

CASE REPORT

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Histopathological changes in the prostate after SpaceOAR hydrogel placement

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ABSTRACT

Spacing Organs at Risk (SpaceOAR) hydrogel has been part of the standard protocol in radiation treatment of prostate cancer to minimize radiation damage to the rectum. However, patients may not always follow through with the initial radiation therapy after the placement of the hydrogel due to involvement of the small bowel in the radiation field as seen in our patient. Here, we report the case of a 58-year-old male who underwent robot-assisted laparoscopic prostatectomy two months after SpaceOAR placement, where the prostate specimen was sent to pathology only with clinical history of “prostate cancer.” This case highlights three important points. First, to describe the histopathological changes in a prostatectomy specimen status post-hydrogel placement for radiation treatment of prostate cancer as it is not well-documented. Second, to distinguish the differential diagnoses of granulomatous prostatitis and mucinous adenocarcinoma. And most importantly, to provide complete details with the histopathology requisition form to efficiently correlate histopathologic changes in the appropriate clinical context.

Keywords: Case report, Hydrogel, Prostate cancer, Prostatectomy, SpaceOAR

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INTRODUCTION

Prostate cancer is one of the commonly diagnosed cancers affecting every one of eight American males with mortality of 2.4% in 2022 [1]. Patients are offered a wide array of therapies from active surveillance to radiation therapy to radical prostatectomy.

Spacing Organs at Risk (SpaceOAR) hydrogel has been part of the standard protocol in radiation treatment of prostate cancer to minimize radiation damage to the rectum. This spacer is extremely biocompatible, being composed mostly of water and polyethylene glycol. The gel ideally separates the prostate and the rectum for about three months then gets absorbed into the body at six months. However, patients may not always follow through with the initial radiation therapy after the placement of the hydrogel due to involvement of the small bowel in the radiation field as seen in our patient.

Here, we report the case of a 58-year-old male who underwent robot-assisted laparoscopic prostatectomy two months after SpaceOAR placement to highlight the unique histopathological characteristics of the partially absorbed hydrogel mimicking tumor characteristics and to differentiate this foreign object

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from prostate adenocarcinoma on pathology. To the best of our knowledge, this is the first case report on the histopathology of the spacer gel after prostatectomy.

CASE REPORT

A 58-year-old Caucasian male with past medical history of hypertension and type 2 diabetes mellitus presented with screening prostate-specific antigen (PSA) of 48.47 and transrectal ultrasound/prostate needle biopsy (TRUS/PNB) showing Gleason score of 3+3=6 in 5 of 12 cores, 4+3=7 in 3 of 12 cores, and 3+4=7 in 1 of 12 cores. After opting for radiation therapy, the patient underwent SpaceOAR placement and was given a six month dose of androgen deprivation therapy. However, during computed tomography planning, small bowel was seen in the radiation field in proximity to the prostate. As a result, the radiation was thought to be unsafe and the patient ultimately underwent robot-assisted laparoscopic prostatectomy. The excised prostate and seminal vesicles were sent for final pathology.

The prostatectomy specimen was received and processed by pathology with only the clinical history of “prostate cancer,” without mentioning the history of the spacer gel placement. Upon gross examination, the 64 gram prostate had periurethral nodules consistent with prostatic hypertrophy, but no additional lesions grossly. The prostate gland was entirely embedded for microscopic examination. Routine hematoxylin and eosin (H&E) stained slides demonstrated Gleason score 4+3=7 acinar adenocarcinoma, with multifocal areas of adjacent acellular pale blue substance, morphologically appearing consistent with mucin (Figures 1 and 2). The apparent mucinous material was surrounded by proliferations of atypical-appearing epithelioid cells and multinucleated cells, which extensively involved the extraprostatic tissue, the surgical margins, and the bilateral seminal vesicles.

The differential diagnosis at this point included mucinous adenocarcinoma and granulomatous inflammation. A mucicarmine stain was positive in the mucinous material (Figure 3). The cellular proliferation surrounding the mucinous proliferations proved to be histiocytic by immunohistochemistry, positive for CD68 and negative for cytokeratins (AE1/AE3 and CAM5.2) (Figure 4). A modified Ziehl-Neelsen stain was negative for acid fast organisms. After obtaining the complete patient history available in the electronic health record, these changes were thought to correlate with the prior hydrogel placement. Thus, we made the final diagnosis of pT2No prostatic adenocarcinoma. At the follow-up examination three months after the prostatectomy, the patient had an undetectable PSA and was down to one pad per day for urinary incontinence.

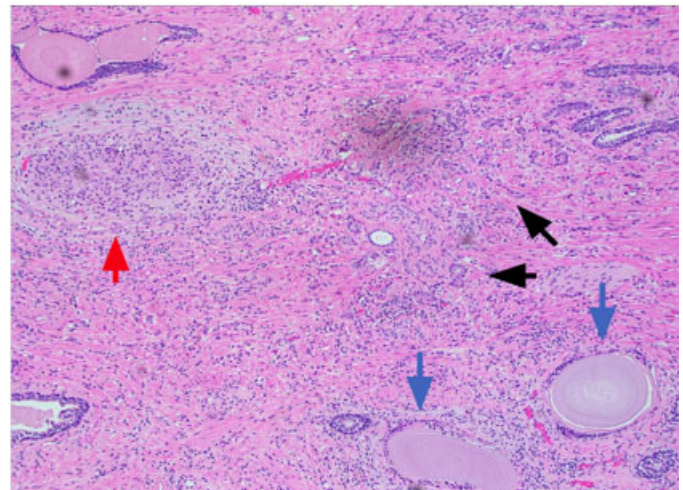


Figure 1: Cystic formations with epithelioid histiocytes and mucin (lower right, blue arrows) with intermixed prostatic acinar adenocarcinoma (Gleason grade 4+3; middle to upper right, black arrows) and granulomatous formations (upper left, red arrow) (Hematoxylin and eosin stain; 100× magnification).

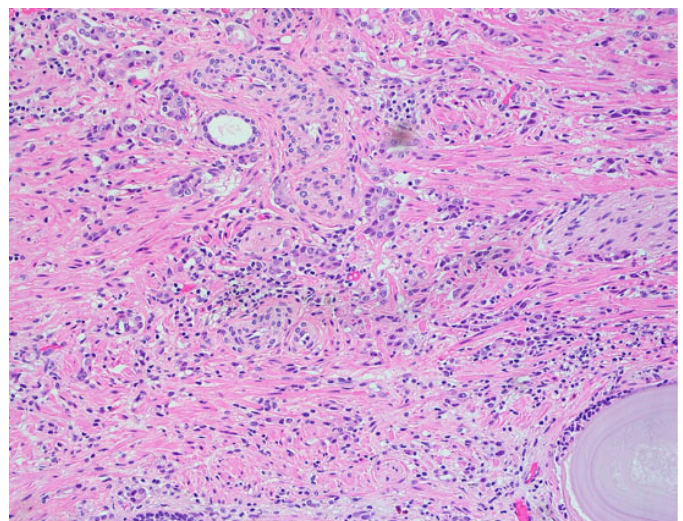


Figure 2: Closer magnification showing cytologic features of the neoplastic glands (upper left to center) intermixed with granulomatous formations and epithelioid histiocytes (center to lower right) with a cystic formation at the lower right aspect. Some cells share similar cytologic qualities such as vesicular chromatin and prominent nucleoli. Although glandular formation can readily distinguish these populations, single cells and poorly formed glands (such as those in Gleason grade 4 and 5 adenocarcinoma) can be difficult to distinguish by routine histology (Hematoxylin and eosin stain; 200× magnification).

DISCUSSION

This case highlights three important points. First, to describe the histopathological changes in a prostatectomy specimen status post hydrogel placement for radiation treatment of prostate cancer as it is not well documented. Second, to distinguish the differential diagnoses of granulomatous prostatitis and mucinous

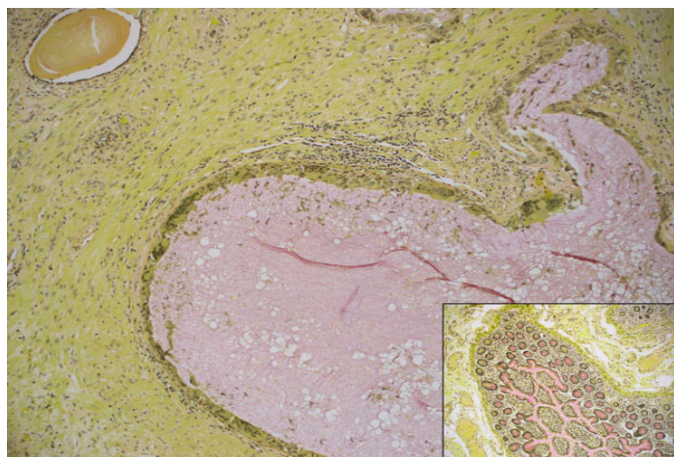


Figure 3: A mucicarmine stain (Ventana; Roche) shows mild reactivity within the SpaceOAR gel. As compared to the control tissue, this is similar in appearance to extravasated mucin. Close inspection shows rare epithelioid histiocytes with intracytoplasmic mucin within the wall. Benign prostatic tissue with corpora amylacea in the upper right for comparison (insert: positive mucicarmine control) (Mucicarmine Special Stain; Vendor: Ventana, Roche; magnification: 100×).

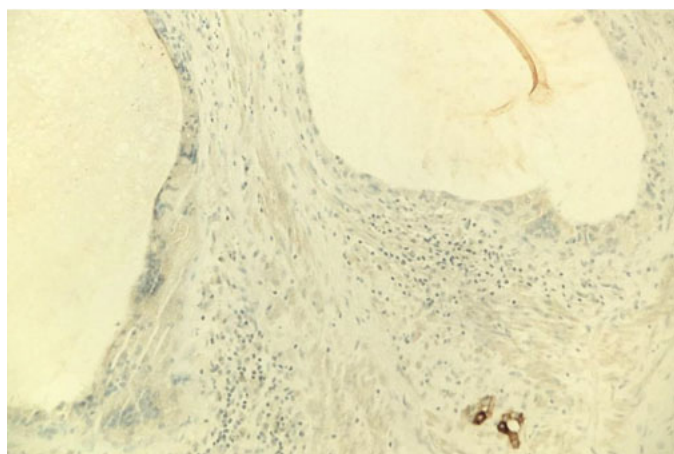


Figure 4: Cellular proliferation associated with mucin-like debris is negative for pancytokeratins by immunohistochemistry. Internal positive control staining present in tumor cells (lower right) (AE1/AE3, 200× original magnification).

adenocarcinoma. And most importantly, to conduct thorough patient history and chart review to correlate histopathologic changes in the appropriate clinical context.

The tissue reaction to the hydrogel is similar to other foreign-body giant cell reactions and granulomatous reactions. An intriguing finding in the context of hydrogel placement is the apparent mucin-like tinctorial quality of the hydrogel. The hydrogel is non-refractile, non-polarizable, and stains with mucicarmine stains, further complicating its mimicry of endogenous mucin. The surrounding histiocytic reaction comprises vaguely palisaded epithelioid histiocytes, frequent multinucleated giant cells, and scattered lymphocytes. The histiocytes are immunoreactive with CD68 immunohistochemical stains and negative for cytokeratins.

Granulomatous prostatitis is a histologic pattern with a multitude of etiologies. This case highlights a unique histologic presentation of granulomatous prostatitis associated with hydrogel spacer for radiation treatment of prostate cancer. Additional diagnostic considerations included mucinous adenocarcinoma, infectious organisms (specifically acid-fast organisms), and non-specific granulomatous prostatitis.

Mucinous adenocarcinoma of the prostate is readily excluded by immunohistochemistry, as adenocarcinoma would be expected to be immunoreactive for pancytokeratins AE1/AE3 and CAM5.2. A diagnosis of mucinous (colloid) carcinoma requires greater than 25% of the tumor volume to be glands with extraluminal mucin [2]. There appears to be no significant survival difference between mucinous adenocarcinoma and typical acinar adenocarcinoma of the prostate [3].

Lower on the differential includes infectious etiologies, specifically extrapulmonary manifestation of tuberculosis to the prostate. Despite being rare, tuberculosis prostatitis has been reported multiple times in literature and described as diffuse caseating epithelioid cell granulomas [4]. Bacillus Calmette-Guérin (BCG) is a vaccine for tuberculosis but also a common treatment for non-muscle invasive bladder cancer in the United States with risk of granulomatous prostatitis affecting up to 1% of patients [5]. However, they did not fit in the clinical context of the patient.

Non-specific granulomatous prostatitis is a diffuse granulomatous inflammation of the prostate most likely as a tissue response to duct rupture in benign prostatic hyperplasia. Clinically, it may appear as prostate cancer with elevated PSA, urinary symptoms, and palpable nodules on digital rectal examination. However, our patient had known prostatic adenocarcinoma.

CONCLUSION

In conclusion, we report a case of prostatectomy after SpaceOAR placement where the prostate specimen was sent to pathology only with clinical history of “prostate cancer.” In this context, the hydrogel had to be differentiated from granulomatous prostatitis and mucinous adenocarcinoma. Our unique case report describes the histopathological changes in a prostatectomy specimen status post hydrogel placement for radiation treatment of prostate cancer and gently reminds us to provide complete details with the histopathological requisition form to efficiently correlate histopathologic changes in the appropriate clinical context.

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Author Contributions

Kenny Lee – Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Benjamin Cook – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Theodore Crisostomo-Wynne – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Ryan Speir – Conception of the work, Design of the work, Acquisition of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Todd R Needs – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Consent Statement

Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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