

# The Patient Burden of Bladder Outlet Obstruction after Prostate Cancer Treatment

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**Purpose:** Bladder outlet obstruction after prostate cancer therapy imposes a significant burden on health and quality of life in men. Our objective was to describe the burden of bladder outlet obstruction after prostate cancer therapy by detailing the type of procedures performed and how often those procedures were repeated in men with recurrent bladder outlet obstruction.

**Materials and Methods:** Using SEER (Surveillance, Epidemiology and End Results)-Medicare linked data from 1992 to 2007 with followup through 2009 we identified 12,676 men who underwent at least 1 bladder outlet obstruction procedure after prostate cancer therapy, including external beam radiotherapy in 3,994, brachytherapy in 1,485, brachytherapy plus external beam radiotherapy in 1,847, radical prostatectomy in 4,736, radical prostatectomy plus external beam radiotherapy in 369 and cryotherapy in 245. Histogram, incidence rates and Cox proportional hazards models with repeat events analysis were done to describe the burden of repeat bladder outlet obstruction treatments stratified by prostate cancer therapy type. We describe the type of bladder outlet obstruction surgery grouped by level of invasiveness.

**Results:** At a median followup of 8.8 years 44.6% of men underwent 2 or more bladder outlet obstruction procedures. Compared to men who underwent radical prostatectomy those treated with brachytherapy and brachytherapy plus external beam radiotherapy were at increased adjusted risk for repeat bladder outlet obstruction treatment (HR 1.2 and 1.32, respectively, each  $p < 0.05$ ). After stricture incision the men treated with radical prostatectomy or radical prostatectomy plus external beam radiotherapy were most likely to undergo dilation at a rate of 34.7% to 35.0%. Stricture resection/ablation was more common after brachytherapy, external beam radiotherapy or brachytherapy plus external beam radiotherapy at a rate of 28.9% to 41.2%.

**Conclusions:** Almost half of the men with bladder outlet obstruction after prostate cancer therapy undergo more than 1 procedure. Furthermore men with bladder outlet obstruction after radiotherapy undergo more invasive endoscopic therapies and are at higher risk for multiple treatments than men with bladder outlet obstruction after radical prostatectomy.

**Key Words:** prostatic neoplasms, urinary bladder neck obstruction, prostatectomy, radiotherapy, brachytherapy

## Abbreviations and Acronyms

BNC	= bladder neck contracture
BOO	= bladder outlet obstruction
BPH	= benign prostatic hyperplasia
BT	= brachytherapy
DVIU	= direct vision internal urethrotomy
EBRT	= external beam radiotherapy
PCa	= prostate cancer
PCT	= PCa therapy
RP	= radical prostatectomy
TUIBNC	= transurethral incision of BNC
TURBNC	= transurethral resection of BNC
TURP	= transurethral resection of prostate

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SURGERY and radiotherapy for PCa are associated with a risk of BOO, including urethral stricture, BNC and stenosis of the prostatic urethra. This is a significant burden on the health and quality of life of men. We have previously reported that by 10 years after PCT surgery for BOO is performed in 20% to 38% of elderly men, varying by type of PCT.<sup>1</sup> Therapy for urethral strictures has also been shown to be associated with complications, including bleeding, infection and incontinence, further worsening the disease burden in these patients.<sup>2</sup>

Almost 3 million men are living with PCa in the United States and 230,000 more are diagnosed each year.<sup>3</sup> The combination of a large cancer survivor population and a relatively common adverse effect of treatment requires us to better understand the burden endured by men with BOO.<sup>4</sup> A single dilation or urethrotomy of BNC after RP is successful in 25% to 75% of cases.<sup>5–8</sup> The limited literature suggests that endoscopic management of BOO after radiotherapy is successful in 40% to 60% of cases.<sup>9–11</sup> Given the success rates of endoscopic therapy, patients with BOO after PCT may require multiple urological interventions, increasing the burden of BOO.<sup>8,12,13</sup> Another way that BOO may burden affected men is in the invasiveness of the procedures performed (eg dilation vs transurethral resection). To our knowledge this has not been previously studied.

The incidence of BOO after PCT is well established. Instead we sought to focus on the subpopulation that has been treated for BOO and describe the burden of BOO in these men. We did this by detailing 1) the type of procedures performed for BOO and 2) how often those procedures are repeated in men with recurrent BOO. We hypothesized that irradiated patients with BOO would have a greater burden of disease than men with BOO after radical prostatectomy in that they would be treated with more invasive procedures and undergo more repeat procedures.

## MATERIALS AND METHODS

SEER registries collect cancer diagnosis and initial treatment information on residents of 17 geographic areas of the United States. Linking SEER data with Medicare claims data provides long-term followup of health care use. Using SEER-Medicare linked data we identified 100,874 elderly men with complete claims data who received local therapy for nonmetastatic prostate cancer, diagnosed between 1992 and 2007. Cohort creation was described previously.<sup>1</sup> The men were divided into groups by local cancer treatments administered in the first 12 months following diagnosis, including EBRT, BT, BT plus EBRT, RP, RP plus EBRT and cryotherapy. Uncommon combinations (eg RP plus BT) and patients who did not receive any local therapy were excluded from

analysis. Patients treated with high and low dose rate brachytherapy were grouped together due to the small number of the former. Of the 100,874 patients 12,676 (12.6%) underwent a procedure to treat BOO as described and our analysis is limited to these men.

## Outcome

We required that inpatient or outpatient claims for BOO procedures be associated with a BOO diagnosis. The supplementary Appendix (<http://jurology.com/>) lists diagnosis and procedure codes. BOO procedures of interest were grouped into categories for analysis, including 1) dilation of the urethra or prostate, 2) incision of the urethra or bladder neck, including DVIU, transurethral incision of the prostate or TUIBNC and 3) resection/ablation of the prostate or bladder neck, including TURBNC, TURP, and prostate laser and ablative therapy. Other procedures for BOO were rare and included a urethral stent, urethroplasty or suprapubic cystostomy. All procedures were accompanied by a diagnosis code consistent with urinary retention, BPH, urethral stricture or BNC. Of course BPH is inconsistent with a diagnosis of PCa but such miscoding of prostatic obstruction is common after radiation and the common practice is to include these events.<sup>14,15</sup> In the absence of cancer progression as described they likely represent prostatic urethral stricture rather than BPH or locally advanced prostate cancer.

To avoid double counting we required at least 7 days between procedures. When more than 1 type of procedure was billed within 7 days, we chose the most invasive treatment as the treatment type to describe that event, that is resection was prioritized over incision, which took priority over dilation.

## Covariates

Covariates available from the SEER-Medicare linked database included age at diagnosis, race, ZIP Code<sup>TM</sup> specific income and education level, tumor stage and WHO grade at diagnosis. Comorbidities were classified using the adaptation by Klabunde et al of the Charlson comorbidity score.<sup>16</sup> We defined baseline BOO as any claim for BOO using the criteria above occurring in the 12 months prior to PCT.

## Analytical Approach

By definition all men experienced at least 1 BOO event after PCT. To describe the burden of multiple BOO treatments we developed a histogram of the number of treatments that a man experienced during the cancer survivorship phase of life and stratified this by PCT type. To account for differences in followup we describe the incidence rate and incidence rate ratios across cancer treatment groups. On repeated events analysis we used a Cox proportional hazards proportional means model with inference based on the robust sandwich covariance estimate to generate unadjusted HRs and SEs.<sup>17</sup> The multivariate model predicted time to event for each treatment group, adjusting for all covariates described.

Time to event was calculated as the time elapsed from the claim date of cancer treatment to the first BOO event and then the time to each subsequent BOO event on repeated events analysis. Followup was calculated from the date of the first cancer treatment to death or

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