Catheter Management After Benign Transurethral Prostate Surgery: RAND/UCLA Appropriateness Criteria

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ABSTRACT

OBJECTIVES: To formally assess the appropriateness of different timings of urethral catheter removal after transurethral prostate resection or ablation. Although urethral catheter placement is routine after this common treatment for benign prostatic hyperplasia (BPH), no guidelines inform duration of catheter use.

STUDY DESIGN: RAND/UCLA Appropriateness Methodology.

METHODS: Using a standardized, multiround rating process (ie, the RAND/UCLA Appropriateness Methodology), an 11-member multidisciplinary panel reviewed a literature summary and rated clinical scenarios for urethral catheter duration after transurethral prostate surgery for BPH as appropriate (ie, benefits outweigh risks), inappropriate, or of uncertain appropriateness. We examined appropriateness across 4 clinical scenarios (no preexisting catheter, preexisting catheter [including intermittent], difficult catheter placement, significant perforation) and 5 durations (postoperative day [POD] 0, 1, 2, 3-6, or ≥7).

RESULTS: Urethral catheter removal and first trial of void on POD 1 was rated appropriate for all scenarios except clinically significant perforations. In this case, waiting until POD 3 was deemed the earliest appropriate timing. Waiting 3 or more days to remove the catheter for patients with or without preexisting catheter needs, or for those with difficult catheter placement in the operating room, was rated as inappropriate.

CONCLUSIONS: We defined clinically relevant guidance statements for the appropriateness of urethral catheter duration after transurethral prostate surgery. Given the lack of guidelines and this robust expert panel approach, these ratings may help clinicians and healthcare systems improve the consistency and quality of care for patients undergoing transurethral surgery for BPH.

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Benign prostatic hyperplasia (BPH) is a leading diagnosis among male Medicare beneficiaries. Approximately 100,000 men are treated with transurethral prostate surgery each year, making it one of the most common surgical procedures in the United States.[1] The procedure is performed using various approaches and routinely involves urinary catheter placement. Given an increasing focus on appropriateness of care for policy,[2] payment,[3] quality,[4-6] and patient-centered care,[7] clarifying appropriate urinary catheter duration after this common surgery could help improve consistency and quality of care for healthcare organizations and their patients treated surgically for BPH.

However, there are no guidelines for the duration of urinary catheter use after transurethral prostate surgery.[8] Some providers recommend overnight urinary catheter placement, whereas others recommend leaving the catheter in place for days afterward. Observational studies indicate that catheter removal and trial of void the day after surgery is safe for most patients,[9-11] relieving them of their 1-point restraint[12] and associated discomfort sooner rather than later. Decreasing indwelling urinary catheter duration not only reduces patient discomfort and nursing care during the hospitalization and after discharge, but it also lowers the risks of complications, including catheter-associated urinary tract infections (UTIs).[13,14] Although the former might affect patient satisfaction and postsurgical care utilization, the latter is an important quality-of-care metric, especially when catheter use might be scrutinized as inappropriate by national institutions such as the CDC.[15] In the absence of evidence-based guidelines, defining the most appropriate duration of urinary catheter use after this procedure may help decrease practice variation, reduce postoperative complication risk, and improve consistency and quality of care for patients with BPH and lower urinary tract symptoms.

For these reasons, we assessed the appropriateness of different timings of urinary catheter removal among patients treated with transurethral resection or ablation of the prostate. Following the RAND/UCLA Appropriateness Method,[16] we asked a multidisciplinary panel of experts and practicing urologists to review the studies included in our literature search and use their clinical expertise to

rate the appropriateness of different options for urinary catheter removal and trial of void after transurethral prostate surgery. This manuscript details and synthesizes findings from this approach in order to provide guidance for and promote standardization of urinary catheter use after this common BPH surgery within and across healthcare organizations.

TAKEAWAY POINTS

Given increasing focus on appropriateness of care for quality, payment, and policy, clarifying appropriate urinary catheter duration after transurethral prostate surgery could help improve consistency and quality of care for healthcare organizations. In particular:

- Urethral catheter removal and trial of void on postoperative day 1 after the procedure was rated appropriate for all scenarios except clinically significant perforations.
- Waiting 3 or more days to remove a catheter for a first voiding trial after these common procedures was inappropriate for the majority of patients.
- Both indwelling catheter placement and intermittent catheterization were acceptable approaches to a failed trial of void.

METHODS

Appropriateness Methodology

We used the RAND/UCLA Appropriateness Method to develop these appropriateness criteria.[16] We previously used this multidisciplinary, stepped approach to define appropriateness of urinary catheter use in hospitalized medical patients and perioperatively for general and orthopedic surgery patients.[17,18] The methodology couples scientific evidence for a given practice—in this case, urinary catheterization after transurethral prostate surgery—with clinical judgment to produce clinically relevant guidance statements regarding a procedure's appropriateness in light of a patient's symptoms, test results, and medical/surgical history. This robust approach has been used to define appropriate care, and even develop quality indicators, across many clinical scenarios, including coronary revascularization, endoscopic sinus surgery, and active surveillance for prostate cancer.[19-21] This approach has been shown to be useful to provide guidance when more definitive studies are lacking and has been predictive of future randomized controlled study results.[22] Finally, managed care and accountable care organizations are increasingly adding metrics involving appropriateness of care (eg, appropriate diagnostic imaging services)[2,6,23] for quality assessment, and even value-based purchasing programs for their beneficiaries' providers, making this approach and its findings relevant and timely.[24]

Literature Review

The first step of the RAND/UCLA Appropriateness Method is to conduct a literature review to identify the most relevant articles for a given practice. The literature is divided into categories based on relevance and level of evidence, and common clinical scenarios for appropriateness rating are identified. Similar to prior appropriateness research projects, we began our literature search with a systematic review of databases (Web of Science, CINAHL, Embase, Cochrane, and PubMed/MEDLINE). We searched available literature for studies assessing outcomes for patients undergoing transurethral resection (using monopolar or bipolar technique) or ablation (using plasma vaporization "button procedure" or photoselective vaporization for BPH, including enucleation of the prostate). We searched each database using Boolean logic (eg, AND, OR) for our various combinations of transurethral prostate surgery types. The MeSH system was also searched separately. The literature search and scenario development occurred between September 2014 and February 2015 and included 4428 articles before excluding duplicates across all databases (**Figure 1**). Our study team urologist (T.A.S.) reviewed 472 articles meeting subsequent criteria by abstract, title, keyword, and full text to select the final articles. Forty-four articles met inclusion criteria for our study.

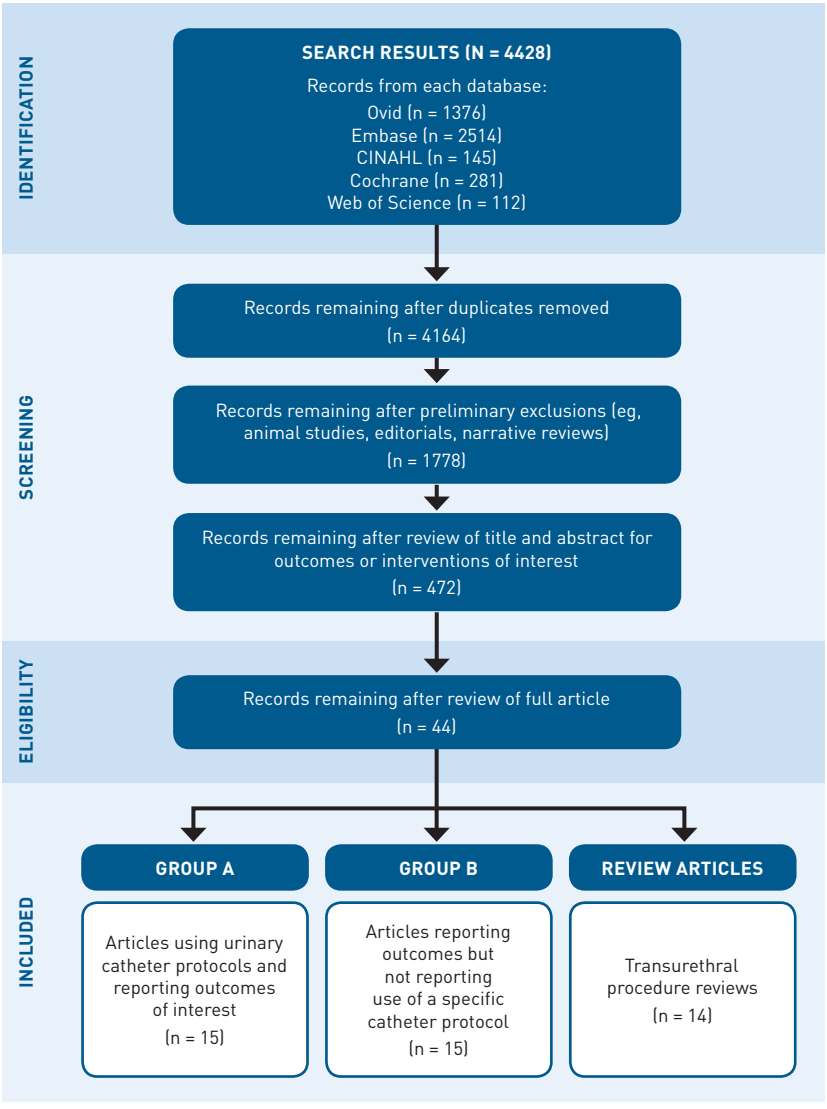
We categorized these articles into 3 groups (A, B, and C) based on their relevance to urinary catheter strategies after transurethral prostate surgery and patient outcomes. Group A (n = 15) articles assessed a particular urinary catheter strategy and its impact on patient outcomes. We expected these articles to be of highest relevance for describing the evidence available to inform appropriateness ratings. Group B (n = 15) studies reported relevant patient outcomes without assessing a particular type of urinary catheter strategy. Group C (n = 14) included supplementary articles (eg, review articles). We provided copies of all articles and generated summary tables for articles in groups A and B (**eAppendix Table 1** [eAppendix available at **ajmc.com**]), highlighting outcomes of interest. We also provided the team with an overview of transurethral surgical procedures for treating BPH from UpToDate[25] as a reference to give a general overview of BPH and its surgical treatments, particularly for the nonurologist members of the panel (eg, nurses, infectious disease physicians).

Clinician Panel Rating Process

Next, we recruited experienced practicing clinicians, including urologists who had performed transurethral prostate surgery across a variety of practice types (academic, private, government) and US regions (West, Midwest, Northeast), and subject matter experts (eg, BPH, infectious disease, neurogenic bladder) to participate in this panel by sending an introductory email describing the panel and process. Panelists (N = 11) (**eAppendix Table 2**) included urologists (n = 8), nurses (n = 2) who care for urologic patients, and an infectious diseases physician with expertise in UTIs.

Participating panelists were sent materials to complete a round 1 independent rating of the clinical scenarios (March-April 2015). They were sent instructions, literature summary tables, relevant articles, and a scoring document (see **Figure 2** for example section of the round 1 scoring document) that included the clinical scenarios and asked when the first trial of void should occur after surgery. They were asked to examine appropriateness across 4 clinical scenarios (no preexisting catheter, preexisting catheter [including intermittent], difficult catheter placement, significant perforation) and 5 durations

FIGURE 1. PRISMA Diagram for the Systematic Review of Urethral Catheter Duration After Transurethral Prostate Surgery



PRISMA indicates Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

(postoperative day [POD] 0, 1, 2, 3-6, or ≥7). All scenarios were for adult male patients in acute care inpatient or ambulatory surgery settings undergoing routine surgery. Panelists were instructed to use their best clinical judgment in combination with evidence from the literature review and to assume no other relevant patient characteristics (eg, comorbidities, catheter trauma). They also rated the appropriateness of intermittent straight catheterization (ISC) and indwelling urinary catheter placement after a failed first trial of void, including time to a second trial of void.

Catheter removal was considered appropriate if "the expected health benefit (eg, relief of pain, reduction in anxiety, improved functional capacity) exceeds the expected negative consequences (eg, mortality, morbidity, anxiety, pain, time lost from work) by a sufficiently wide margin that the procedure is worth doing, exclusive of cost."[26] For each scenario, we asked the panelist to rate the appropriateness of the duration of urethral catheterization by circling a number on a scale from 1 to 9. A rating of 1 indicated that the harms significantly outweigh the benefits (ie, inappropriate), whereas a rating of 9 indicated that the benefits significantly outweigh the harms (ie, appropriate). A central rating of 5 indicated that the benefits or harms were considered equal or that the participant was unable to make an informed rating of the clinical scenario.

After the initial round 1 ratings were complete, we conducted a 1-hour conference call (April 17, 2015) to clarify the clinical scenarios and reduce disagreement or uncertainty in panelist ratings. Gross hematuria requiring bladder irrigation was not included in the final scenarios because catheter removal would not be clinically appropriate per the panel. The panel was then brought together for a face-to-face meeting in which each scenario, preliminary scores, and rating differences were discussed to determine a final appropriateness score for each clinical scenario. This round 2 meeting was conducted on May 4, 2015. Panelists rerated each clinical scenario after the in-person discussion. The median round 2 scores were used to classify each scenario as appropriate (panel median score of 7-9), uncertain or neutral (panel median score of 4-6), or inappropriate (panel median score of 1-3). In addition, if 4 or more panelists rated a scenario as appropriate (median score of 7-9) and 4 or more rated it as inappropriate (median score of 1-3), the scenario was rated as uncertain or neutral due to disagreement.

RESULTS

Literature Summary

As detailed in eAppendix Table 1, 15 studies[9,10,27-39] published from 1991 to 2014 were identified for transurethral prostate and/or ablation procedures reporting at least 1 outcome of interest (catheter use, urinary retention, urinary tract infection, or other complications) for patients with respect to a specific postoperative urinary catheter removal protocol. Five studies were randomized controlled trials,[32,34,36-38] 5 were quasi-experimental studies with controls,[10,27,28,30,33] and the remaining 5 were cohort studies without a comparison group.[9,29,31,35,39] Variations in early catheter removal protocols included removal on

FIGURE 2. Example of Clinical Scenarios From the Round 1 Rating Document

Section I: Clinical scenarios for rating appropriateness of urinary catheter use and urinary retention monitoring protocols

Instructions: Please circle your rating of the appropriateness of each urinary management strategy for each scenario on a scale of 1 to 9.

1 = Highly inappropriate; 5 = Neutral or uncertain; 9 = Highly appropriate.

A. How long is urinary catheter use appropriate after transurethral resection or ablation of the prostate for benign prostatic hyperplasia (BPH)? For these clinical scenarios, assume the patient has had either transurethral resection of the prostate (monopolar or bipolar technique) or transurethral ablation of the prostate. Ablation procedures for consideration including transurethral laser enucleation, plasma vaporization ("button procedure"), or photoselective vaporization. Assume the patient has no other clinical indication for a urinary catheter besides a transurethral resection or ablation of the prostate for BPH.

	Urinary Management Strategies				
	Appropriateness of removing the Foley catheter to permit a voiding trial in this time frame				
Clinical Scenarios	POD 0: Removing Foley at end-of-case or in the postanesthesia care unit	POD 1	POD 2	POD 3-6	POD 7 or later
A1. Transurethral resection or ablation of prostate for benign prostatic hyperplasia	**A brief overview of transurethral resection or ablation of the prostate for BPH from UpToDate can be located in the "Review" articles provided on the USB drive labeled "Appendix C_UpToDate_ Transurethral Resection of the Prostate."**				
a. No preexisting catheter need, no difficulty with catheter placement, and no need for irrigation for hematuria with blood clots	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
b. Patient required a Foley catheter prior to admission due to severity of prostatic obstruction	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
c. Patient required ISC before admission due to severity of prostatic obstruction	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
d. Patient required ISC use prior to admission for reason(s) other than prostatic obstruction	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
e. Foley placement by the urologist in the operating room was difficult	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
f. Intraoperative cystoscopic finding indicated perforation of the prostatic capsule	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
g. Bladder irrigation is needed for management of gross hematuria with blood clots at conclusion of the procedure	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9

ISC indicates intermittent straight catheterization; POD, postoperative day.

same day of surgery; removal within 24 hours or on POD 1, including removal at midnight on day of surgery versus 6 AM on POD 1[32]; and removal 48 hours postoperatively.[30] Overall, the studies reported similar or improved outcomes for the early catheter removal strategy (compared with either concurrent or historical controls, as varied by study design), including the shortest catheterization periods investigated (all 4 studies investigating same-day removal[29,35,37,38]). Many studies also reported significantly reduced length of stay and either calculated or presumed reduced hospital costs for cases employing the early catheter removal protocols.

Panel Findings

Table 1 details the panel responses across a group of common scenarios. Removing the urethral catheter on the day of surgery was deemed appropriate for patients both with and without preexisting catheter needs. However, a voiding trial on the day of surgery was rated inappropriate for patients with a difficult catheter placement after surgery or those with intraoperative findings of clinically significant prostatic capsule perforation (eg, obvious urine extravasation).

Based on our panel ratings, urinary catheter removal and first trial of void on POD 1 was appropriate for all scenarios except clinically significant perforations. In this case, waiting until POD 3 was deemed the earliest appropriate timing for removal. The panel was split with respect to catheter removal on PODs 1 and 2 for the perforation scenario, with some panelists rating removal appropriate and others rating it inappropriate. Furthermore, the perforation scenario was the only appropriate indication for waiting

TABLE 1. Appropriateness of Urinary Catheter Duration After Transurethral Prostate Surgery According to Clinical Scenario[a]

Clinical Scenario	Urethral Catheter Removal After Transurethral Prostate Surgery	
"How long is urinary catheter use appropriate after transurethral resection or ablation[b] of the prostate for benign prostatic hyperplasia (BPH)?"	Appropriateness of removing Foley catheter by POD 0 at the end of the case or in the postanesthesia care unit	Appropriateness of removing Foley catheter by POD[c]
No preexisting catheter need, no difficulty with catheter placement, and no need for irrigation for hematuria with blood clots	Appropriate	Appropriate on POD 1 Uncertain on POD 2 Inappropriate on POD ≥3
Patient required urethral catheter or ISC before admission due to severity of prostatic obstruction		
Foley placement by the urologist in the operating room was difficult or urologist predicts replacement would be difficult	Inappropriate	Appropriate on POD 1 or 2 Inappropriate on POD ≥3
Intraoperative cystoscopic finding indicated clinically significant perforation of the prostatic capsule (eg, obvious urine extravasation)	Inappropriate	Disagreement for PODs 1 and 2 Appropriate on POD ≥3

ISC indicates intermittent straight catheterization; POD, postoperative day.

[a]Gross hematuria requiring bladder irrigation was not included in the scenarios because catheter removal would not be clinically appropriate per the panel.

[b]Included enucleation.

[c]Appropriateness of waiting until this POD to conduct the first trial of void.

TABLE 2. Appropriateness of Urinary Catheter Duration Until Second Trial of Void After Transurethral Prostate Surgery According to Hospitalization Status

Clinical Scenario	Appropriateness of Duration of Foley Use Before Second Trial of Void	
"If a Foley was placed after a failure of first trial of void after transurethral resection or ablation[a] of prostate for benign prostatic hyperplasia, what is the appropriateness of the following durations of Foley catheter use before second trial of void?"	Patient still admitted to hospital	Patient discharged home
1 day	Appropriate	Appropriate
2 days	Appropriate	Appropriate
3 days	Uncertain	Appropriate
4 days	Inappropriate	Appropriate
5 days	Inappropriate	Uncertain
6 days	Inappropriate	Disagreement
7 days	Inappropriate	Disagreement
≥8 days	Inappropriate	Inappropriate

[a]Included enucleation.

7 or more days for initial trial of void. Conversely, waiting 3 or more days to remove the catheter for patients with or without preexisting catheter needs, or for those with difficult catheter placement in the operating room, was rated as inappropriate.

The next question was: "After failing the first trial of void after transurethral resection or ablation of prostate for BPH, how appropriate is this type of urinary catheterization to manage retention (ISC and/or indwelling urethral catheter)?" We instructed the panelists to make several assumptions, including no evidence of prostate cancer, acontractile bladder, urethral stricture, need for continuous bladder irrigation for hematuria, difficult catheter placement, or intraoperative clinically significant perforation. The panel uniformly rated both ISC and indwelling urethral catheter placement as appropriate.

As shown in **Table 2**, the panel was then asked "If a Foley was placed after a failure of first trial of void after transurethral resection or ablation (including enucleation) of prostate for benign prostatic hyperplasia, what is the appropriateness of the following durations of Foley catheter use before second trial of void?" to specifically inquire about appropriateness according to hospitalization status (inpatient, discharged home). The panel rated a second trial of void appropriate after 1 or 2 days in hospitalized patients. For patients discharged home, waiting up to 4 days was the longest appropriate duration per the expert panel, with waiting 5 to 7 days for a second trial of void rated as uncertain or raising disagreement among the panelists. However, waiting 8 or more days for a second trial of void for patients discharged home was deemed inappropriate.

DISCUSSION

We used the RAND/UCLA Appropriateness Method to determine appropriate urinary catheter management strategies following transurethral resection and ablation procedures for BPH, including enucleation. We found that waiting 3 or more days to remove a catheter for a first voiding trial after these procedures was inappropriate for the majority of patients. In other words, unless a clinically significant perforation occurs at the time of the procedure, it was deemed appropriate for most patients to have their catheter removed for a trial of void on POD 1. We also found that both ISC and indwelling catheter placement were acceptable approaches to manage patients after failing their first trial of void. If an indwelling catheter was placed after an initial failed trial of void, the panel indicated that hospitalized patients should be given another trial of void within 1 or 2 days. For patients discharged home, the appropriate duration was extended up to 4 days to allow for a second trial of void.

Given the lack of guidelines for urethral catheter duration and this robust expert panel approach to examining appropriate catheter use after one of the most common procedures in the United States, our findings may help improve the consistency and quality of care for patients undergoing transurethral surgery for BPH.

The implications of our findings depend on the extent to which current clinical practice varies with respect to catheter duration after transurethral prostate surgery. However, outside of limited research studies, the duration of catheter use after surgery is poorly understood for at least 2 reasons. First, research has focused on the tremendous variation in population-based rates of transurethral surgery itself, rather than catheter duration. Second, there is a paucity of BPH measures to motivate providers and healthcare systems to track quality of care. Nonetheless, length of stay is arguably a proxy for catheter duration and varies tremendously across hospitals. In fact, a recent study demonstrated greatest variation in length of stay after transurethral prostate resection compared with other common benign urologic surgery types including percutaneous nephrolithotomy and pyeloplasty.[40] This is an important consideration for healthcare systems seeking to minimize length of stay after common procedures like transurethral prostate surgery. Standardizing postoperative catheter use is likely to decrease practice and length of stay variation, minimize catheter discomfort for patients, and potentially lower the risk of postoperative complications (eg, UTI).

The lack of quality indicators for transurethral prostate surgery is striking given the variation in practice across the United States. According to the Dartmouth Atlas, the adjusted rate of inpatient transurethral surgery per 1000 male Medicare beneficiaries varies 6-fold across hospital referral regions, from 0.3 to 1.8.[41] In light of this heterogeneity across varied indications and preferences for the procedure, perhaps focusing initially on perioperative processes of care is warranted. Our appropriateness recommendations from practicing clinicians support urinary catheter duration after surgery as a potential initial quality measure to promote consistent, appropriate care for men surgically treated for BPH. In fact, the RAND/UCLA Appropriateness Method has been used to develop quality indicators across disease and treatment types, setting the precedent for such an approach.[19-21,42] Finally, there is interest by the CDC, which collects measures of catheter-associated UTI and catheter use, in developing a measure of urinary catheter appropriateness that could be applied based on data from the electronic health record (eg, procedure type, comorbidity).[15] In fact, an adjusted standardized utilization ratio for urinary catheter use has been proposed,[43,44] and thus, our work would inform future modifications of this and similar metrics based on urinary catheter appropriateness to be used across healthcare organizations.

Limitations

There are limitations to our approach. First, our panel included 11 members. However, all 8 of the participating urologists performed at least 1 type of transurethral prostate surgery, and the spectrum of procedures (resection, ablation, enucleation) was covered within their clinical expertise. Moreover, the panelists represented a variety of institutions and practice settings across the United States, increasing the generalizability of the findings. Additionally, including a mix of specialists and nonspecialists on our panel provided differing perspectives.[45,46] Second, there were few randomized trials included in our literature review to support appropriateness ratings. However, we did use a systematic approach to identify relevant literature across a range of study types, although several of the studies were published in the 1990s. The panelists were instructed to use their best clinical judgment in addition to the literature review to inform their ratings. Third, our final ratings applied to 4 common clinical scenarios for men undergoing transurethral prostate surgery that emerged through our rating process. Although these likely address the majority of cases in real-world practice, other patient, disease, and procedure characteristics outside of our appropriateness ratings could create challenges for implementation. We did include prostate size in our initial rating tool, but it was removed from our final rating tool based on the limited perceived relevance to catheter duration among the panelists. Furthermore, we did not specifically inquire regarding anticoagulation, although this is typically temporarily discontinued for the majority of patients undergoing this surgery. Last, we did not include all BPH surgery types in our literature review or appropriateness ratings. Although patients having prostate enucleation, by virtue of the degree of tissue removal, may slightly differ from the general population having transurethral resection surgery (eg, larger gland size), the panel felt that catheter management strategies afterward should be largely similar to other transurethral surgery approaches. Overall, our findings are relevant to the majority of transurethral prostate resection, ablation, and enucleation surgery types.

CONCLUSIONS

We defined clinically relevant guidance statements for the appropriateness of catheter duration after transurethral prostate surgery. Findings from our robust methodological approach, including urethral catheter removal and trial of void on POD 1 being rated as appropriate for all scenarios except clinically significant perforations, may help promote the consistency and quality of care for patients undergoing transurethral surgery for BPH within and across healthcare delivery systems. ■

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eAppendix Table 1. Group A Articles - Use and or Outcomes with Respect to Catheter Removal Protocols

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
1. Mamo GJ, Cohen SP. Early catheter removal vs. conventional practice in patients undergoing transurethral resection of prostate. Urology 1991;37:519-22.[4]	**AIM**: A retrospective analysis of 127 of 146 consecutive patients undergoing transurethral resection of the prostate from February 1985 to January 1988 (3-year period) was performed. The catheter was removed on POD 1 in 66 patients (group I) and on POD 2 in 61 patients (group II).	**RESULTS**: There were no significant differences between the two groups in terms of population age, weight of resected glands, operative time, and management. Both groups I and II had 8 complications following catheter removal. **CONCLUSION**: From the data gathered in this review, we conclude that catheter removal on POD 1 following TURP is safe and cost effective. There were no differences in complications following catheter removal when these patients were compared with patients whose catheter was removed on POD 2. A significant difference in postoperative hospital stay between the two groups (average 1.37 days) was found which could be translated into a reduction in hospital cost (average $466.00).
2. Agrawal SK, Kumar AS. Early removal of catheter following transurethral resection of the prostate. British Journal of Urology 1993;72:928-9.[3]	**AIM**: This study was conducted on 83 patients who underwent an uncomplicated transurethral resection of the prostate for carcinoma or benign hyperplasia. In all cases the urethral catheter was removed within 24 h of surgery.	**RESULTS**: The patients ranged in age from 42 to 85 years (average 69.9); 8 of them were 80 years old; 55% had associated medical conditions (Table) but all were ambulatory. Eighteen patients (22%) with a catheter in situ for urinary retention and 65 (88%) with symptoms of urinary outflow obstruction were studied; 77 (93%) had normal renal function and 6 (8%) had a slightly raised serum creatinine. In 68 patients (82%) the pre-operative urine culture was sterile, while 15 (18%) had infected urine; 8 of these 15 patients had an indwelling catheter. A wide variety of organisms was cultured (Str. fuecalis (6), coliform (4), mixed growth (2), Proteus (I), Pseudomonas (I), Staphylococcus (1)). Forty-nine patients (59%) had general and 34 (41%) had spinal anaesthesia. Five patients (6%) had a bladder neck incision for bladder neck hypertrophy and 78 (94%) a TURP. Histology confirmed benign prostatic hyperplasia in 68 patients and prostatic carcinoma in 10. Ten patients (1 2%) had simultaneous procedures for bladder stones, hernia or epididymal cyst. **CONCLUSIONS**: In most reported series the catheter was removed 3 to 5 days following TURP and the average hospital stay was 6 to 9 days (Haltgrewe and Valk, 1962; Melchior et uf., 1974; Mebust et al., 1989). In 2 series (Feldstein and Benson, 1988; Mamo and Cohen, 1991) the catheter was removed on the first post-operative day. In uncomplicated transurethral resection of the prostate, early catheter removal is safe, cost- effective and preferred by both patients and nursing staff. Complication rates were no higher than in cases where the catheters were removed later. Early removal may reduce the incidence of urinary infection, catheter-related dysuria and possibly urethral stricture formation.
3. Dodds L, Lawson PS, Crosthwaite AH, Wells GR. Early catheter removal: a prospective study of 100 consecutive patients undergoing transurethral resection of the prostate. British Journal of Urology 1995;75:755-7.[16]	**OBJECTIVE**: To determine whether early catheter removal after transurethral resection of the prostate (TURP) leads to early hospital discharge with no increase in complications. **PATIENTS AND METHODS**: From October 1992 50 consecutive patients undergoing TURP in each of two hospitals were catheterized for < 24 h or > 36-48 h after the operation. Patients were followed up to assess the frequency and extent of post-operative complications.	**RESULTS**: The two groups, which were standardized as far as possible, had a similar outcome whether the catheter was removed within 24 h or > 36 h after TURP. **CONCLUSION**: Brief catheter drainage after TURP is safe and allows an earlier discharge from hospital than the standard duration of catheterization.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
4. Mueller EJ, Zeidman EJ, Desmond PM, Thompson IM, Optenberg SA, Wasson J. Reduction of length of stay and cost of transurethral resection of the prostate by early catheter removal. British Journal of Urology 1996;78:893-6.[17]	**OBJECTIVE**: To determine whether early removal of the indwelling Foley catheter after transurethral resection of the prostate (TURP) significantly shortens the hospital stay without causing additional morbidity and thus saves costs. **PATIENTS AND METHODS**: For the year commencing 1 July 1991, 119 patients who had undergone TURP had their indwelling catheter removed on the first day after surgery. The results and morbidity of this group of patients were compared with those in 152 patients undergoing TURP during the previous year. The economic consequences of this protocol were calculated using both Medicare and CHAMPUS data.	**RESULTS**: The demographics of the patients in both groups were similar. Post-operative complications occurred in 5% of the study patients and in 6.6% of controls; a transfusion was required in 2.5% and 1.3%, clot retention developed in 1.7% and 3.3% and the hospital stay was reduced from 3.1 to 1.28 days in the study and control patients, respectively. Using Medicare data, the mean cost saving of early catheter removal would be $829 and $1406 for patients aged < 70 and > 70 years, respectively. For CHAMPUS patients, the cost saving would be $1983. **CONCLUSION**: Early removal of the catheter after TURP did not increase morbidity and maintained the efficacy of the procedure. If this practice was adopted nationally, the savings resulting from the reduction in hospital stay would be considerable.
5. Gordon NS. Catheter-free same day surgery transurethral resection of the prostate. The Journal of Urology 1998;160:1709-12.[18]	**PURPOSE**: Transurethral resection of the prostate using electrocautery has long been the standard method of management of lower urinary tract obstructive symptoms. While there has been a trend towards reduced catheterization time following transurethral prostatic resection, this study outlines the methods and results of transurethral prostatic resection performed in the day surgery setting. **MATERIALS AND METHODS**: The study was performed at a free-standing licensed day surgical hospital serving a patient population of more than 150,000. A total of 58 patients of a mean age of 68.77 years (range 49 to 87) underwent same day conventional transurethral prostatic resection. Of the procedures 39 (67%) were performed with spinal and the remainder with general anesthesia	**RESULTS**: Mean overall duration of catheterization was 6.54 hours. Of the 48 patients (82.76%) undergoing single catheterization mean duration was 5.59 hours. Mean total duration of catheterization for 10 patients (17.24%) who required reinsertion of a catheter was 11.09 hours. Duration of catheterization was 7.69 hours for patients treated with spinal and 3.86 for those treated with general anesthesia. Repeat catheterization was required in 10 patients and was due to urethral discomfort in initiating micturition in 8. Postoperative urinary tract infections occurred in 2 patients. No patient was readmitted to the hospital for retention of urine but 1 was admitted to a private hospital for management of postoperative fever and 1 for monitoring of tachycardia. **CONCLUSIONS**: Conventional transurethral resection of the prostate can be effectively managed in the day surgery setting with minimal morbidity. There are significant advantages in reduction of catheterization time and duration of hospital stay, and the procedure compares favorably with new modalities.
6. Valero Puerta JA, Sanchez Gonzalez M, Medina Perez M, Valpuesta Fernandez I, Guerrero Guerra JL. [Reduction of hospital stay, because of the early removal of the bladder catheter in transurethral resection of the prostate]. Reduccion de la estancia hospitalaria, por la retirada precoz de sonda vesical en la reseccion transuretral de prostata Archivos Espanoles de Urologia 1998;51:327-30.[19]	**OBJECTIVE**: To analyze the effects of removal of the bladder catheter 48 hours following transurethral resection of the prostate for benign prostatic hyperplasia in relation to the length of hospital stay and the incidence of important postoperative complications. **METHODS**: A study was conducted on 117 patients who had undergone TURP at our hospital over a period of one year. They were divided into two groups: group I comprised 55 patients in whom the bladder catheter had been systematically removed 48 hours following the procedure and had been discharged from hospital once they had attained a satisfactory micturition; group II comprised 62 patients in whom the bladder catheter was removed following conventional practice.	**RESULTS**: The mean length of hospital stay for the early catheter removal group was 2.02 days versus 3.85 days for group II. The postoperative complication rate was similar for both groups. **CONCLUSIONS**: Early removal of the bladder catheter following TURP does not increase the complication rate. It shortens the length of hospital stay and reduces the cost of the procedure.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
7. Mottola A, Daniele G, Caselli B, Palminteri V. [Early catheter removal after transurethral resection of the prostate]. Precoce rimozione del catetere dopo resezione transuretrale della prostata [The Italian Journal of Urology and Nephrology] Minerva Urologica e Nefrologica 1999;51:103-4.[20]	**BACKGROUND**: Thanks to the introduction of new optical systems and advances in technology, transurethral resection is now the most widely used method in the management of prostatic adenoma. **METHODS**: A study has been carried out on 25 patients aged from 50 to 80 years submitted to an uncomplicated transurethral resection of the prostate for benign hyperplasia. Patients with intense retention of urine, capsular perforation, bladder neck undermining, considerable haemorrhage in the recovery room and postoperative fever have been EXCLUDED from the study. The urethral catheter which is normally removed 3 to 5 days post operatively, was removed within 24 hours of surgery.	**RESULTS**: 80% of patients were discharged within 48 hours and the follow-up carried out by means of bacterial urinary culture, urinary pressure monitor and echography, showed that there were no significant complications. **CONCLUSIONS**: In conclusions, this study made it possible to select patients on which an early catheter removal is possible and to evaluate the real advantages of such a method.
8. McDonald CE, Thompson JM. A comparison of midnight versus early morning removal of urinary catheters after transurethral resection of the prostate. Journal of Wound, Ostomy, and Continence Nursing 1999;26:94-7.[21]	**PURPOSE**: This article describes a study that compares the outcomes of midnight versus early morning urethral catheter removal after transurethral resection of the prostate. **SUBJECTS AND SETTING/METHODS**: The research setting was a large, metropolitan hospital in Sydney, Australia. Forty-eight patients who had undergone transurethral resection of the prostate were randomly assigned to either group A, catheter removal at 2400 hours (n = 20), or group B, catheter removal at 0600 hours (n = 28). **MAIN OUTCOME MEASURES**: Data collected included time to first void, volume of first void, time between catheter removal and discharge from hospital, weight of prostatic resection, and tissue pathology	**RESULTS**: There was no significant difference between the 2 groups with respect to pathology, weight of prostatic resection, mean volume of first void, or time to first void after catheter removal. There was a significant difference in the time between catheter removal and discharge from hospital. Eighty-five percent of those having catheters removed at 2400 hours were discharged on the same day as catheter removal, as compared with 65% of those who underwent catheter removal at 0600 hours (chi 2 = 12.684; P < 0.005). **CONCLUSION**: After transurethral resection of the prostate, removal of the urethral catheter at 2400 hours reduced the length of hospital stay, but did not significantly affect the time to first void or the volume of the first void.
9. Toscano IL, Jr., Maciel LC, Martins FG, Fernandes AR, Mello LF, Glina S. Transurethral resection of the prostate: Prospective randomized study of catheter removal after 24 or 48 hours following surgery. Brazilian Journal of Urology 2001;27:144-7.[22]	**INTRODUCTION**: Transurethal resection of prostate (TURP) is the gold standard in surgical treatment of benign prostate hyperplasia and the best POD of catheter withdrawal after TURP is not well established. The goal of this study is to prospectively compare the rate of complications in patients whose urinary catheters were removed in the first or in the second day after TURP. **MATERIAL AND METHODS**: One hundred and four men were randomized to be in Group I or II. In Group I (54 patients) the catheter was removed in the first POD after TURP and in Group II (50 patients) the catheter was withdrawn in the second POD. Average age was 68.8 years in group I sand 69.5 in group II (p > 0.05).	**RESULTS**: The average prostate weight was 54 g in group I and 55.8 g in group II (p>0.05) and operative time was, in average, 93.3 minutes and 91.6 minutes, respectively (p > 0.05). Both group were evaluated according to postoperative complications. Five patients in-group I and 3 in group II had severe hematuria after catheter removal, treated with conservative measures (replacement of urinary catheter and irrigation). Urinary retention occurred in two patients of group I. These complications were not statistically significant in the two study groups. Conclusions: There was no difference in the occurrence of complications in patients in which the urinary catheter was removed in the first or second POD after TURP.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
10. Chander J, Vanitha V, Lal P, Ramteke VK. Transurethral resection of the prostate as catheter-free day-care surgery. BJU International 2003;92:422-5.[23]	**OBJECTIVE**: To evaluate the feasibility of transurethral resection of the prostate (TURP) as catheter-free day-care surgery. **PATIENTS AND METHODS**: The study comprised 64 patients (mean age 62.4 years) with a mean (range) American Urological Association symptom score of 21.4 (9-31) and prostate volume (by ultrasonography) of 32.8 (17-50) mL, and with no significant comorbidity. The patients were admitted on the morning of the surgery and, under brief spinal anaesthesia, underwent standard TURP. After surgery the urethral catheter was removed as soon as the effluent was clear. The patients were discharged after they could pass urine freely and with a good stream.	**RESULTS**: The mean duration of catheterization after TURP was 7.15 h; 59 patients (92%) had their catheter removed within 10 h (mean duration 6.42 h). There were no major complications during or after TURP. After removing the catheter, no patients required its reinsertion for failure to void or for clot retention. The mean hospital stay after TURP was 10.7 h and 98% of patients were discharged within 23 h of surgery. **CONCLUSION**: TURP can be conducted safely in a day surgery setting in patients with mild to moderate benign prostatic enlargement and no coexisting medical illness.
11. Şahin C, Kalkan M. The effect of catheter removal time following transurethral resection of the prostate on postoperative urinary retention. European Journal of General Medicine 2011;8:280-3.[24]	**AIM**: This clinical study investigates the effect of catheter removal time on re-catheterisation following transurethral resection of the prostate. Method: This study includes 66 surgical candidates diagnosed with benign prostate hyperplasia. Cases were randomised into three groups. The catheter was removed on the first post-operative (Group I), second post-operative (Group II) and third post-operative (Group III) day. A record was kept of re-catheterised cases.	**RESULTS**: In Group I, we identified four cases of vesical globe and 1 case of active haemorrhaging between the 5th and 70th hour (av. 18 hours) following removal of the catheter that required re-catheterization. One case from Group II developed a need for re-catheterisation (vesical globe) in the sixth hour. There were no cases requiring re-catheterisation in Group III. Differences in age, prostate volume, resection time and amount of irrigation fluid in all three groups were statistically insignificant. **CONCLUSION**: Although the number of cases is insufficient, this study identified a statistically significant relation between early catheter removal following transurethral resection of the prostate and development of urine retention.
12. Durrani SN, Khan S, Ur Rehman A. Transurethral resection of prostate: early versus delayed removal of catheter. Journal of Ayub Medical College, Abbottabad: JAMC 2014;26:38-41.[25]	**BACKGROUND**: Transurethral resection of prostate is the gold standard operation for bladder outflow obstruction due to benign prostatic enlargement. However, catheter removal day is variable. The objective of this study was to compare early and delayed catheter removal groups in terms of length of hospital stay, weight of resected prostate, duration of resection, peri-operative blood transfusion, and postoperative complications. **METHODS**: This randomized controlled trial was carried out in Urology Unit-B, Institute of Kidney Diseases Peshawar from 1st September 2009 to 31st July 2011. Patients were selected by simple random sampling technique after taking informed consent and divided into two groups: Group A-standard catheter removal group and Group B-early catheter removal group. The study EXCLUDED patients with large post-void urine volume, simultaneous internal urethrotomy and transurethral resection of prostate, co-morbidity and intra-operative complications. Patients were discharged after removal of catheter if they voided successfully. In Group-A the catheters were kept for more than one day according to the standard protocol of our ward. The data were analysed using SPSS-17.	**RESULTS**: The study included 320 patients, 163 in Group-A and 157 in Group-B. Mean weight of resected tissue in Group-A was 46.67 +/- 9.133 grams; it was 45.22 +/- 7.532 grams in group B. Mean catheter removal day was 4.13 +/- 1.65 days in Group-A; and 1.23 +/- 0.933 days in Group-B. Mean length of hospital stay was 3.57 days +/- 1.028 in Group-A and 1.29 days +/- 1.030 in Group-B (p-value < 0.05). Length of hospital stay strongly correlated with the day of catheter removal. There was no significant difference between the two groups in terms of postoperative complications. **CONCLUSION**: Removal of catheter on first POD after transurethral prostatectomy does not increase the postoperative complications and results in shorter hospital stay.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
13. Khan A. Day care monopolar transurethral resection of prostate: Is it feasible? Urology Annals 2014;6:334-9.[26]	**INTRODUCTION**: Benign prostatic hyperplasia is a common disease accounting for 30% of our OPD cases and about 25% of our surgery cases. Various treatment options are now available for more efficient care and early return to work. We wanted to determine the safety and feasibility of day care monopolar transurethral resection of prostate (m-TURP), by admitting the patients on the day of surgery and discharging the patient without catheter on the same day. We also compared the morbidity associated with conventional TURP where in the catheter is removed after 24-48 h of surgery and day care TURP where in the catheter is removed on the day of surgery. **MATERIALS AND METHODS**: A total of 120 patients who fulfilled the criteria were included in the study which was conducted between November 2008 and December 2010. A total of 60 patients were assigned for day care and 60 for conventional monopolar TURP. There was no significant difference in age, prostatic volume or IPSS score. Day care patients were admitted on day of surgery and discharged the same day after the removal of catheter.	**RESULTS**: Both the groups were comparable in outcome. Stricture rate was less with day care TURP. Mean catheterization time was similar to laser TURP. **CONCLUSION**: Monopolar TURP is still the gold standard of care for BPH. If cases are selected properly and surgery performed diligently it remains the option of choice for small and medium sized glands and patients can be back to routine work early.
14. Shum CF, Mukherjee A, Teo CPC. Catheter-free discharge on first postoperative day after bipolar transurethral resection of prostate: Clinical outcomes of 100 cases. International Journal of Urology 2014;21:313-8.[27]	**OBJECTIVES**: Our center has adopted a protocol for catheter-free first POD discharge after bipolar transurethral resection of the prostate. We present the immediate, 1-month and 6-month outcomes of our first 100 cases following this protocol. Methods: All bipolar transurethral resection of the prostate patients followed the protocol regardless of indications and background comorbid conditions. Bladder irrigation was stopped in the evening after transurethral resection of the prostate, and the catheter was removed at 06.00 hours. All patients were discharged on the first POD. They were reviewed at 1 month and 6 months with the International Prostate Symptom Score and uroflowmetry.	**RESULTS**: The mean age of the study population was 70.8 years. A total of 40 patients had urinary retention and were on an indwelling catheter before transurethral resection of the prostate. A total of 14 patients had other surgeries in the same setting as the transurethral resection of the prostate. The mean resection weight was 32.7g. The mean irrigation time and catheter time were 4.2h and 15.0h, respectively. The improvement in terms of International Prostate Symptom Score, quality of life score, peak flow rate and post-void residual volume was comparable with those reported in the literature for bipolar transurethral resection of the prostate. Similarly, early and late complication rates also compared favorably with the literature. The perioperative cost was significantly reduced. **CONCLUSIONS**: Catheter-free first POD discharge after bipolar transurethral resection of the prostate is safe with good clinical outcomes and cost savings. (copyright) 2013 The Japanese Urological Association.

eAppendix Table 1. Group B Articles – Outcomes, but not necessarily with respect to a standardized catheter removal protocol

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
15. Millan Rodriguez F, Rosales Bordes A, Montlleo Gonzalez M, Salvador Bayarri J, Vicente Rodriguez J. Clinical trial of the effect of urethral catheter on the etiology of urethral stenosis following transurethral resection of the prostate. Archivos españoles de urología 1999;52:967-72.	**OBJECTIVE**: To analyze the effect of the urethral catheter and urethral secretions in the development of urethral stricture post-transurethral resection of the prostate (TURP). **METHODS**: A clinical study was conducted on 109 patients treated by TURP. The patients were randomly assigned to one of the following groups: A (suprapubic catheter), B (urethral catheter), C (urethral cleansing). The incidence of urethral stricture in the different groups was compared using the chi-square test and survival was analyzed by the Kaplan Meier method.	**RESULTS**: 5 patients were lost to follow-up (4.5%). The median number of days the catheter was indwelling was one day for group A, and 4 days for groups B and C. The overall incidence of urethral stricture was 4.3%; by groups the incidence was 3.8% for group A, 3% for B and 5.9% for group C. The differences were not statistically significant. **CONCLUSION**: The study showed no statistically significant differences in the incidence of post-TURP urethral stenosis in patients with a suprapubic or urethral catheter. Furthermore, urethral stenosis was not less frequent in patients in whom urethral cleansing was performed.
16. Talic RF, El Tiraifi AM, El Faqih SR, Hassan SH, Attassi RA, Abdel-Halim RE. Prospective randomized study of transurethral vaporization resection of the prostate using the thick loop and standard transurethral prostatectomy. Urology 2000;55:886-90.	**OBJECTIVES**: Transurethral vaporization resection of the prostate (TUVRP) is a recent modification of the standard transurethral prostatectomy (TURP). The procedure uses one of the novel, thick resection loops coupled to augmented electrocutting energy. We evaluated the safety and efficacy of TUVRP in comparison with TURP. **METHODS**: Sixty-eight patients with prostatic outflow obstruction were prospectively randomized between equal TUVRP and TURP treatment groups. Safety parameters evaluated included changes in serum hemoglobin, hematocrit, and sodium 1 and 24 hours after resection. Operative time, catheterization time, and incidence of complications were noted. Efficacy parameters included evaluation by the International Prostate Symptom Score and maximum flow rate.	**RESULTS**: Patients of both groups were balanced for the different baseline variables. One hour after TURP, patients had significantly lower levels of hemoglobin, hematocrit, and sodium (P = 0.03, 0.03, and 0.01, respectively). The prostate resection weight was similar in both groups; however, the difference in the mean operative time was significant (TUVRP group 42.4 minutes and TURP group 35.9 minutes, P = 0.02). The postoperative catheterization time was significantly shorter for the TUVRP group (23.1 (+/-) 10.3 versus 36 (+/-) 17.3 hours, P <0.0001). All patients were followed up for an average of 9 months. The International Prostate Symptom Score was 4 (+/-) 3.4 and 5.6 (+/-) 3.1 and the maximum flow rate was 19 (+/-) 6.5 and 15.2 (+/-) 10 mL/s for the TUVRP and TURP groups, respectively; these differences were statistically significant (P = 0.03 and 0.01, respectively). Complications included urethral strictures (6 patients) and delayed hemorrhage with clot retention (2 patients); no differences in the incidence of complications were noted between the two groups. **CONCLUSIONS**: The results of the present study have demonstrated that TUVRP is as safe and efficacious as TURP in the treatment of men with prostatic outflow obstruction. The shorter catheterization time observed after TUVRP may be clinically significant, considering the demand for lower morbidity profiles by patients. The longer operative time in TUVRP was related to the slower motion of the Wing electrode needed to add the advantages of electrovaporization.
17. Vavassori I, Piccinelli A, Manzetti A, Valenti S, Vismara A. Holmium laser enucleation of the prostate combined with mechanical morcellation in 155 patients with benign prostatic hyperplasia. *Urology*. 2002;60(3):449-453.	**OBJECTIVES**: To report our experience with holmium laser enucleation of the prostate (HoLEP) combined with mechanical morcellation for the treatment of symptomatic benign prostatic hyperplasia (BPH). **METHODS**: From January 2000 to May 2001, 155 consecutive patients with BPH underwent HoLEP combined with mechanical morcellation and were followed up for at least 6 months. A pulsed high-powered 80-W holmium-neodymium:yttrium-aluminum-garnet laser was used (power setting 2.0 J/pulse, 35 pulses/s, and 70 W). The enucleated tissue was removed by a transurethral mechanical morcellator.	**RESULTS**: The preoperative mean prostate volume was 53 +/- 39 cm3; 38.7% of patients had an estimated gland volume greater than 50 cm3; 30.8% had BPH complicated by urinary retention, bladder calculi, bladder diverticula, or urethral stricture. The total mean operative time was 87 +/- 44 minutes, the resected weight was 37 +/- 26 g, and the morcellation efficiency was 1.9 +/- 1.6 g/min. The catheter time was 18 +/- 13.5 hours and the hospital stay 1.5 +/- 1.0 days. No patient needed a blood transfusion or experienced hyponatremia. The patients were followed up for a mean of 13 +/- 5 months (range 6 to 24). The International Prostate Symptom Score, quality-of-life score, and peak urinary flow rate had improved significantly 1 month after HoLEP and continued to improve in the next few months, regardless of whether the gland volume was more or less than 50 cm3. **CONCLUSIONS**: HoLEP combined with mechanical morcellation is an efficient surgical intervention for BPH, regardless of gland size.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
18. Wang X-F, Li B, Ji J-T, et al. [Comparative study of transurethral electrovaporization of prostate versus transurethral resection of prostate on benign prostatic hyperplasia]. Zhonghua nan ke xue = National journal of andrology 2002;8:428-30.	**OBJECTIVES**: To compare the efficacy of transurethral electrovaporization of prostate (TUVP) with transurethral resection of prostate (TURP)., METHODS: 206 patients with symptomatic benign prostatic hyperplasia (BPH) whose prostatic sizes were all less than 60 grams were randomly divided into two groups. 97 cases were treated by TUVP while the other 109 cases were treated by TURP. The patients who underwent either TUVP or TURP were followed up for 12-34 months with an average of 20 months postoperatively.	**RESULTS**: Both groups showed the significant decline in the mean IPSS (international prostatic symptom score) ($P < 0.01$), the mean PVR (Postovoiding Residual Volume) ($P < 0.01$), while increase in mean Qmax (Peak uroflow rate) ($P < 0.01$) in 12 months, 24 months after the operation. There were significant differences in the mean duration of operation or catheterization postoperatively ($P < 0.05$). The main complications of post-operation in the two groups were stress incontinence, TUR syndrome, urethral stricture, secondary bleeding. **CONCLUSIONS**: Both TUVP and TURP are effective treatment for the patient with BPH whose prostatic size is less than 60 grams. TUVP spends shorter time of the operation and postoperative catheterization than that of TURP.
19. Malek RS. Photoselective vaporization of the prostate: initial experience with a new 80 W KTP laser for the treatment of benign prostatic hyperplasia. *Journal of endourology / Endourological Society.* 2003;17(2):93-96.	**PURPOSE**: To study the safety and efficacy of a new high-power potassium-titanyl-phosphate laser (KTP/532; Niagara PV trade mark laser system; Laserscope, San Jose, CA) for transurethral photoselective vaporization of benign obstructive prostate tissue. **PATIENTS AND METHODS**: The KTP/532 laser energy at 80 W was delivered by a 6F side-firing fiber through a 23F continuous-flow cystoscope. Photoselective vaporization of the prostate (PVP) using sterile water irrigation was performed under spinal anesthesia on an outpatient basis in 10 patients with a preoperative mean prostate volume of 41.37 +/- 18.5 cc (range 24-76.3 cc). The mean lasing time was 19.8 +/- 4.9 minutes.	**RESULTS**: Two patients experienced 1 to 7 days of mild dysuria, and one who was taking warfarin had mild transient hematuria, but none had urinary retention or other complications. The mean catheterization time was 17.2 +/- 9.6 hours (range 0-28 hours). At 1 year, the outcomes, which had showed significant improvement sustained throughout the follow-up, were as follows: mean American Urological Association Symptom Score decreased from 23.2 +/- 4.7 to 2.6 +/- 0.5 (88.8%), the mean quality of life score improved from 4.3 +/- 0.7 to 0.4 +/- 0.5 (90.7%), the mean peak urinary flow rate increased from 10.3 +/- 1.4 mL/sec to 30.7 +/- 5.8 mL/sec (198.1%), and the mean postvoiding residual volume decreased from 137.6 +/- 112.2 mL to 3.0 +/- 4.8 mL (97.8%). The mean prostate volume decreased by 27%. **CONCLUSIONS**: This pilot study indicates that PVP with the new 80 W KTP/532 laser is a simple, safe, and efficacious outpatient procedure for the treatment of obstructive BPH.
20. Hong B-f, Yang Y, Cai W, Gao J-p, Wang C-y, Wang X-x. Photoselective vaporization of the prostate in the treatment of benign prostatic hyperplasia. *Chinese medical journal.* 2005;118(19):1610-1614.	**BACKGROUND**: The treatment of symptomatic benign prostatic hyperplasia (BPH) remains a challenge for most urologic surgeons. We studied a cumulative cohort of patients with symptomatic benign prostatic hyperplasia (BPH) who underwent photoselective vaporization of the prostate (PVP) and evaluated the efficacy and safety of this procedure. **METHODS**: A total of 196 patients with lower urinary tract obstruction symptoms secondary to BPH were treated using laser vaporization of the prostate under sacral canal anesthesia at our institutions. The therapeutic results were assessed using following variables: the safety and efficacy of sacral anesthesia, blood loss, operative time, indwelling catheterization. Preoperative and perioperative parameters were evaluated in the international prostate symptom score (IPSS), quality of life score (QoL), maximal urinary flow rate (Qmax), post-void residual urine volume (PVR) and the change of sexual function. Patients were also assessed for 3-month follow up.	**RESULTS**: PVP was performed successfully for all patients. There were 195 patients under sacral anesthesia and 1 patient under epidural anesthesia. Mean operative time was (45.2 +/- 18.5) minutes. The mean IPSS decreased from (26.6 +/- 3.2) to (5.6 +/- 1.4) and the QoL score decreased from (5.7 +/- 0.4) to (1.6 +/- 0.5), respectively ($P < 0.05$), while mean Qmax increased from (6.7 +/- 2.5) ml/s preoperatively to (19.6 +/- 2.4) ml/s, PVR decreased from 158.4 to 25.8 ml, respectively ($P < 0.05$). Average catheterization time was (1.8 +/- 0.9) days. There was no significant blood loss or fluid absorption during the period of PVP. Complications consisted of transient dysuria in 3 patients (1.5%), delayed gross hematuria in 5 patients (2.5%), respectively. Significant improvement in clinical outcomes were noted as early as 3 months after PVP treatment. **CONCLUSIONS**: PVP is considered as a high satisfaction rate by patient and a minimal postoperative complication. Hence, PVP is a novel, safe, effective and minimal invasive treatment for patients with symptomatic BPH.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
21. Tefekli A, Muslumanoglu AY, Baykal M, Binbay M, Tas A, Altunrende F. A hybrid technique using bipolar energy in transurethral prostate surgery: A prospective, randomized comparison. Journal of Urology 2005;174:1339-43.	**PURPOSE**: We assessed the efficacy and safety of transurethral resection and vaporization with bipolar PlasmaKinetic(registered trademark) energy. **MATERIALS AND METHODS**: During a 2-year period 101 men with benign prostatic hyperplasia were randomly assigned to PlasmaKinetic(registered trademark) surgery or standard transurethral prostate resection (TURP). Patient demographics, indications for surgery, preoperative and postoperative International Prostate Symptom Score, uroflowmetry scores, operative time, catheterization duration, hospital stay and complication rates were compared.	**RESULTS**: Complete data on 96 patients with a mean age (+/-) SD of 69.1 (+/-) 6.1 years was available at a mean followup of 18.3 (+/-) 6.7 months (range 12 to 23). In the PlasmaKinetic(registered trademark) and TURP groups mean operative time was 40.3 (+/-) 11.4 (range 30 to 60) and 57.8 (+/-) 13.4 minutes (range 45 to 75), respectively (p <0.01). The mean volume of saline irrigation during the PlasmaKinetic(registered trademark) procedure was significantly lower than that of hyperosmolar solution irrigation during TURP (p <0.05). Patients in the PlasmaKinetic(registered trademark) and TURP groups were catheterized a mean of 2.3 (+/-) 0.7 (range 2 to 4) and 3.8 (+/-) 0.7 days (range 3 to 5), respectively (p <0.05). The mean improvement rate from baseline at month 12 in International Prostate Symptom Score and the maximal urinary flow rate was similar in the 2 groups. Severe irritative symptoms were the most common complaints after PlasmaKinetic(registered trademark) surgery, as observed in 6 cases (12.2%). Recatheterization was necessary in 3 cases (6.1%) cases in the PlasmaKinetic(registered trademark) group and in 1 (2.1%) in the TURP group. During followup urethral stricture formation was observed in 3 patients (6.1%) cases in the former group and in 1 (2.1%) in the latter group (p = 0.002). Reoperation was required in 2 (4.1%) and 1 (2.1%) cases in the PlasmaKinetic(registered trademark) and TURP groups, respectively. **CONCLUSIONS**: Transurethral surgery with PlasmaKinetic(registered trademark) bipolar energy seems to be a promising alternative to prostatic tissue removal with shorter operative, catheterization and hospitalization times, although increased rates of postoperative irritative symptoms and urethral stricture formation must be further evaluated. Copyright (copyright) 2005 by American Urological Association.
22. Yang Y, Hong BF, Fu WJ, Xu Y, Chen YF, Zhang CE. A comparative study on the photoselective vaporization of the prostate and transurethral electrovaporization resection of prostate for the treatment of benign prostatic hyperplasia. *Zhonghua wai ke za zhi [Chinese journal of surgery].* 2007;45(14):951-953.	**OBJECTIVE**: To compare the therapeutic effects of the greenlight photoselective vaporization of prostate (PVP) and transurethral electrovaporization resection of prostate (TUVP) for the treatment of symptomatic benign prostatic hyperplasia (BPH). **METHODS**: One hundred and sixty-three cases of BPH were treated with PVP and TUVP. All patients were followed up with International Prostatic Symptom Score (IPSS), quality of life (QOL), blood loss, operative time, indwelling catheterization, mean Qmax, residual urinary volume (RUV) and operative complications.	**RESULTS**: IPSS, QOL, Qmax and RUV were significantly improved after either of the procedures (P < 0.05), no significant difference in the improvement of subjective symptoms and objective signs had been noted with the different procedure (P > 0.05). Mean operative time was (37 +/- 15) min for TUVP and (45 +/- 28) min for PVP, the resection time was longer for PVP than TUVP (P > 0.05), but the intraoperative bleeding and catheterization time were less for PVP than TUVP (P < 0.05). Postoperative complications were less for PVP than TUVP (P < 0.05). The incidence of hematuria in TUVP group had been 41.4%, and urinary irritation after PVP group was 55.2% (P < 0.05). **CONCLUSIONS**: PVP has the same therapeutic effect as TUVP and less adverse side effects than TUVP. It is a new technique for the treatment symptomatic BPH.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
23. Spaliviero M, Araki M, Wong C. Short-term outcomes of greenlight HPS(trademark) laser photoselective vaporization prostatectomy (PVP) for benign prostatic hyperplasia (BPH). *Journal of Endourology*. 2008;22(10):2341-2347.	**PURPOSE**: We evaluated our initial experience with the GreenLight HPS(trademark) laser, a technologically improved version of the potassium-titanyl-phosphate (KTP) laser for PVP. **MATERIALS AND METHODS**: Transurethral PVP was performed using a GreenLight HPS(trademark) side-firing laser system. Patients had American Urological Association Symptom Score (AUASS), Quality of Life (QoL) score, Sexual Health Inventory for Men (SHIM) score, serum prostate specific antigen (PSA), maximum flow rate (Qmax) and post void residual (PVR) determinations and volumetric prostate measurements with transrectal ultrasonography (TRUS). Laser and operative times and energy usage were recorded. AUASS, QoL, SHIM, Qmax and PVR were evaluated 1, 4, 12, 24, and 52 weeks post-surgery. Serum PSA and TRUS were obtained at 12 weeks and serum PSA was repeated at 52 weeks.	**RESULTS**: Seventy consecutive patients with a median age of 67 (45-86) years underwent GreenLight HPS(trademark) laser PVP from July 2006 through March 2008. Median prostate volume was 61.6 (20.9-263.0) mL with a median PSA of 1.4 (0.1 -10.1) ng/mL. Mean laser and operative times and energy usage were 13 (3-34) minutes, 30 (6-100) minutes and 85 (11-235) kJ, respectively. All were outpatient procedures with 49 (70%) patients catheter-free at discharge. No urethral strictures or urinary incontinence were noted. Median AUASS decreased from 22 to 8, 6, 5, 5, and 4 ($p<0.001$) while the median Qmax increased from 9.4 to 20.4, 20.3, 21.2, 18.8, and 20.0 mL/s ($p<0.001$) during the follow-up period. **CONCLUSIONS**: At one year, our experience suggests that GreenLight HPS(trademark) laser PVP is safe and effective for treating lower urinary tract symptoms secondary to BPH.
24. Fu WJ, Zhang X, Yang Y, et al. Comparison of 2-(mu)m Continuous Wave Laser Vaporesection of the Prostate and Transurethral Resection of the Prostate: A Prospective Nonrandomized Trial With 1-year Follow-up. Urology 2010;75:194-9.	**OBJECTIVES**: To compare the safety and efficacy of the 2-(mu)m continuous wave (cw) laser vaporesection of the prostate with transurethral resection of prostate (TURP) in patients with symptomatic benign prostatic hyperplasia (BPH). **METHODS**: In this prospective study, 100 patients with a prostate weight of < 80 g underwent 2-(mu)m cw laser vaporesection (n = 58) or TURP (n = 42). Efficacy follow-up included measurement of International Prostate Symptom Score, quality of life score, maximal urinary flow rate, and postvoid residual volume. Peri- and postoperative complications were also compared.	**RESULTS**: The mean operative time was slightly longer in the 2-(mu)m laser group, 54.2 (+/-) 20.8 minutes, than the TURP group 42.0 (+/-) 10.5 minutes (P <.05). No blood transfusion was needed in the 2-(mu)m laser group. Catheter indwelling time 1.8 (+/-) 0.3 days vs 3.4 (+/-) 1.9 days, and hospitalization time 3.2 (+/-) 1.6 days vs 6.5 (+/-) 2.4 day were shorter in 2-(mu)m laser group than in TURP group (P <.05). Within the 12-month follow-up, the mean International Prostate Symptom Score improved by 85.4% in the laser group and 81.1% in the TURP group. Mean maximal urinary flow rate. increased 229.2% for the laser group and with a similar increase of 218% for the TURP group (P >.05); however, perioperative morbidity was less in the 2-(mu)m laser group. **CONCLUSIONS**: The 2-(mu)m cw laser vaporesection is a novel technology with favorable perioperative safety as well as the same therapeutic effect as TURP, and has the advantage of significantly less blood loss, shorter hospitalization, and shorter catheter indwelling time.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
25. Son H, Paick J-S. Comparative Analysis of the Efficacy and Safety of Photoselective Vaporization of the Prostate for Treatment of Benign Prostatic Hyperplasia according to Prostate Size. *Korean journal of urology*. 2010;51(2):115-121.	**PURPOSE**: This study was conducted to perform a comparative analysis of the efficacy and safety of photoselective vaporization of the prostate (PVP) for treatment of benign prostatic hyperplasia (BPH) in men with a prostate volume greater than 60 cc. **MATERIALS AND METHODS**: The clinical data of 249 men with symptomatic BPH who underwent PVP between January 2006 and June 2008 were retrospectively analyzed. All patients were classified into two groups according to their prostate volume (group A, <60 cc; group B, >/=60 cc). The preoperative evaluation included a digital rectal exam, urinalysis, prostate-specific antigen levels, International Prostate Symptom Score (IPSS), quality of life (QoL) score, maximal flow rate (Qmax), postvoid residual urine volume (PVR), and transrectal ultrasonography. The total operative time, used energy (kJ), urethral Foley catheter indwelling period, and the number of hospital days were recorded afterward. The IPSS, QoL score, Qmax, and PVR were evaluated at 1, 3, 6, and 12 months postoperatively.	**RESULTS**: In both groups, significant improvements in the subjective and objective voiding parameters were achieved and these improvements were sustainable for at least 1 year with minimal complications. During the follow-up period, the PVR in group B significantly increased. Retrograde ejaculation and urethral stricture were the common complications in both groups. There was no significant difference in the incidence rate. **CONCLUSIONS**: PVP is safe and efficacious, with durable results for men with symptomatic BPH and large prostate volumes.
26. Strom KH, Gu X, Spaliviero M, Wong C. Perioperative and delayed adverse events of greenlight HPS(trademark) laser photoselective vaporization prostatectomy (PVP). *Journal of Endourology*. 2010;24:A66.	**INTRODUCTION**: GreenLight HPS(trademark) is a relatively new technology for the treatment of lower urinary tract symptoms (LUTS) resulting from benign prostatic hyperplasia (BPH). Purpose: We report the incidence, prevention and management of perioperative (<30 days) and delayed (>30 days) adverse events in patients treated with GreenLight HPS(trademark) laser photoselective vaporization prostatectomy (PVP). **MATERIALS AND METHODS**: Patients had American Urological Association Symptom Score (AUASS), Quality of Life (QoL) score, Sexual Health Inventory for Men (SHIM), serum prostate specific antigen (PSA), maximum flow rate (Qmax) and post void residual (PVR) determinations and volumetric prostate measurements with transrectal ultrasonography (TRUS). AUASS, QoL, SHIM, Qmax and PVR were evaluated up to 24 months postsurgery. Adverse events were recorded perioperatively and at each follow-up interval.	**RESULTS**: 195 consecutive patients with a mean age of 67.0(+/-)9.2 years, prostate volume of 68.3(+/-)40.3mL and PSA of 2.6(+/-)3.3 ng/mL underwent GreenLight HPS(trademark) laser PVP. Mean laser and operative times and energy usage were 13.6(+/-)10.3 minutes, 32.2(+/-)24.0 minutes and 91.8(+/-)69.8 kJ, respectively. All were outpatient procedures. Perioperative complications included nonsignificant intraoperative bleeding (3.1%), postoperative clinically non-significant hematuria<7 days duration (58.5%), hematuria requiring clot evacuation (1.0%), urinary retention requiring temporary recatheterization (5.1%), urinary tract infection (4.6%) and prostatitis (0.5%). Delayed complications included hematuria (1.0%), retrograde ejaculation (37.4%) and bladder neck contracture (1.0%). No urethral strictures, urinary incontinence or erectile dysfunction were noted. **CONCLUSIONS**: GreenLight HPS(trademark)M laser PVP has a low incidence of perioperative and delayed adverse events.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
27. Georgescu D, Multescu R, Stanescu F, Jecu M, Geavlete P. Bipolar plasma vaporization vs monopolar and bipolar TURP-A prospective, randomized, long-term comparison. *Urology*. 2011;78(4):930-935.	**OBJECTIVE**: To perform a prospective, randomized, long-term comparison between bipolar plasma vaporization of the prostate (BPVP), bipolar transurethral resection in saline (TURis), and monopolar transurethral resection of the prostate (TURP) concerning the perioperative and follow-up parameters., METHODS: A total of 510 patients with benign prostatic hyperplasia (BPH), Q(max) <10 mL/s, International Prostate Symptom Score (IPSS) >19, and prostate volume between 30 and 80 mL were enrolled in the trial. All cases were evaluated preoperatively and at 1, 3, 6, 12, and 18 months after surgery by IPSS, quality of life, Q(max), and ultrasonography.,	**RESULT**: Each study arm including 170 cases emphasized similar preoperative parameters. The capsular perforation and intraoperative bleeding rates as well as the mean hemoglobin drop were significantly decreased for BPVP by comparison with TURis and TURP. The postoperative hematuria, blood transfusion, and clot retention rates were significantly higher in the TURP group. The operation time was significantly shorter only for BPVP patients, whereas the catheterization period and hospital stay were significantly reduced for BPVP, followed by TURis. The rates of irritative symptoms and urethral strictures were similar in the 3 series. The recatheterization, bladder neck sclerosis, and retreatment rates were significantly lower in the BPVP group. During the 1, 3, 6, 12, and 18 months' follow-up, the BPVP series emphasized significantly superior parameters in terms of IPSS and Q(max). **CONCLUSION**: BPVP represents a valuable endoscopic treatment alternative for BPH patients, with superior efficacy and satisfactory complication rate. The long-term follow-up emphasized durable improvements of the postoperative parameters for BPVP.
28. Hussein AA, Eltabey AM. Holmium laser enucleation versus transurethral resection of the prostate 1-year follow-up results of a randomized clinical trial. *European Urology, Supplements*. 2012;11(1):e637-e637a.	**INTRODUCTION & OBJECTIVES**: A prospective, randomized clinical trial to compare the safety, efficacy, and medium-term durability of holmium laser enucleation of the prostate (HoLEP) combined with mechanical morcellation versus standard transurethral resection of the prostate (TURP) for the surgical treatment of patients with bladder outlet obstruction due to benign prostatic hyperplasia (BPH). The patients had prostates that were greater than 30 g and less than 100 g and were followed for 1 year. **MATERIAL & METHODS**: From May 2010 to April 2011 100 consecutive patients with lower urinary tract obstruction (LUTS) due to BPH were randomized to either surgical treatment with HoLEP (group 1, n = 50) or standard TURP (group 2, n =50). Preoperative assessments included American Urological Association (AUA) symptom score, serum prostate-specific antigen (PSA), post-voiding residual (PVR) urine volume, transrectal ultrasound (TRUS), and urodynamic pressure flow studies including measurement of peak urinary flow rate(Qmax). Perioperative parameters included total operating time, resected tissue weight, hemoglobin loss, presence or absence of blood transfusion, time of catheter removal, and duration of hospital stay. Postoperative evaluations were conducted at 1, 6, and 12 months to assess AUA symptom scores, PVR, and Qmax, and any postoperative complications.	**RESULTS**: There were no significant differences between the HoLEP and the TURP groups regarding pre-operative assessments Patients in the HoLEP group had shorter catheterization times and hospital stays than patients in the TURP group (1.5(+/-)1.4 versus2.1(+/-)1.1,and 2.6(+/-)1.2 versus3.8(+/-)1.6 respectively). There was no significant difference in operating times between the two groups ,but more prostatic tissues were retrieved from the HoLEP group with a faster rate(0.6gm/min versus0.5gm/min). Mean hemoglobin loss was lower in the HoLEP group (1.8 (+/-)1.3 g/dL versus 2.9 (+/-) 1.5 g/dL). There was a significantly greater improvement from baseline AUA symptom scores and PVR urine volumes in the HoLEP group versus the TURP group, at all postoperative assessments. Postoperatively, 25% of patients in group 1 (HoLEP) and 20% of patients in group 2 (TURP) had irritative voiding symptoms which were self limited. Urethral stricture occurred in three cases (one case in the HoLEP group and two cases in the TURP group). **CONCLUSIONS**: HoLEP had significantly less perioperative morbidity than TURP, with more improved micturition parameters. HoLEP is proved to be a safe and highly effective technique for surgical treatment of bladder outlet obstruction due to BPH.

Reference	Aims & Methods Catheter Use / Important Exclusions in Patient Selections	Results & Conclusions Key Outcomes : Catheter use/Urinary Retention/Urinary Infections/Other Outcomes
29. Stucki P, Marini L, Mattei A, Xafis K, Boldini M, Danuser H. Bipolar Versus Monopolar Transurethral Resection of the Prostate: A Prospective Randomized Trial Focusing on Bleeding Complications. Journal of Urology 2015.	**PURPOSE**: We compare monopolar vs bipolar transurethral resection of the prostate in patients with benign prostatic hyperplasia, focusing on functional outcomes as well as rates of bleeding complications and the transurethral resection syndrome. **MATERIALS AND METHODS**: A total of 137 patients with benign prostatic hyperplasia (mean age 67 years, range 47 to 91) were prospectively randomly assigned to undergo monopolar (67) or bipolar (70) transurethral resection of the prostate. Patient characteristics of the 2 groups were similar. Hemoglobin (as a marker of blood loss) was measured preoperatively and perioperatively. I-PSS, I-PSS-QoL score, maximal flow rate and post-void residual urine volume were assessed preoperatively and 3 and 12 months postoperatively. Duration of surgery, indwelling catheter use and hospitalization were also documented, as were postoperative clot retention requiring removal by catheterization or surgery, and rates of bladder neck and/or urethral strictures.	**RESULTS**: No significant perioperative differences were found in duration of surgery, catheterization or hospitalization, or in blood loss or rates of blood transfusion and transurethral resection syndrome. Postoperatively there were no significant differences in I-PSS or I-PSS-QoL scores, or rates of rehospitalization, clot retention, blood transfusions, reoperation or urethral strictures. However, bladder neck stricture occurred significantly more often in the bipolar group (8.5% vs 0%, p = 0.02). The 3 and 12-month followup showed significant and equal improvement in micturition in the 2 groups. **CONCLUSIONS**: Bipolar and monopolar transurethral resection of the prostate are effective and safe techniques for the surgical treatment of benign prostatic hyperplasia. The only significant difference between them was a significantly higher rate of bladder neck strictures with bipolar resection of the prostate.

eAppendix Table 2. Characteristics of Male Genitourinary Surgery Panelists for Urinary Catheter Appropriateness Panel

Name	Title	Affiliation*	Specialty
Michael Balk, RN	Operating Room Circulating Nurse	Mercy Health Saint Mary's Hospital, Grand Rapids, MI	Nursing
Donald R. Bodner, MD	Professor of Urology	Louis Stokes Cleveland VA Medical Center, Cleveland, OH Case Western Reserve University School of Medicine, Cleveland, OH	Urology
Sansern Borirakchanyavat, MD	Chief of Urology	Southern California Permanente Medical Group, Panorama City, CA	Urology
Bruce L. Jacobs, MD, MPH	Assistant Professor	University of Pittsburgh School of Medicine, Pittsburgh, PA	Urology
John T. Leppert, MD, MS	Assistant Professor	Stanford University, Stanford, CA; VA Palo Alto Health Care System, Palo Alto, CA	Urology
Daniel J. Morgan, MD, MS	Associate Professor; Hospital Epidemiologist	University of Maryland, Baltimore, MD; VA Maryland Healthcare System, Baltimore, MD	Infectious Diseases
Michael C. Risk, MD, PhD	Assistant Professor	University of Minnesota, Minneapolis, MN; VA Minneapolis Health Care System, Minneapolis, MN	Urology
Andrea Starnes, RN	Infectious Diseases Nurse Case Manager	VA Ann Arbor Healthcare System, Ann Arbor, MI	Infectious Diseases; Nursing
Seth A. Strope, MD, MPH	Assistant Professor	Washington University School of Medicine, St. Louis, MO	Urology
Jonathan N. Warner, MD	Assistant Professor	University of Michigan, Ann Arbor, MI	Urology
John T. Wei, MD, MS	Professor	University of Michigan, Ann Arbor, MI	Urology

*At time of panel participation