18.04 ($\pm$ 5.80), but the mean ($\pm$ SD) IIEF score after BPH surgery of the respondents was found to be 17.63 ($\pm$ 5.78). IIEF scores before and after BPH surgery were compared using an independent t-test and do not show a statistically significant difference implying that there was no significant difference in erectile function pre-operatively and post-operatively.

Factors Associated with Erectile Dysfunction

By running binary logistic regression we have seen, types of anesthesia, types of surgery, post-prostatectomy complication, symptom duration, duration of catheterization before surgery, surgeon experience, duration of hospitalization, duration of catheterization after surgery, duration of surgery, privies IIEF score and IPSS score preoperatively were a candidate for

multivariate analysis because their P value was less or equal to 0.25 during binary logistic regressions.

By running multiple logistic regressions, we found that IPSS score before surgery, types of anesthesia, IIEF before surgery, and duration of catheterization before surgery were significantly associated with erectile dysfunction. The odds of developing erectile dysfunction among BPH patients who underwent BPH surgery with an IPSS score of 20-35 before surgery were six times more likely compared to an IPSS score of below 20 before surgery (AOR: 5.69, 95% CI: 1.44, 2.23). Duration of catheterization for more than a week before surgery increases the chance of developing erectile dysfunction among BPH patients who underwent BPH surgery by nearly two times compared to those who have duration of catheterization for a week or less (AOR: 2.00, 95%: 1.03, 3.907).

Similarly, those who have IIEF less than 22 before surgery were nearly six times more likely to develop erectile dysfunction among BPH patients who underwent BPH surgery compared to those who have IIEF 22 and above before surgery (AOR: 6.42, 95% CI: 2.81, 14.67). The odds of developing erectile dysfunction among BPH patients who underwent BPH surgery with general anesthesia were nearly four times more likely to develop erectile dysfunction compared to spinal anesthesia (AOR: 3.91, 95% CI: 1.53, 9.90) (Table 4).

Table 4. Binary and multivariate logistic regression analysis showing factors of erectile dysfunction among BPH patients treated with BPH surgery Northeast Ethiopia July 2023(N=210)

Variables	Category	Erectile dysfunction		P value	COR (95% CI)	P value	AOR (95% CI)
		Yes	No				
Types of surgery	RPP	34	26	0.23	1.27 (0.69, 2.32)		
	TVP	76	74		1		
Size of the prostate	0-59 cm ³	58	52	0.16	1		
	60 cm ³ and above	52	48		0.971 (0.56, 1.67)		
Types of anesthesia	Spinal	84	88	0.03	1	0.004	1
	General	26	12		2.27 (1.07, 4.78)		3.91 (1.53, 9.90)
Symptom duration	Less than 1 year	46	58	0.02	1		
	1 year and above	64	42		1.92 (1.11, 3.32)		
Surgeon experience	Up to five years	44	46	0.38	0.78 (.45, 1.35)		
	Above five years	66	54		1		
Duration of hospitalization	0-8 days	34	24	0.24	1		
	Above 8 days	76	76		0.70 (.38, 1.30)		
Duration of catheterization after surgery	0-8 days	54	34	0.02	1	0.07	
	Above 8 days	56	66		0.53 (0.30, 0.93)		1.9 (0.94, 3.83)
IIEF before surgery	22-25	10	37	0.0001	1	0.001	1
	Below 22	100	63		5.87 (2.72, 12.63)		6.42 (2.81, 14.67)
Duration of catheterization before surgery	0-7 days	42	28	0.11	1	0.04	1
	Above 7 days	68	72		0.63 (0.35, 1.12)		2.00 (1.03, 3.907)
Post prostatectomy complication	Yes	30	14	0.02	2.30 (1.14, 4.65)		
	No	80	86		1		
Duration of surgery	Less than 100 minute	72	78	0.04	1		
	100 minute and above	38	22		1.87 (1.01, 3.46)		
IPSS score before surgery	8-19 moderate	12	4	.070	1	0.01	1
	20-35 severe	98	96		0.34 (0.10, 1.09)		5.69 (1.44, 2.23)

1=reference, over all statistics=0.81, IPSS: international prostate symptom score, IIEF: international index of erectile function, TVP: trans-vesical prostatectomy, RVP: radical vesical prostatectomy

Discussion

This study was conducted to assess the impact of BPH surgery on erectile function and associated factors among BPH patients who underwent BPH surgery. The findings of this study showed that there is significant erectile dysfunction among BPH patients who underwent BPH surgery. This study found that around 52.4%- (95% CI: 43.5, 59.0) of patients who got BPH treatment by BPH surgery had different forms of erectile

dysfunctions ranging from mild to severe after BPH surgery, but the most significant one is severe erectile dysfunction. This study showed that the magnitude of severe erectile dysfunction among BPH patients treated by BPH surgery was 12% (95% CI: 9.5, 14.5). This finding had showed a similar magnitude of severe erectile dysfunction secondary to BPH surgery with studies conducted in different countries ranging from 12.5 to 14% ED respectively [13-15].

Even though surgical intervention can impair erectile functions, this study does not imply this consequence and ED is almost similar pre-operatively and post-operatively among BPH patients. The mean ($\pm$ SD) IIEF score before BPH surgery was found to be 18.04 ($\pm$ 5.80), but the mean ($\pm$ SD) IIEF score after BPH surgery of the respondents was found to be 17.63 ($\pm$ 5.78) and did not show statistically significant difference of erectile function pre-operatively and post-operatively. This finding is supported by studies conducted in different areas, like meta-analysis conducted to assess the impact of different invasive procedure modalities effect on sexual function and concluded erectile function remains the same after most surgical procedures for bladder outlet obstruction [16-18]. However, this finding differs from a study that reported a significant difference in the mean score of IIEF before and after surgery [19]. A study done in Korea identified a significant decile in erectile function scores for the first 3 months after transurethral prostate resection [20].

On the other hand study done in Indonesia identified that transurethral resection of the prostate has no impact on sexual function, rather improvements were noted [21]. The source for this variation could be brought about due to many factors like differences in health-seeking behavior and socio-demographic variations. Some studies have documented about improvement of erectile function after plasma kinetic resection of the prostate in the absence of capsular perforation [22]. Because capsular perforation can further increase post-operative erectile dysfunction risk [7,23].

Our finding showed that IPSS before surgery was associated with erectile dysfunction. Baseline values of IPSS before surgery showed a significant association with ED [8]. More severe lower urinary tract symptoms and higher values of IPSS were correlated with an increased risk of ED [24]. The possible cause for this relationship can be caused by surgery relieving the compressed erectile nerves secondary to BPH might result in better erection function postoperatively. High IPSS at baseline means, patients are suffering from many lower urinary symptoms secondary to bladder outlet obstruction caused by BPH. After a successful operation, these symptoms have to be reduced, and end up with a better experience of sexual activity. However, this finding contradicts to study done in Korea that assessed the association between IIEF and IPSS and identified no association [15]. Other researchers identified an age-defendant significant association between lower urinary tract symptoms and ED [25]. Improved prostate symptoms are related to better voiding symptoms, better quality of life, and improved erectile function. The further the patient suffers from severe prostate symptoms, the more likely to have low libido, then after treatment, the reverse is true.

In this study duration of catheterization showed a significant association with ED and this can be directly related to the

high burden of preoperative lower urinary tract sufferings like bladder outlet obstruction and urine retention. The study found that 60.9% of patients treated with double J catheterization developed severe erectile dysfunction and the impact of the catheter on erectile dysfunction remains for months after it is removed [26]. Several biological mechanisms can be proposed to explain this association but clinical signs and symptoms managed by inserting a catheter can also damage erection nerves and contribute to ED. Long-term indwelling catheterization can be associated with cystitis, pyelonephritis, urethritis, bladder spasms, penile fractures, urethral stricture, phimosis, ischemic necrosis of the penis, pseudo aneurysm of bulbar artery and iatrogenic hypospadias [27]. Indeed either of these complications might lead to ED.

The present study showed that Baseline values of IIEF before surgery showed a significant association with ED. Similarly study conducted in China to compare transurethral resection of the prostate with plasma kinetic resection of the prostate showed that the baseline value of IIEF before surgery showed significant association with ED [22]. The main penile anatomy responsible for erection is corpora cavernosa which are proximally separated to fuse with each eschial tuberosity of the pelvis [12]. Erection problems involving main erection bodies like corpora cavernosa can be sustained post-operatively.

In this study, the use of general anesthesia showed a significant association with ED. This may be the fact that general anesthesia can decrease blood flow, oxygenation, and nitric oxide throughout the body including the penis and this is the opposite of the erection mechanism. Different anesthetic drugs have different effects on erectile function. Opioids are linked with a reduction in testosterone production, which can lead to reduced desire and erectile dysfunction. Similarly, benzodiazepines, another group of anesthetic agents have been associated with a reduction in sexual desire and arousal.

Limitations of the Study

The domains of the questionnaires' are sensitive reproductive issues and subjective data and this might contribute to biases.

Conclusion

The proportion of erectile dysfunction after benign prostatic hyperplasia surgery was higher. Benign prostatic hyperplasia surgery has no significant impact on the erectile function of patients who underwent benign prostatic hyperplasia surgery for benign prostatic hyperplasia treatment. Types of anesthesia, IIEF before surgery, IPSS before surgery, and duration of catheterization before surgery significantly increased the chance of erectile dysfunction after benign prostatic hyperplasia surgery. Surgeons, nurses, and surgery residents should assess erectile function before surgery for BPH patients to reduce further risk of erectile dysfunction.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

This study was approved by the Ethics Approval Committee of Wollo University College of Medicine and Health Science. (Reference no.: CMHS 1521/24/14, Date: 15.10.2014). Data was collected anonymously to ensure confidentiality, and all data collection was conducted in compliance with the declaration of Helsinki.

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