Journal of Carcinogenesis
Covering Genesis to Therapeutics

Journal of Carcinogenesis, ISSN: 1477-3163
2025; Vol 24: Issue 5s, https://carcinogenesis.com/

Surgical Interventions Upon Diagnosis among Benign Prostatic Hyperplasia and Prostate Cancer cases: A Retrospective Study with Systematic Review

Mohammed Alfozan[1*]

[*1]MD, Department of Surgery, College of Medicine, Prince Sattam bin Abdulaziz University, Al-Kharj, 16278, Saudi Arabia.

Email ID: dr.masf@gmail.com

ABSTRACT

Benign prostatic hyperplasia (BPH) and prostate cancer (PCa) stand as two of the most prevalent conditions affecting the prostate, each demanding distinct diagnostic and surgical strategies. This systematic review aims to take an overview of the surgical interventions used by surgeons and attempted on patients diagnosed with benign prostatic hyperplasia and prostate cancer. Many surgical interventions can be used with various degrees of appropriateness and effectiveness in terms of long-term survival for male patients. This systematic eview used search engine tools of Web of Science, Google scholar, and other search engines. From total 451 studies were collected from different search engines, and by using Rayan software to remove duplicates, only 10 studies were eligible and chosen for further assessment in both quality and bias. The most affective results are unipolar transurethral resection (TURP), Bipolar TURP, and open prostatectomy. The TUIP is not preferred for cases between 60 and 69 years old. The unipolar transurethral resection (TURP), Bipolar TURP, and open prostatectomy. Regarding the reimbursements paid mean per procedure was 1.43 times higher than for traditional procedures. Clearer diagnostic tools and more personalized approaches are needed to balance symptom relief with cancer control while maintaining patients' quality of life.

Keywords: *Benign prostatic hyperplasia; BPH; prostate cancer; PCa; surgical interventions; systematic review.*

How to Cite: Mohammed Alfozan, (2025) Surgical Interventions Upon Diagnosis among Benign Prostatic Hyperplasia and Prostate Cancer cases: A Retrospective Study with Systematic Review, *Journal of Carcinogenesis*, *Vol.24, No.5s*, 310-320

1. INTRODUCTION

Benign prostatic hyperplasia (BPH) and prostate cancer (PCa) stand as two of the most prevalent conditions affecting the prostate, each demanding distinct diagnostic and surgical strategies. BPH—a nonmalignant proliferation of prostatic stromal and epithelial components—commonly manifests as lower urinary tract symptoms (LUTS), such as urinary frequency, urgency, nocturia, weak stream, and hesitancy (Devlin et al., 2021). Conversely, prostate cancer is the most frequent malignancy in male population worldwide, and remains one of the leading causes of cancer-related death among men globally (Siegel et al., 2020). While discrete in pathogenesis, BPH and PCa frequently overlap in early presentation, which makes diagnosis and management decisions challenging (Zhang et al., 2023). but also affects children, particularly in low- and middle-income countries (LMICs) where access to care is limited. Paediatric cancer presents unique challenges, necessitating global initiatives to improve treatment accessibility and survival rates.[2] Children with cancer face difficulties understanding their diagnosis and coping with treatment outcomes, including pain, which is highly prevalent and distressing.

BPH prevalence rises sharply with age: about 50% of men between 51 and 60 years of age exhibit histological or symptomatic evidence (Devlin et al., 2021). LUTS, the most common problem associated with BPH, may likewise mask or mimic prostate cancer symptoms, complicating differential diagnosis (Merriel et al., 2022). The shared risk factors—age, hormonal changes, and concurrent comorbidities—further blur clinical boundaries. Routine evaluation frequently includes digital rectal examination (DRE), serum prostate-specific antigen (PSA), and symptom scoring, including the International Prostate Symptom Score (IPSS) (Cao et al., 2021). However, DRE and PSA elevation lack specificity, introducing diagnostic ambiguity (Merriel et al., 2022). Advanced imaging—namely multiparametric MRI—has enhanced localization and risk stratification, yet findings may still overlap, especially in complex anatomies (Li et al., 2024). Established guidelines such as those promulgated by NICE emphasize the need for robust diagnostic pathways to separate benign from malignant etiologies while guiding appropriate intervention (*2021 Exceptional Surveillance of Prostate Cancer*, 2021).

Surgically addressing BPH has evolved considerably. Historically, transurethral resection of the prostate (TURP) has been the gold standard, lauded for effective symptom relief and increased urinary flow, often outperforming pharmacological therapy in durability. Nonetheless, TURP carries notable postoperative side effects such as retrograde ejaculation, bleeding, and longer catheterization or hospitalization times. In response, minimally invasive surgical therapies (MIST) have been developed—including laser enucleation modalities (HoLEP, thulium, photoselective vaporization), prostatic urethral lift (UroLift), water vapor thermal therapy (Rezum), and office-based procedures—aimed at reducing morbidity while preserving functional outcomes (Enikeev et al., 2022; Nguyen et al., 2024).

Notably, aquablation— using robotically executed surgeon-controlled high-pressure water jet—has emerged as a promising alternative. In a comparative study, aquablation demonstrated improved objective urinary flow measures (maximum flow rate and post-void residual) and BPH-related symptoms compared to the standard surgical treatment (TURP), with maintained improvement over five years (Gilling et al., 2022). However, even the most advanced BPH surgeries may incidentally reveal prostate cancer upon histopathological evaluation, raising management dilemmas about the significance of such incidental findings and whether further oncological intervention is warranted (Li et al., 2024).

Conversely, radical prostatectomy remains a principal curative approach for localized prostate cancer (Sekhoacha et al., 2022). In patients with concomitant BPH, the proposed intervention may serve dual purposes—but at the risk of increased morbidity compared to more focused BPH procedures (Yang et al., 2021). Surgical choice must therefore balance obstructive symptom relief against oncological control, all while preserving quality of life.

The overlapping symptoms, imperfect diagnostic tools, and intersecting surgical options make clinical decision-making particularly complex. Physicians must weigh the risks of overtreatment—especially when dealing with incidental low-risk cancers—against that of delayed diagnosis and health deterioration. Moreover, patient factors such as age, sexual function, comorbidities, and individual preferences must guide a personalized, risk-based approach. Shared decision-making, aided by reliable diagnostic clarity and multidisciplinary input, remains essential (Sekhoacha et al., 2022; Yang et al., 2021). This systematic review aims to take an overview of the surgical interventions used by surgeons and attempted on patients diagnosed with benign prostatic hyperplasia and prostate cancer.

2. MATERIALS AND METHODS

This is an observational retrospective study, where related data were collected from the Oncology department in College of Medicine, Prince Sattam bin Abdulaziz University, Al-Kharj, Saudi Arabia.

The study was held for five years at the time period between November 2019 to December 2025. Data of patients who have experienced either BPH or PCa were collected. For only, age, body mass index, and medical history as well as the procedures used).

Inclusion and exclusion criteria

Inclusion criteria:

- All patients who have been diagnosed with prostate cancer or BPH in Prince Sattam bin Abdulaziz University, Al-Kharj, Saudi Arabia.

Exclusion criteria:

- Incomplete patients' records which lack main data.

Data collection

After getting the ethical approval. Data pertaining to demographics and interventions used was carried out. The descriptive statistical analysis was performed.

Protocol

All the collected studies were selected according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines that were set and revised before for formulating systematic reviews, asking a specific question based on the Participants, Intervention, Control, Outcome, and Time (PICOT) model and its framework was listed:

(P) Participants: subjects who underwent surgical intervention for either prostate cancer (PCa) or benign prostatic hyperplasia (BPH).

(I) Intervention: performing and implementing any time of surgeries.

(C) Control: If available, the lifestyle and non-surgical control.

(O) Outcome: Quality of life and urological function improve.

(T) Time: Studies published from 2000 till 2025.

The research question was: “What are the most common and widely used surgical interventions for controlling BPH and

PCa after the confirmatory diagnosis?".

Using PRISMA chart guidelines to collect, extract, and clean all reports related to this systematic review (Fig. 1). From total 451 studies were collected from different search engines, and by using Rayan software to remove duplicates (n=71) and any studies were ineligible (n=112), about 268 studies were then further screened and 54 studies were retrieved to only 214 obeyed to the screening to remove any reported out of scope, not using a fit model of surgeries, in journal not well specified, and studies took the observational findings from non-surgeons ((n=204).

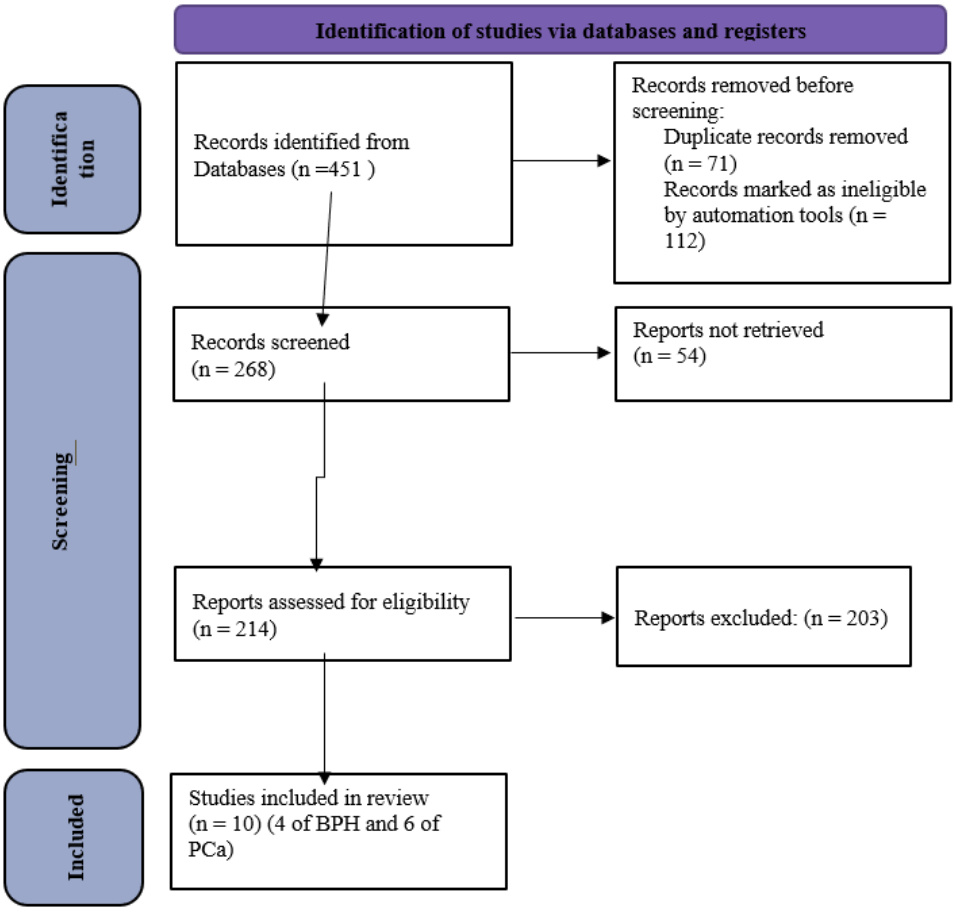

Figure 1 PRISMA flowchart of this study

Data Sources and Search Strategy

The databases sources used for this systematic review were the National Library of Medicine (NLM), Cochrane Central Register of Controlled Trials (CENTRAL), the PubMed Central (PMC), Google scholar, and the Web of Science (WOS) electronic databases. These databases sources were searched for findings published in the last 25 years until June 2025. The MeSH terms (Medical Subject Headings) used in were: "Benign prostatic hypertrophy, Benign prostatic hyperplasia, BPH, prostate cancer, prostatic cancer, prostate neoplasm, surgeries, interventions".

Inclusion and exclusion criteria

The inclusion criteria for this systematic study selections were:

In the last twenty five years of studies.

Studies were carried out in hospitals or specialties related to urology settings.

Reports either interventional or observational relating to earth BPH or PC of surgical control and management.

While the exclusion criteria for this systematic study selections were:

Studies out of surgeon based management.

Narrative, literature, and systematic reviews.

Non-English language studies.

Data Extraction and Analysis

The data were extracted and analyzed via the reviewer who effectively and firstly extracted data from full texts of the included and selected articles, involving general information, introduction, site of studies, and type of surgical intervention, type of diseases (BPH or PCa), discussion of these data conclusions, future perspectives and studies limitations.

Discussion between the two reviewers cleared up the confusion about the studies' eligibility to get the most reliable and eligible results to be discussed later on

Risk of Bias (RoB) and Quality of the Reports in the Selected Articles

This research assessment involved the studies guidelines provided by authors, with a total of 4 items besides other specific quality criticism items. Each item was rated by the reviewer with scores of 0 (not reported) or 1 (reported), the following table shows the checklist for the studies.

Table 1 Quality assessment for the included studies

Study	Clear aim	Appropriate statistical analysis	Goo results 'presentation	Suitable discussion	Total score
Sun et al. (2005)	1	0	1	1	3
Ibis et al. (2021)	1	1	1	1	4
Al Khayal et al. (2021)	1	0	1	1	3
Ditonno et al. (2024)	1	1	0	1	3
Wilt et al. (2012)	1	1	1	1	4
Warlick et al. (2006)	1	1	1	1	4
Yaseen (2023)	0	1	1	0	2
Hamdy et al. (2023)	1	1	1	1	4
Hamdy et al. (2016)	1	1	1	1	4
Yoo et al. (2023)	0	1	1	1	3

Al Khayal et al. (2021) used questionnaire based in the patients' perspectives, it is not widely considered a good for reliable data. Taking a wide range of ages and diagnosis depending on the patients perspectives only may give some degree of bias. The small sample size is another bad consequence to the obtained data. Ibis et al. (2021) worked on large sample of population and did not report the prostate size for the intervention type.

Sun et al. (2005) found from centers' point of view and experience that some of techniques are widely used among surgeons over others, but the Japan specifically, Hong King is the only area od study which may cause a degree of bias. Ditonno et al. (2024) scoped on the utilization and the cost related point of view as well as the reimbursement degree. Lacking other reasons for choosing the most appropriate surgical intervention is observed.

Warlick et al. (2006) worked on small sample size of patients. The risk and CI are calculated to assure the outcomes of patients to delayed and immediate surgical intervention. Wilt et al. (2012) employed an observational study on large sample size to assess the median follow up of 10 years only. Hazard ratio is a suitable statistical test for assessing the outcomes.

Yaseen (2023) had an adequate sample size when compared to Iraq country, in a retroactive design. Yoo et al. (2023) found that the outcomes covered the economic level too and the other health insurance aids. Hamdy et al. (2016) reported in his first study the 10-years outcome while their second study Hamdy et al. (2023), reported other 15-years outcome with an adequate sample size and two types of interventions.

3. RESULTS

Population characteristics and interventions used

Their mean age among population was 54±14 years old and their BMI was 26.4±4.6 Kg/m^2

Table 2 The personal characters among the study population

Characters	Mean±S.D
Age (years)	54±14
Body mass index (Kg/m^2)	26.4±4.6
Medical history N (BPH, Prostate cancer)	
Hypertension	25,41
Diabetes mellitus	12,148
Cardiovascular diseases	2,4

From the previous data reports, ILC was the most common procedure made for patients with BPH while radiotherapy was the most common procedure for prostate cancers (n=451).

Table 3 The most used procedures used for BPH and prostate cancer

Surgical intervention for BPH	No. of cases	Percentage
TUMT	24	21.05
VLAP	18	15.79
ILC	36	31.58
HoLRP	18	15.79
PVP	12	10.53
TUVP	4	3.51
TUVRP	2	1.75
Plasma kinetic resection		
Surgical intervention for Prostate cancer		
Prostatectomy	127	21.97
Radiotherapy	451	78.03

Characteristics of the Studies

The main study characteristics for BPH and prostate cancer ten studies are listed in the following two tables.

Table 4 Characteristics of included studies for BPH

Study	Study	Location	Sample size	Interventions' made	Conclusion
Sun et al. (2005)	Retrospective	Hong Kong, Japan	32 Centers	Holmium-YAG laser in Holmium laser resection of the prostate (HoLRP), high-power electrocautery vaporisation in transurethral vaporisation of the prostate (TUVP), high-power electrocautery thick loop resection with or without a feedback system in transurethral vaporisation-resection of the prostate (TUVRP), KTP laser in photoselective vaporisation of the prostate (PVP), and bipolar electrocautery loop resection in plasma kinetic resection. Transurethral incision of the prostate (TUIP).	The prostate transurethral resection is the standard surgical intervention in most (12 of 13) of urology centers Hong Kong
Ibis et al. (2021)	Cross-sectional	Turkey	94,954 patients	monopolar transurethral prostate resection (M-TURP), transurethral incision of the prostate (TUIP), open prostatectomy (OP), bipolar transurethral prostate resection (BTURP), and holmium laser enucleation of the prostate (HoLEP)	The B-TURP as a resection technique and HoLEP as an enucleation technique replace M-TURP from the different studied interventions.
Al Khayal et al. (2021)	Cross-sectional	Saudi Arabia	65 Urologists	The unipolar transurethral resection (TURP), open prostatectomy, and Bipolar TURP.	The TURP continues to be the main intervention as an intervention. Open

					prostatectomy is widely used intervention too.
Ditonno et al. (2024)	Retrospective		274 808 patients	The transurethral resection of the prostate (TURP), holmium/thulium laser enucleation of the prostate (HoLEP/ThuLEP), laparoscopic/robot-assisted SP, and open simple prostatectomy (SP).	The patients undergoing SP and HoLEP/ThuLEP have a lower retreatment probability.

Table 5 Characteristics of included studies for prostate cancer

Study	Study	Location	Sample size	Interventions' made	Conclusion
Wilt et al. (2012)	Cohort	United states of America	731 patients	Radical Prostatectomy and Observation	The radical prostatectomy has no significant reduction of prostate-cancer Mortality.
Warlick et al. (2006)	Cohort	United states of America	35 patients	Delayed Versus Immediate Surgical Intervention	The delayed prostate cancer surgery does not appear to compromise curability for cases with low size prostate
Yaseen (2023)	Retrospective	Iraq	115 patients	radical prostatectomy, robotic prostatectomy, surgical castration, and bilateral orchiectomy	The radical prostatectomy is the most widely known surgical procedure for patients with metastatic prostate cancer
Hamdy et al. (2023)	Cohort	United Kingdom	82,429 patients	Prostatectomy and radiotherapy	The prostatectomy highly used as surgical procedure
Hamdy et al. (2016)	Cohort	United Kingdom	82,429 patients	Prostatectomy and radiotherapy	The prostatectomy as well as the radiotherapy are associated

					with lower disease metastases and progression
Yoo et al. (2023)	Retrospective	Korea	29,973 patients	Only radical prostatectomy	The radical prostatectomy has high health outcomes for cases along period of follow up

Benign prostatic hyperplasia and its most used interventions

Different surgical interventions are committed to be performed among male patients diagnosed with BPH, as shown,

Al Khayal et al. (2021) reported that it depends on prostate size, unipolar transurethral resection (TURP), Bipolar TURP, and open prostatectomy. About half of respondents preferred open prostatectomy for prostate size above 100 gm, open prostatectomy is preferred while prostate sizes less than 100 gm, the TURP is preferred.

Ibis et al. (2021) reported a age-related type of intervention, as reported by previous records, TUIP is not preferred for cases between 60 and 69 years old. Other interventions are widely performed in the previous age group. Also, he reported that B-TURP is the most preferred resection technique.

Sun et al. (2005) found that the transurethral resection of the prostate is the technique

of choice for BPH treatment. He searched for different interventions such as TUMT, VLAP, ILC, HoLRP, TUVP, TUVRP, and PVP as well as the plasma kinetic resection.

Ditonno et al. (2024) worked on the cost effectiveness and the utilization of the surgical procedures; The most common procedure was transurethral resection of the prostate and the traditional surgery remained most performed for the entire period. Regarding the reimbursements paid mean per procedure was 1.43 times higher than for traditional procedures. He worked on different procedures such as HoLEP/ThuLEP), laparoscopic/robot-assisted SP, and open simple prostatectomy (SP).

Prostate cancer and its most used interventions

Male patients diagnosed with prostate cancer are also obeyed to different surgical interventions,

Warlick et al. (2006) found that the health outcome is more important than other outcomes, the different grades of prostate cancer may limit the degree of outcomes. According to age, and PSA marker level. Both delayed and quick intervention have a significant effect on the quality of 10 years as outcome.

Wilt et al. (2012) discussed different morbidities according to their age, race, and other conditions in relation to surgeons and patients' outcomes with using only radical prostatectomy versus observation. Yaseen (2023) discussed the advanced level of the tumor and metastases and comparing both radiotherapy and surgery in controlling the stage of prostatic cancer.

Yoo et al. (2023) concentrated on the radical prostatectomy over 5-years of survival, and the insurance type included in the study, to report that the economic status and resident did not affect treatment patterns and postoperative oncological outcomes.

Hamdy et al. (2016) and Hamdy et al. (2023) found out from long-term health outcomes for surgeries and radiotherapy. To find that radiotherapy and surgeries are associated with lower incidences of PCa progression.

4. DISCUSSION

This systematic review aims to take an overview of the surgical interventions used by surgeons and attempted on patients diagnosed with benign prostatic hyperplasia and prostate cancer.

Benign prostatic hyperplasia and its most used interventions

The reviewed studies collectively demonstrate that the choice of surgical intervention for benign prostatic hyperplasia (BPH) is strongly influenced by several patient- and procedure-related factors, including prostate size, patient age, surgeon preference, and cost-effectiveness considerations. Al Khayal et al. (2021) highlighted prostate volume as a key determinant in decision-making, noting that open prostatectomy remains the preferred option for glands larger than 100 g, while transurethral resection of the prostate (TURP) is favored for smaller prostates. This aligns with longstanding surgical

practice, in which open approaches are typically reserved for markedly enlarged glands to ensure complete adenoma removal.

In contrast, Ibis et al. (2021) emphasized the influence of patient age on surgical selection. Their findings indicated that transurethral incision of the prostate (TUIP) is seldom utilized in men aged 60–69 years, while alternative procedures, particularly bipolar TURP, are more commonly performed in this age group. The preference for bipolar resection techniques likely reflects their improved safety profile, including reduced risk of transurethral resection syndrome and better hemostasis compared with monopolar TURP.

Sun et al. (2005) provided broader insights into evolving surgical technologies, confirming TURP as the reference standard for BPH while also describing the emergence of minimally invasive and laser-based options, including transurethral microwave thermotherapy (TUMT), visual laser ablation of the prostate (VLAP), interstitial laser coagulation (ILC), holmium laser resection (HoLRP), transurethral vaporization (TUVP), transurethral vapor resection (TUVRP), and photoselective vaporization (PVP). While these techniques offer advantages such as shorter recovery times and reduced bleeding, their widespread adoption has been variable.

More recently, Ditonno et al. (2024) examined the economic dimension of BPH surgery, underscoring that TURP and traditional open procedures remain the most frequently performed despite the availability of newer laser and minimally invasive techniques. Interestingly, their cost-analysis demonstrated that reimbursements were 1.43 times higher for modern interventions such as holmium laser enucleation (HoLEP) and thulium laser enucleation (ThuLEP), as well as robotic or laparoscopic approaches, compared with conventional procedures. This finding suggests that economic considerations and health system policies may significantly shape procedure utilization, beyond clinical efficacy alone.

Taken together, these findings indicate that while TURP continues to serve as the benchmark intervention for BPH, surgical decision-making is complex and multifactorial. Prostate size, patient age, procedure-related risks, technological availability, and cost-effectiveness all play pivotal roles. The persistence of traditional approaches despite the advent of newer technologies reflects not only their proven efficacy but also financial and accessibility constraints. Future research should therefore aim to balance innovation with real-world applicability, ensuring that advances in surgical management translate into both clinical benefit and sustainable health care practice.

5. PROSTATE CANCER AND ITS MOST USED INTERVENTIONS

Surgical interventions for prostate cancer remain central to disease management, though treatment decisions are influenced by a combination of clinical, demographic, and socioeconomic factors. Warlick et al. (2006) emphasized that long-term health outcomes are prioritized above other considerations, with age, prostate-specific antigen (PSA) levels, and cancer grade shaping prognosis and treatment effectiveness. Their findings suggest that both immediate and delayed surgical intervention can have a meaningful impact on quality of life and survival over a 10-year period, highlighting the importance of individualized treatment timing.

The influence of patient demographics and comorbidities on treatment outcomes was further illustrated by Wilt et al. (2012), who compared radical prostatectomy with observation. Their results demonstrated that age, race, and existing health conditions not only affect postoperative outcomes but also guide clinical decisions regarding whether surgery or conservative management is more appropriate. This underscores the need to align surgical choice with patient-specific risk profiles.

Yaseen (2023) expanded this perspective by evaluating treatment in advanced-stage and metastatic cases, comparing surgery with radiotherapy. The study indicated that both modalities play significant roles in disease control, although their effectiveness may vary depending on tumor progression and extent of metastasis. Similarly, Hamdy et al. (2016, 2023) provided evidence from long-term follow-up studies, confirming that both surgery and radiotherapy are associated with reduced rates of prostate cancer progression, further validating their role in standard treatment algorithms.

Interestingly, Yoo et al. (2023) explored the socioeconomic context of surgical outcomes, assessing the effect of insurance type and residence on radical prostatectomy results. Their findings suggest that financial and regional differences did not significantly influence treatment patterns or postoperative oncological outcomes, indicating a degree of equity in access and effectiveness once patients undergo surgery.

Overall, the reviewed studies highlight the multifactorial nature of surgical decision-making in prostate cancer. While radical prostatectomy remains a cornerstone treatment, the choice between surgical and nonsurgical options is shaped not only by tumor biology and patient health status but also by long-term outcome expectations. The consistency of evidence supporting both surgery and radiotherapy as effective interventions suggests that personalized approaches, integrating patient age, disease stage, and health priorities, are essential to optimizing prostate cancer management.

6. LIMITATIONS OF THE STUDY

The main limitation for this study is absence of the randomized controlled trials, only collected data from reports were the source of information. The physician's perspectives towards the most effective intervention is not present. No clear assessment bias system was obtained or reviewed for this number of studies. NO more case control or cohort studies are employed.

7. CONCLUSION

Benign prostatic hyperplasia and prostate cancer are two of the most common conditions in aging men. Although they are biologically different, they often overlap in symptoms, risk factors, and even treatment pathways. This overlap makes diagnosis and surgical decision-making challenging, especially since procedures for BPH may delay or obscure prostate cancer detection, while surgery for cancer carries higher risks. Clearer diagnostic tools and more personalized approaches are needed to balance symptom relief with cancer control while maintaining patients' quality of life.

8. RECOMMENDATIONS

The future of managing prostate disease lies in better diagnosis and less invasive treatments. Advances such as multiparametric MRI, new biomarkers, and genomic tools may help distinguish between BPH and prostate cancer earlier and more accurately. At the same time, modern surgical techniques, robotics, and focal therapies aim to reduce side effects while improving outcomes. Artificial intelligence may also support doctors in tailoring treatment to each patient. Together, these developments may help resolve the long-standing conflict between managing benign enlargement and detecting malignancy in the prostate.

REFERENCES

[1] Al Khayal, A. M., Balaraj, F. K., Alferayan, T. A., Alrabeeah, K. A., & Abumelha, S. M. (2021). Current surgical procedures for benign prostatic hyperplasia and impression of new surgical modalities. Urology Annals, 13(2), 95-100.

[2] Cao, Q., Wu, Y., Guan, W., Zhu, Y., Qi, J., & Xu, D. (2021). Diagnosis of chronic prostatitis by noninvasive methods in elderly patients with benign prostatic hyperplasia in China. Andrologia, 53(6), e14055. https://doi.org/10.1111/and.14055

[3] Devlin, C. M., Simms, M. S., & Maitland, N. J. (2021). Benign prostatic hyperplasia—What do we know? BJU International, 127(4), 389–399. https://doi.org/10.1111/bju.15229

[4] Ditonno, F., Manfredi, C., Licari, L. C., Bologna, E., Franco, A., Pandolfo, S. D., Sio, M. D., Nunzio, C. D., Fiori, C., Cherullo, E. E., Olweny, E. O., Antonelli, A., & Autorino, R. (2024). Benign Prostatic Hyperplasia Surgery: A Snapshot of Trends, Costs, and Surgical Retreatment Rates in the USA. European Urology Focus, 10(5), 826–832. https://doi.org/10.1016/j.euf.2024.04.006

[5] Enikeev, D., Misrai, V., Rijo, E., Sukhanov, R., Chinenov, D., Gazimiev, M., Taratkin, M., Azilgareeva, C., Morozov, A., Herrmann, T. R. W., & Glybochko, P. (2022). EAU, AUA and NICE Guidelines on Surgical and Minimally Invasive Treatment of Benign Prostate Hyperplasia: A Critical Appraisal of the Guidelines Using the AGREE-II Tool. Urologia Internationalis, 106(1), 1–10. https://doi.org/10.1159/000517675

[6] Gilling, P. J., Barber, N., Bidair, M., Anderson, P., Sutton, M., Aho, T., Kramolowsky, E., Thomas, A., Kaufman, R. P., Badlani, G., Plante, M., Desai, M., Doumanian, L., Te, A. E., & Roehrborn, C. G. (2022). Five-year outcomes for Aquablation therapy compared to TURP: Results from a double-blind, randomized trial in men with LUTS due to BPH. The Canadian Journal of Urology, 29(1), 10960–10968.

[7] Hamdy, F. C., Donovan, J. L., Lane, J. A., Mason, M., Metcalfe, C., Holding, P., ... & Neal, D. E. (2016). 10-year outcomes after monitoring, surgery, or radiotherapy for localized prostate cancer. New England Journal of Medicine, 375(15), 1415-1424.

[8] Hamdy, F. C., Donovan, J. L., Lane, J. A., Metcalfe, C., Davis, M., Turner, E. L., ... & Neal, D. E. (2023). Fifteen-year outcomes after monitoring, surgery, or radiotherapy for prostate cancer. New England Journal of Medicine, 388(17), 1547-1558.

[9] Ibis, M. A., Cayan, S., Tokatli, Z., Orhan, I., Ascı, R., Kocamanoglu, F., ... & Yaman, O. (2021). Trends in benign prostatic hyperplasia surgery over the years: A multicenter 14-year retrospective study. Turkish Journal of Urology, 47(6), 501.

[10] Li, E. V., Lee, M. S., Guo, J., Dean, N., Kumar, S., Mi, X., Zhou, R., Neill, C., Yang, X., Ross, A. E., & Krambeck, A. E. (2024). Modern predictors and management of incidental prostate cancer at holmium enucleation of prostate. The Prostate, 84(16), 1427–1433. https://doi.org/10.1002/pros.24781

[11] Merriel, S. W. D., Pocock, L., Gilbert, E., Creavin, S., Walter, F. M., Spencer, A., & Hamilton, W. (2022).

Systematic review and meta-analysis of the diagnostic accuracy of prostate-specific antigen (PSA) for the detection of prostate cancer in symptomatic patients. BMC Medicine, 20(1), 54. https://doi.org/10.1186/s12916-021-02230-y

[12] Nguyen, D.-D., Li, T., Ferreira, R., Baker Berjaoui, M., Nguyen, A.-L. V., Chughtai, B., Zorn, K. C., Bhojani, N., & Elterman, D. (2024). Ablative minimally invasive surgical therapies for benign prostatic hyperplasia: A review of Aquablation, Rezum, and transperineal laser prostate ablation. Prostate Cancer and Prostatic Diseases, 27(1), 22–28. https://doi.org/10.1038/s41391-023-00669-z

[13] Sekhoacha, M., Riet, K., Motloung, P., Gumenku, L., Adegoke, A., & Mashele, S. (2022). Prostate Cancer Review: Genetics, Diagnosis, Treatment Options, and Alternative Approaches. Molecules, 27(17), 5730. https://doi.org/10.3390/molecules27175730

[14] Siegel, R. L., Miller, K. D., & Jemal, A. (2020). Cancer statistics, 2020. CA: A Cancer Journal for Clinicians, 70(1), 7–30. https://doi.org/10.3322/caac.21590

[15] Sun, W., Man, C., Ngai, R., Wong, B., Yiu, T., & Association, H. K. U. (n.d.). Surgical intervention for benign prostatic hyperplasia in Hong Kong.

[16] Warlick, C., Trock, B. J., Landis, P., Epstein, J. I., & Carter, H. B. (2006). Delayed Versus Immediate Surgical Intervention and Prostate Cancer Outcome. JNCI: Journal of the National Cancer Institute, 98(5), 355–357. https://doi.org/10.1093/jnci/djj072

[17] Wilt, T. J., Brawer, M. K., Jones, K. M., Barry, M. J., Aronson, W. J., Fox, S., ... & Wheeler, T. (2012). Radical prostatectomy versus observation for localized prostate cancer. New England Journal of Medicine, 367(3), 203-213.

[18] Wilt, T. J., Brawer, M. K., Jones, K. M., Barry, M. J., Aronson, W. J., Fox, S., ... & Wheeler, T. (2012). Radical prostatectomy versus observation for localized prostate cancer. New England Journal of Medicine, 367(3), 203-213.

[19] Yang, L., Lee, J. A., Heer, E., Pernar, C., Colditz, G. A., Pakpahan, R., Imm, K. R., Kim, E. H., Grubb, R. L., Wolin, K. Y., Kibel, A. S., & Sutcliffe, S. (2021). One-year urinary and sexual outcome trajectories among prostate cancer patients treated by radical prostatectomy: A prospective study. BMC Urology, 21(1), 81. https://doi.org/10.1186/s12894-021-00845-0

[20] Yaseen, W. K. (2023). Observational study of surgical treatment of prostate cancer in Iraq. Onkologia i Radioterapia, 17(7).

[21] Yoo, S., Oh, S., Cho, M. C., Son, H., & Jeong, H. (2023). A Nationwide Study of Differences in Surgical Treatment Rates and Oncological Outcomes for Prostate Cancer according to Economic Status and Region. Cancer Research and Treatment, 55(2), 652–658. https://doi.org/10.4143/crt.2022.893

[22] Zhang, Y., Li, W., Zhang, Z., Xue, Y., Liu, Y.-L., Nie, K., Su, M.-Y., & Ye, Q. (2023). Differential diagnosis of prostate cancer and benign prostatic hyperplasia based on DCE-MRI using bi-directional CLSTM deep learning and radiomics. Medical & Biological Engineering & Computing, 61(3), 757–771. https://doi.org/10.1007/s11517-022-02759-x