

The Clinical Impact of Depression and Anxiety on Complications After Prostate Cancer Treatment: A Retrospective Cohort Study

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Purpose: This large retrospective study aims to better understand the relationship of depression and anxiety with posttreatment complications in prostate cancer patients, specifically erectile dysfunction (ED) and urinary incontinence.

Materials and Methods: We retrospectively reviewed prostate cancer patients diagnosed between 2016–2021. Patient Health Questionnaire-9 scores were obtained to measure anxiety and depression before undergoing prostate cancer treatment. We examined the presence and severity of ED and urinary incontinence at posttreatment intervals. Our primary outcome was the association between pretreatment anxiety and depression with an increased incidence of posttreatment ED and urinary incontinence.

Results: In total, 489 patients treated for prostate cancer were included in this study. At baseline, 92% of patients had minimal or mild depression, while 8% experienced moderate to severe depression. Posttreatment complications were evaluated at the first posttreatment visit and during 6-month and 12-month follow-ups. ED was observed in 66%, 65%, and 61% of patients at these respective time points. Urinary incontinence was reported in 35%, 26%, and 19% of patients at these posttreatment time points, respectively. No significant associations were found between anxiety and incontinence or ED. However, at all posttreatment time points, patients with moderate to severe depression compared to minimal or mild depression had a greater prevalence of incontinence ($p=0.026$, $p=0.049$, and $p=0.019$ respectively). There was a trend toward increased severity of incontinence, as measured by urinary pad usage, in patients with moderate to severe depression compared to patients with minimal or mild depression.

Conclusion: The relationship between depression and prostate cancer is established, but this study is the first of its kind to demonstrate the significant association of moderate to severe depression with posttreatment incontinence. These findings underscore the need for integrating mental health considerations into the comprehensive care of prostate cancer patients, with the goal of reducing posttreatment complications.

Key Words: Anxiety, Depression, Urinary incontinence, Prostatic neoplasms, Postoperative complications

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- **Research Ethics:** This study received approval from the Institutional Review Board (IRB) of University of Oklahoma Health Sciences Center (IRB No. 12270).
- **Conflicts of Interest:** The authors have nothing to disclose.



INTRODUCTION

Prostate cancer is the second most prevalent cancer in men and the second leading cause of cancer mortality in men, with an estimate of 299,010 new cases in 2024 in the United States [1]. Some established risk factors for prostate cancer include age, ethnicity, family history, and smoking [2]. Additionally, modifiable risk factors like anxiety and depression have been linked to the progression of prostate cancer, potentially promoting invasion and metastasis [3-5]. Notably, the prevalence of anxiety and depression is higher among prostate cancer patients compared to the general population [6,7]. This elevated prevalence persists across all stages of treatment, with no significant variation based on the type of therapy selected [6]. Although anxiety and depression have clear clinical implications for prostate cancer patients, their specific impact on posttreatment complications remains underexplored.

As the number of prostate cancer survivors continues to rise, enhancing posttreatment outcomes becomes increasingly important. While psychiatric conditions following treatment have been studied, our study uniquely analyzes the presence of depression and anxiety before treatment [8]. We aim to investigate the relationship between pretreatment depression and anxiety with the most common posttreatment complications in prostate cancer patients, specifically erectile dysfunction (ED) and urinary incontinence [9].

MATERIALS AND METHODS

A retrospective review was conducted with informed consent obtained from all participants in this study. The STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) guidelines were followed to conduct this retrospective cohort study.

In total, 1575 patients presented to University of Oklahoma Department of Urologic Surgery for prostate cancer treatment from 2016 to 2021. Of these, 489 patients with a confirmed diagnosis of prostate cancer were included in this study. Exclusion criteria were applied to patients who were not treated for prostate cancer, had incomplete Patient Health Questionnaire-9 (PHQ-9) forms, were prisoners, women, adolescents, or were lost to follow-up. This study

utilized data extracted from patient charts within the OU Physicians Electronic Health Record. These charts were deidentified and abstracted into a REDCap database for analysis.

Patients with prostate cancer were engaged in a patient-centered treatment approach and provided with counseling on the associated risks and benefits of various treatment options. Prostate cancer treatments included in this analysis were active surveillance, surgery, radiation therapy, hormone therapy, chemotherapy, biologic therapy, and bisphosphonate therapy [10]. Preliminary PHQ-9 scores were collected as an objective measure of anxiety and depression within the patient population diagnosed with prostate cancer. Depression severity was classified based on PHQ-9 total scores, with cutpoints of 0–4 for minimal, 5 for mild, 10 for moderate, 15 for moderately severe, and 20 for severe depression, respectively. The severity of urinary incontinence and ED was assessed at 4 intervals: pretreatment baseline, first posttreatment visit, 6-month posttreatment, and 12-month posttreatment. Urinary incontinence was measured by daily urinary pad use (0, 1, 2, 3–4, 5–6, 7+) with the use of 2 or more pads per day classified as incontinent according to our protocol. ED was defined as the inability to engage in intercourse.

Statistical analysis included a comparative assessment using chi-square analysis for categorical variables and Fisher exact test when more than 20% of the expected cell counts were less than 5. When applicable, all statistical analyses were conducted with the assumption that data were missing at random, and appropriate methods were employed to preserve the sample size and minimize bias and preserve the integrity of the analysis. For all outcomes, p-values were 2-sided, with statistical significance predefined at $p < 0.05$.

RESULTS

A total of 489 patients treated for prostate cancer met all inclusion criteria for this study. Table 1 presents the presence and severity of depression at baseline and at 3 posttreatment time points: the first posttreatment visit, 6-month follow-up, and 12-month follow-up. At baseline, 92% of patients had minimal or mild depression, while 8% experienced moderate to severe depression. The table also illustrates the

Table 1. Baseline and posttreatment characteristics of prostate cancer patients (n=489)

Characteristic	No. (%)
Depression at baseline	
Minimal or mild depression	451 (92)
Moderate to severe depression	38 (8)
Depression at first posttreatment	
Minimal or mild depression	146 (95)
Moderate to severe depression	8 (5)
Depression at 6-month posttreatment	
Minimal or mild depression	70 (91)
Moderate to severe depression	7 (9)
Depression at 12-month posttreatment	
Minimal or mild depression	126 (93)
Moderate to severe depression	9 (7)
Severity of depression at baseline	
Minimal	390 (80)
Mild	61 (12)
Moderate	18 (4)
Moderately severe	13 (3)
Severe	7 (1)
Severity of depression at first posttreatment	
Minimal	127 (82)
Mild	19 (12)
Moderate	5 (3)
Moderately severe	1 (1)
Severe	2 (1)
Severity of depression at 6-month posttreatment	
Minimal	57 (74)
Mild	13 (17)
Moderate	5 (6)
Moderately severe	1 (1)
Severe	1 (1)
Severity of depression at 12-month posttreatment	
Minimal	109 (81)
Mild	17 (13)
Moderate	4 (3)
Moderately severe	5 (4)
Severe	0 (0)
Erectile dysfunction at first posttreatment	
Yes	266 (66)
No	139 (34)
Erectile dysfunction at 6-month posttreatment	
Yes	257 (65)
No	141 (35)
Erectile dysfunction at 12-month posttreatment	
Yes	240 (61)
No	151 (39)
Incontinence at first posttreatment	
Continent	290 (65)
Incontinent	158 (35)
Incontinence at 6-month posttreatment	
Continent	323 (74)
Incontinent	116 (26)
Incontinence at 12-month posttreatment	
Continent	347 (81)
Incontinent	83 (19)

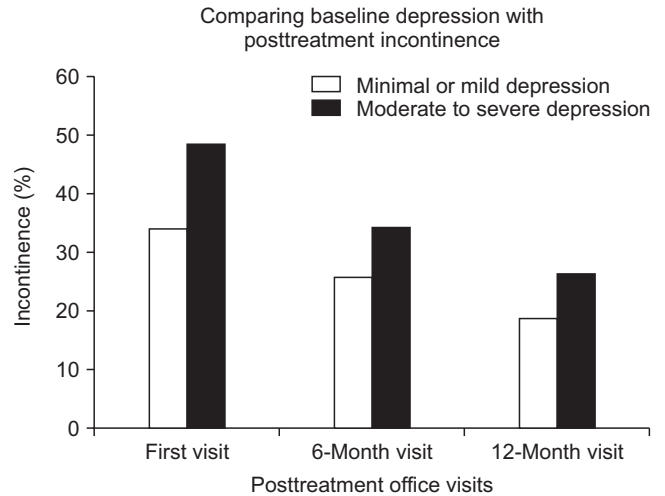


Fig. 1. Comparison of baseline depression and posttreatment incontinence requiring at least 2 pads daily.

prevalence of posttreatment ED and urinary incontinence at these time points. ED was reported by 66%, 65%, and 61% of patients at the first posttreatment, 6 months, and 12 months, respectively. Incontinence was reported by 35%, 26%, and 19% of patients at these corresponding time points.

No significant differences were observed in continence versus incontinence or ED based on depression status at baseline. Similarly, there were no significant associations between anxiety and either incontinence or ED. However, patients with moderate to severe depression, compared to those with minimal or mild depression, exhibited a greater prevalence of incontinence at all posttreatment time points (Fig. 1).

Tables 2–4 compare baseline depression levels with pad use at each posttreatment time point. Our data demonstrated that although patients showed improvement over time, those with moderate to severe depression had a significantly higher association with increased pad use at each time point compared to those with minimal or mild depression ($p=0.026$, $p=0.049$, $p=0.019$, respectively). At the first posttreatment visit, 34.5% of patients with moderate to severe depression used at least 3 pads per day, compared to only 13.4% of patients with minimal or mild depression. This trend persisted at 6 months and 12 months, with 25% versus 8.1% and 6.6% versus 4.4% of patients requiring at least 3 pads per day, respectively.

Table 2. Comparison of baseline depression with pad use at first posttreatment visit

Baseline depression	Pads/day, n (%)						p-value
	0	1	2	3–4	5–6	7+	
Minimal or mild	219 (62.9)	53 (15.2)	29 (8.3)	30 (8.6)	13 (3.7)	4 (1.1)	0.028*
Moderate to severe	13 (44.8)	5 (17.2)	1 (3.4)	6 (20.7)	2 (6.9)	2 (6.9)	

*p<0.05, statistically significant differences.

Table 3. Comparison of baseline depression with pad use at 6-month posttreatment

Baseline depression	Pads/day, n (%)						p-value
	0	1	2	3–4	5–6	7+	
Minimal or mild	230 (66.9)	70 (20.3)	16 (4.7)	19 (5.5)	7 (2.0)	2 (0.6)	0.049*
Moderate to severe	17 (53.1)	6 (18.8)	1 (3.1)	5 (15.6)	2 (6.3)	1 (3.1)	

*p<0.05, statistically significant differences.

Table 4. Comparison of baseline depression with pad use at 12-month posttreatment

Baseline depression	Pads/day, n (%)						p-value
	0	1	2	3–4	5–6	7+	
Minimal or mild	264 (76.5)	58 (16.8)	8 (2.3)	11 (3.2)	4 (1.2)	0 (0)	0.019*
Moderate to severe	20 (66.7)	5 (16.7)	3 (10.0)	0 (0)	1 (3.3)	1 (3.3)	

*p<0.05, statistically significant differences.

DISCUSSION

Prostate cancer poses a significant global health challenge, with a profound impact on patients' quality of life both during and after treatment. Among the various posttreatment complications, urinary incontinence and ED are particularly concerning, as they can persist for varying durations and exert substantial physiological and psychological effects.

Our study revealed a compelling association between baseline depression severity and posttreatment urinary incontinence in prostate cancer patients. Specifically, those with moderate to severe depression at baseline were significantly more likely to experience worse incontinence outcomes compared to those with minimal or mild depression. While the prevalence and severity of incontinence decreased for all patients over the 12-month period following treatment, the impact of moderate to severe depression remained evident. At each posttreatment time point, patients with moderate to severe depression consistently exhibited higher rates of significant incontinence, as indicated by greater pad use, compared to their counterparts with less severe depression. This trend highlights the persistent and detrimental impact of severe depression on posttreatment quality of life.

The complex interplay of various factors helps elucidate the link between baseline depression and posttreatment urinary continence. Biochemically, the dysregulation of central nervous system neurotransmitters in depression, such as serotonin and norepinephrine, may disrupt neural pathways responsible for bladder control, potentially worsening incontinence posttreatment [11]. Additionally, depression-related inflammation could impair bladder function and neural signaling, further contributing to urinary dysfunction following treatment [12]. Psychologically, the distress and cognitive impairments linked to depression might intensify the perception and management of urinary symptoms, complicating adherence to interventions and exacerbating functional impairment [13]. These interactions underscore the intricate relationship between neurobiological, inflammatory, and psychological factors in influencing posttreatment outcomes.

Our study emphasizes the importance of integrating mental health considerations into comprehensive prostate cancer care. We identify the urgent need for tailored support, targeted interventions, and routine mental health assessments for patients, especially those at risk for or experiencing moderate to severe depression. Addressing

depression early in the treatment process may not only alleviate psychological distress but also improve functional outcomes posttreatment, including urinary incontinence. Additionally, research on prostate cancer recurrence suggests that worsening depression correlates with an increased rate and risk of recurrence after treatment [14].

While our study offers valuable insights, it is not without limitations. The retrospective design and reliance on subjective symptom assessments introduce potential biases and limit the generalizability of our findings [15]. As a single-institution study, our results may not fully capture the diversity of patient experiences across different healthcare settings. Investigations into the timing and duration of mental health treatment relative to prostate cancer treatment could provide valuable insights for optimizing patient outcomes. A comprehensive approach to assessing and managing this patient population is essential for supporting prostate cancer patients and improving their overall quality of life.

CONCLUSIONS

Our study has unveiled a significant association between moderate to severe depression and posttreatment urinary incontinence in prostate cancer patients. This increased severity and prevalence of incontinence in this group represent a crucial advancement in understanding the impact of mental health on prostate cancer outcomes. These findings underscore the urgent need to integrate mental health considerations into the comprehensive care of prostate cancer patients, with the goal of reducing posttreatment complications.

NOTES

• **Author Contribution:** Conceptualization: JH, JB, EJD, WPH. Data curation: EJD, WPH. Formal analysis: JH, EJD, WPH. Funding acquisition: JH. Methodology: JH, JB, EJD, WPH. Project administration: JH. Visualization: JH, JB, EJD, WPH. Writing - original draft: JH, JB, EJD, WPH. Writing - review & editing: JH, JB, EJD, WPH.

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