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BENIGN PROSTATIC HYPERPLASIA (K MCVARY, SECTION EDITOR)

Cost Comparison of Benign Prostatic Hyperplasia Treatment Options

Molly E. DeWitt-Foy[1,2] · Bradley C. Gill[1,2,3] · James C. Ulchaker[1,2]

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Abstract

Purpose of Review To provide an economic context within which to consider treatment options for benign prostatic hyperplasia (BPH). To this end, this review provides a comparison of the costs of combination medical therapy, operative treatment, and office-based therapies for BPH from a payer perspective.

Recent Findings Analysis of Medicare charges from the authors' institution, as well as local retail costs of medication, demonstrated a wide range in costs of commonly used BPH treatments. In this study, interventions for BPH reached cost equivalence with combination medical therapy within 6 months to 8 years.

Summary A myriad of options for managing men with symptomatic BPH exist. It is prudent not only to consider surgeon preference and patient-specific factors when selecting a treatment but also to understand the economic impact different BPH therapies confer.

Keywords Benign prostatic hyperplasia · Lower urinary tract symptoms · Cost analysis · Medication therapy management

Introduction

The enlarged prostate has presented a challenge to man and his treating physician for over 5000 years. The urologic community has made great progress since the era of reeds as catheters (3000 BCE), the blind "Punch" procedure of the 1570s, and the development of the irrigating cystoscope in 1897 [1]. With a plethora of medical, surgical, and procedural options available to the modern-day urologist, selecting a treatment modality for the ~50% of men over 50 years of age with symptomatic benign prostatic hyperplasia (BPH) is a more nuanced endeavor [2]. In addition to efficacy, potential side effects, and patient-specific factors, the costs of treatment remain an important consideration.

Lifelong management of BPH with oral medications may offer durable relief with minimal burden for some men, while others may require more timely surgery without a trial of medical therapy. However, at some point in the course of their condition, many men will fall between the two ends of this spectrum—for these patients in particular, consideration of each treatment's relative cost is worthwhile. Using Medicare payment data and drug prices, this manuscript offers a cost model for the myriad of available BPH therapies, framed within a review of the current literature. Management options included in analyses range from single or dual medication therapy to office-based interventions, and surgical treatments, with or without inpatient hospital admission.

This article is part of the Topical Collection on *Benign Prostatic Hyperplasia*

✉ Molly E. DeWitt-Foy
dewittm@ccf.org

Bradley C. Gill
gillb@ccf.org

James C. Ulchaker
ulchakj@ccf.org

[1] Department of Urology, Glickman Urological and Kidney Institute, Cleveland Clinic, Mail Stop Q10-1 9500 Euclid Avenue, Cleveland, OH 44195, USA

[2] Lerner College of Medicine, Education Institute, Cleveland Clinic, Mail Stop NA21 9500 Euclid Avenue, Cleveland, OH 44195, USA

[3] Department of Biomedical Engineering, Lerner Research Institute, Cleveland Clinic, Cleveland, OH, USA

Methods

Literature Review

Existing literature was collected and reviewed through a PubMed search including the terms "benign prostate hyperplasia" and "economics" or "cost." Unless seminal in the field, reviews published prior to 2008 were excluded. Current

clinical guidelines, as well as articles aimed at comparing relative effectiveness of BPH therapies, were also reviewed.

Cost Model

Local price ranges for BPH medications were approximated using publicly available consumer assistance tools from goodrx.com, specific to the authors' practice location. Medication costs were estimated assuming no insurance coverage. Although a number of pharmacies, online, mail-order, and otherwise, offer significant discounts (up to 96% off retail price) for these medications, this pricing is highly variable and access to such deals can also be limited [3]. Thus, the annual cost range was reported using the lowest discounted price, as well as standard retail price, but relative cost ratios were calculated utilizing the lowest price without discount. The cost of combined medical therapy was estimated using the lowest-cost alpha-adrenergic agent and the lowest-cost 5-alpha reductase inhibitor, again utilizing the medication price without insurance coverage or discount.

For the purpose of this review, "surgical therapy" encompasses surgeries completed in the operating room with the assistance of a licensed anesthetist and can be further subdivided into outpatient or inpatient surgeries, depending on whether a significant postoperative hospitalization was required. Office-based procedures are those that can be completed in a procedural room with local anesthesia and without the need for an anesthetist.

Costs of surgical and procedural treatments for BPH were calculated from the payer perspective using 2018 Medicare reimbursement data from the authors' institution. Listed costs are the averages of all procedures performed in each category over the prior calendar year, in an attempt to minimize variability relating to patient-specific charges. These costs do not factor in the pre-operative evaluation, routine post-operative management, or the treatment of post-operative complications, including re-operation.

Relative cost percentages compare each treatment to the most affordable therapy in its respective category. Based on this analysis, costs of all other interventions are expressed as a percentage of the cost of convective water vapor ablation (the least costly intervention), and all medications are compared with terazosin monotherapy (the least costly medication). The duration of combination medical therapy needed to reach cost equivalence with each intervention was then calculated using the previously described medication and procedural costs.

Results

Medical Therapy

The medical management of BPH is largely based on the use of medications from two classes—alpha-adrenergic antagonists and 5-alpha reductase inhibitors (5ARIs). The use of phosphodiesterase inhibitors was not assessed in this study. Though some patients may be well managed on one therapy or the other, several large trials, including MTOPS (Medical Therapy of Prostatic Symptoms) and CombAT (Combination therapy of Avodart and Tamsulosin), demonstrate a superiority of combination therapy with alpha-blockers and 5ARIs over either medication class on its own. In addition to being more effective, combining medications from these two classes may also promote adherence—though 5ARIs can stop or reverse the disease process itself by decreasing prostate size, they require many months to benefit symptoms, which may challenge compliance early on. The addition of alpha-blockers is useful because they can provide symptom benefit significantly sooner after initiation [4, 5].

MTOPS, which randomized patients to a 5ARI (finasteride), an alpha-blocker (doxazosin), combination therapy, or placebo, demonstrated reduced risk of acute urinary retention, incontinence, renal insufficiency, and recurrent urinary tract infections in each medication arm versus placebo, with an even greater risk reduction in those on combination therapy relative to either drug alone [6]. Similarly, CombAT randomized patients to an alpha-blocker (tamsulosin), a 5ARI (dutasteride), or both. Symptom benefit and clinical progression of BPH were both significantly improved in the combination therapy arm. Administration of combination therapy was shown to reduce the rate of acute urinary retention, clinical progression, and the need for surgical intervention for BPH [7].

Though generally well tolerated, the most common side effects for combination therapy included ejaculatory dysfunction, orthostatic hypotension, dizziness, decreased libido, erectile dysfunction, gynecomastia, and breast or nipple pain [8]. In addition to the noted side effect profile, combination therapy also comes with a heftier price tag. The cost of medical therapy can vary significantly based upon the specific medications prescribed, insurance coverage, and by individual pharmacy. Comparing pricing ranges from goodrx.com, annual out of pocket costs for BPH medical therapy for a man without insurance prescription coverage can range from as little as $145.68 for discounted Finasteride to as much as $5155.80 for combination therapy with retail price Silodosin and Dutasteride (Table 1).

Surgical Therapy

A wide range of surgical therapies now exist for the treatment of BPH. The updated 2018 AUA BPH guidelines help delineate the patient-specific factors that might aid a urologist to pick one intervention over another. For example, men with very large glands may be better served by simple prostatectomy or laser enucleation, while men with average size glands are likely good candidates for TURP, photovaporization of the

Table 1 Costs of medications for BPH using generic prices from goodrx.com, assuming no insurance coverage

Medication	Covered by Medicare Part D (Y/N)	Average monthly cash price without insurance or coupon ($)	Annual cost range, with or without coupons, no insurance ($)	Relative cost (%)
Tamsulosin 0.4 mg	Yes	$76.77	161.04–921.24	134.59
Finasteride 5 mg	Yes	$57.04	145.68–684.48	100
Alfuzosin 10 mg	Yes	$82.11	162–985.32	143.95
Doxazosin 4 mg	Yes	$95.35	288–1144.20	167.16
Silodosin 8 mg	No	$261.91	737.40–3142.92	459.17
Terazosin 5 mg	Yes	$62.51	196.20–750.12	109.60
Dutasteride 0.5 mg	Yes	$167.74	255.96–2012.88	293.95
Combination therapy (finasteride + terazosin)	Yes	$119.55	341.88–1434.60	209.60

prostate, laser enucleation, convection water vapor therapy (up to 80 g), or the prostatic urethral lift (up to 80 g). For the man who wants to maintain antegrade ejaculation, the latter two office-based procedures are the most appropriate options. In addition to treatments for standard-sized prostates, transurethral incision of the prostate may be employed for the man with obstructive symptoms but a small prostate (< 30 g) [9]. In reality, the selection of surgical technique may be otherwise largely dependent on the training and skill set of the specific surgeon. With that, this article aims at arming urologists with an understanding of the financial impact of selecting one BPH treatment over another.

Though medical management of BPH is a reasonable first option for many patients, some men warrant immediate treatment with surgery. These clinical scenarios are also well outlined in the AUA BPH guidelines—BPH as the cause of renal insufficiency, refractory retention, recurrent UTIs, recurrent bladder stones/gross hematuria, lower urinary tract symptoms (LUTS) refractory to other therapies, or intolerance of/unwillingness to use other therapies. In these situations, the AUA recommends urologists proceed to surgery without an initial or further trials of medical therapy [9].

Operating room time, equipment, and length of hospital stay are three of the largest contributors to the cost of surgical treatment [10]. At the author's institution, a robotic simple prostatectomy was on average over $4000 more costly than an open simple prostatectomy, despite the longer average length of stay associated with the open version of the procedure (an average of 0.8 days for robotic and 1.5 days for open). Even when a robotic simple prostatectomy was performed as an outpatient procedure, the operation cost was twice that of the transurethral surgeries. The difference in charges for an inpatient versus outpatient robotic simple prostatectomy was $4806 and reflects both the cost of hospital admission. In the analysis presented here, outpatient transurethral operations were all of similar cost—TURP was the least costly option, $348 less than a button vaporization and $424 less than photovaporization of the prostate (PVP) (Table 2).

Previously published data demonstrated similar trends. Kaplan et al. used time-driven activity-based costing to model relative costs associated with a range of BPH treatments. Their group also estimated the cost of an inpatient simple prostatectomy to be roughly four times that of TURP [11••]. Other studies have found PVP to be less expensive [12] or more expensive than TURP [13, 14••].

Relative effectiveness of surgical treatment options for BPH has been reported in a number of previously published studies. Ulchaker and Martinson report a change from baseline IPSS after medical therapy, convective water vapor ablation, urethral lift, transurethral needle ablation, PVP, and TURP. TURP saw the largest change in IPSS at 1 year with PVP performing similarly. Convective water vapor ablation, transurethral needle ablation, and urethral lift each resulted in an approximately 3–5 points lower change from baseline IPSS than TURP or PVP [14••]. In comparing robotic-assisted and open simple prostatectomy, Cockrell and Lee found a robotic approach conferred lower morbidity and a shorter hospital stay, while functional outcomes did not differ between the two. Holmium laser enucleation of the prostate was found to have a steeper learning curve, but similar operative time and hospital stay as robotic simple prostatectomy [15].

While the individual patient's medical history may dictate choice of therapy, it can also increase the risk of complications and thus cost of a given operation. In one systematic review of 88 trials assessing 15 different types of transurethral BPH procedures, the risk of significant bleeding was highest among patients undergoing monopolar TURP, and lowest among those treated with laser vaporization [16]. In the same vein, the current AUA guidelines utilize available evidence to recommend that holmium laser enucleation of the prostate (HoLEP), thulium laser enucleation of the prostate (ThuLEP), or PVP be considered for managing BPH in men on anticoagulants who require surgery [9].

Table 2 Cost of BPH intervention based upon institutional Medicare data

Class of intervention	Intervention	Average Medicare cost per patient	Relative cost (%)
Inpatient surgery	Robotic simple prostatectomy	$11,583	1395.54
	Open simple prostatectomy	$7088	853.98
Outpatient surgery	Button vaporization	$3643	438.92
	Robotic simple Prostatectomy	$6777	816.51
	Laser vaporization	$3719	448.1
	TURP	$3295	396.99
Office-based procedure	Convective water vapor ablation	$830	100
	Prostatic urethral lift	$3779	455.30

Office-Based Procedures

The options for office-based therapies have evolved in recent years. The once common ablative interventions of the late 1990s are no longer on the list of recommended procedures in the most recently updated AUA guidelines. However, contemporary options include convective water vapor ablation (CWVA) and the prostatic urethral lift (PUL). Similar to their predecessors, these procedures can be performed in the office without the need for general anesthesia, offer a minimal convalescence period, and preserve ejaculatory function with little to no risk of erectile dysfunction [17••]. Both office-based procedures have demonstrated smaller changes in International Prostate Symptom Score (IPSS) at 1 year when compared with TURP (− 11.65 after CWVA versus − 10.65 after PUL versus − 16.79 after TURP) [14••]. Despite initial concerns about the durability of these procedures, medium-term updates of prospective trials have demonstrated durable improvement in flow rates [18, 19].

The 4-year results from the prospective randomized study of CWVA became available in 2019 and included 188 men, of whom 53 crossed over from the sham procedure arm [18]. Prostate size ranged from 30 to 80 g, and enlarged median lobes were not excluded. Significant symptom relief and improved quality of life, without any erectile or ejaculatory dysfunction, persisted through 4 years of follow-up [18]. Similarly, 5-year results from the prospective randomized controlled trial evaluating PUL demonstrated persistent improvements in flow (44%) and quality of life (50%), though 13.6% of patients required subsequent (retreatment) surgery [19]. Furthermore, it should be noted that men with enlarged median lobes were excluded from this study; however, the procedure was approved in December 2017 by the FDA for median lobe treatment following the MEDLift study [20].

Based on data from the authors' institution, Medicare costs for the PUL were $2949 higher than those for CWVA (Table 2). Ulchaker and Martinson's analysis confirms this finding, with the difference in cost associated with the two procedures listed at $3000, in favor of CWVA [14••]. This likely stems from the fact that CWVA utilizes a single device, which can be fired multiple times to deliver treatment throughout the prostate, whereas the PUL device can only be fired once and requires a new device for each implant. Thus, treating a prostate with more devices can result in a higher cost of treatment.

Cost Comparison

Even if insurance coverage and zip code are held constant, the annual cost of medical therapy can vary widely based solely upon medication selection alone. Assuming retail price without coupons or insurance coverage, medical therapy for BPH spans a 459% range ($2457.52) for monotherapy and a 359.4% range ($3721.20) for combination therapy. Similarly, Medicare payments for surgical or procedural interventions for BPH varied up to 1395% ($10,754) within the data analyzed.

While the absolute values of these costs change across health systems (especially for procedures, in light of geographic payment modifiers), the relative differences between them should remain relatively transferrable. Thus, the key information to be gained from the analyses presented in this manuscript are the relative cost differences of the varied management strategies. Time to equivalence of each therapy was modeled against the most affordable combination medical therapy, given the data demonstrating superior efficacy with a two-drug regimen compared with monotherapy with either drug class alone [6, 7].

In assessing the isolated costs of procedures and index admission alone, robotic simple prostatectomy with inpatient hospitalization was the most costly intervention, with an equivalence time of just over 8 years of combination medical therapy. Performed as an outpatient procedure, robotic simple prostatectomy would require 4.72 years of combination medication to reach the cost equivalence. Open simple prostatectomy with inpatient hospitalization was similar, at 4.94 years, and remained more costly than any of the outpatient options.

Outpatient operations reached cost equivalence after 2.3 to 4.72 years of combination medical therapy. TURP conferred the lowest cost but was within $400 of both button

Table 3 Time until cost equivalence of BPH interventions and combination medical therapy

Class of intervention	Intervention	Treatment cost ($)	Equivalence time (years)
Inpatient surgery	Robotic simple prostatectomy	$11,583	8.07
	Open simple prostatectomy	$7088	4.94
Outpatient surgery	Button vaporization	$3643	2.54
	Robotic simple Prostatectomy	$6777	4.72
	PVP	$3719	2.59
	TURP	$3295	2.30
Office-based procedure	Convective water vapor ablation	$830	0.58
	Prostatic urethral lift	$3779	2.63
Combination medical therapy (1 year)	Finasteride + terazosin	$1434.60	1.00

vaporization and PVP. Of the office-based procedural options, PUL fell within the cost range of outpatient surgical procedures, reaching cost equivalence after 2.63 years of medications. CWVA presented the same amount of cost as 6.96 months (0.58 years) of combination medical therapy (Table 3).

Comparing these results to those of other studies, it appears the relative cost savings achieved by surgical intervention compared with medical therapy are largely country specific. An analysis out of Australia and Europe demonstrated less cost associated with medical therapy for BPH as compared with surgery in each country, albeit with wide variance between nations [12]. Specifically, finasteride monotherapy for up to 6 years was less expensive than a TURP in Germany, while a man would have to continue finasteride for 37 years to reach the price of a TURP in Spain [21••]. While this may speak to the relatively high price of medications in the USA, the assumptions made regarding insurance coverage must be accounted for when interpreting the models presented in this article.

The duration of combination medical therapy needed to reach cost equivalence with BPH procedures has been reported in previously published studies. Ulchaker and Martinson's in-depth analysis of the cost-effectiveness of various treatments for BPH, for example, yielded very similar costs as those determined in the current study, with outpatient transurethral surgeries reaching cost equivalence after 2.30 to 2.98 years of medical therapy [14••]. Reviews by Gill et al. and Smith et al. also report similar findings, with estimates on the range of 0.61 to 1.28 years of medical therapy accruing costs similar to outpatient transurethral procedures [22, 23, 24••].

Masucci et al. used institutional data to describe perioperative costs for PVP, monopolar TURP, and bipolar TURP. Their group found PVP was the least costly, despite higher equipment costs, but this was likely driven by admission status; 95% of PVPs were outpatient procedures, while 94% of TURPs were admitted postoperatively [12]. A cost-effectiveness analysis from Spain reached similar conclusions—PVP was less costly than TURP because hospital admission was not required for the former [23]. As studies from Smith and Masucci did not compare costs to medical therapy, cost equivalence for these studies was estimated using current generic retail prescription prices and ranged from 0.61 to 3.46 years of medical therapy (Table 4).

Table 4 Review of published BPH treatment costs and cost-equivalence times

	DeWitt-Foy 2019	Equivalence time (years)	Gill 2018	Equivalence time (years)	Ulchaker 2017	Equivalence time (years)	Smith 2016	Equivalence time (years)	Masucci 2018	Equivalence time (years)
CWVA	$830	0.58	$1742	1.05	$2582	1.49	–	–	–	–
PUL	$3779	2.63	$2721	1.64	$6386	3.68	–	–	–	–
PVP	$3719	2.59	$2127	1.28	$5099	2.94	$1855	1.29	$3836	2.67
TURP	$3295	2.30	$1667	1.01	$5181	2.98	$870	0.61	$4963	3.46
TUNA	–	–	–	–	$2855	1.64	$1932	1.35	–	–
TUMT	–	–	–	–	–	–	$2096	1.46	–	–
MEDS	$1434.60	1.00	$1656	1.00	$1736	1.00	$1434.60**	1.00	$1434.60**	1.00

CWVA convective water vapor ablation, *PUL* prostatic urethral lift, *PVP* photovaporization of the prostate/laser prostatectomy, *TURP* transurethral resection of the prostate, *TUNA* transurethral needle ablation of the prostate, *TUMT* transurethral microwave therapy, *MEDS* combination medical therapy

**Generic retain prices used for comparison as no cost data was provided from the study in question

Though not addressed in the current analysis, the relative effectiveness of BPH procedures is an important consideration with regard to the patient and for the long-term costs associated with each option. Ulchaker and Martinson's study simulated incremental cost-effectiveness ratios (ICERs) for interventions and medications. In their analyses, CWVA was cost saving in comparison with a TURP, but also less effective, while PUL was less effective and more costly than CWVA. Unsurprisingly, they found TURP and PVP to be similar in terms of both cost and efficacy. Erman et al. approached cost analysis by comparing upfront pharmacotherapy followed by surgery (TURP or PVP) upon medication failure to surgery (TURP or PVO) as initial treatment. In their model, upfront pharmacotherapy followed by TURP was the most costly and most economically unattractive option, while upfront TURP was approximately $1015 more costly than PVP and only slightly more effective than utilizing the laser [25].

As with any cost analysis, the current study is subject to limitations. In order to present a simplified cost equivalence model, each therapy was considered in isolation, without factoring in preceding or subsequent treatment. For instance, the costs associated with pre-operative workup can vary, potentially including ultrasound, cystoscopy, and urodynamics, along with an office visit. Yet, these pre-operative costs are not specific to one treatment over another, potentially factoring them out of analyses. Likewise, as complication rates vary by intervention, so does the risk of incurring additional charges following the index procedure. Lastly, while a comprehensive analysis of the listed treatments was provided, data on other means of BPH management (i.e., HoLEP) and emerging technologies (i.e., automated water jet ablation) is lacking.

Conclusions

It is estimated 50–75% of men over age 50 and 80% of men over age 70 experience lower urinary tract symptoms as a result of BPH [26]. The economic burden of this condition is substantial, an estimated $4 billion dollars annually in 2006, and will only increase as the US population continues to age [27]. While a myriad of options are available to the urologist tasked with treating BPH, he or she must decide which treatment is best for each particular case. Factoring into this decision, urologists should consider their own experience and skill set, the comorbidities, anatomy, and priorities of the patient, as well as the cost of each option, as presented here and elsewhere.

Compliance with Ethical Standards

Conflict of Interest Molly E. DeWitt-Foy and Bradley C. Gill each declare no potential conflicts of interest.

James C. Ulchaker reports personal fees from Boston Scientific and Foretc Medical.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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