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Case of NUTM::CIC fusion sarcoma surrounding inflatable penile prosthesis

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ABSTRACT

A 66 year old male with history of inflatable penile prosthesis (IPP) placement was incidentally diagnosed with a 5 cm inguinal mass abutting the IPP reservoir after prostate MRI performed for an elevated PSA. This was surgically resected en bloc with his ipsilateral testicle and IPP reservoir, with final pathology demonstrating a high-grade round cell NUTM::CIC fusion sarcoma. Management is primarily surgical, though patients with high-risk features may require adjuvant chemoradiation.

1. Introduction

Inflatable penile prosthesis (IPP) placement has commonly reported complications of device infection, erosion, and mechanical failures.[1] However, it is not generally associated with desmoplastic reactions or surrounding malignancy.[2] We present an exceedingly rare, Ewing-like round cell sarcoma encompassing the IPP reservoir and surrounding structures.

2. Case report

The patient is a 66 year old male with history of type II diabetes (HbA1c 9.1 %) and erectile dysfunction with inflatable penile prosthesis placed in 2013. He initially presented for evaluation of elevated PSA 7.7 in September 2022. MRI Prostate showed a 66g prostate without any suspicious PIRADS lesions. The MRI incidentally noted a 5cm × 3cm mass of the left inguinal canal surrounding the penile prosthesis balloon reservoir (Fig. 1). The patient began having ipsilateral groin pain shortly after his MRI, and a CT abdomen/pelvis at his local emergency room confirmed the lesion and absence of metastatic disease.

Percutaneous biopsy of the mass was performed showing malignant neoplasm with extensive necrosis. Stains were positive for vimentin, but were nonspecific for a primary site. Staging PET scan was performed and did not show evidence of metastatic disease. The case was discussed at multidisciplinary tumor board with consensus for wide local excision with ipsilateral radical orchiectomy, as well as removal of IPP reservoir due to concern for possible sarcoma. Of note, his prosthetic had not been used for some time and the patient was not sexually active; however he was interested in preservation of the IPP cylinders.

3. Operative course

Preoperative vancomycin and gentamicin antibiotics were administered. An inguinal incision was made similar to radical orchiectomy and dissected down to the external oblique fascia. There was no direct involvement with the external oblique fascia, and an incision was made in the direction of the fascial fibers. The mass was noted to be fixed to the pubic symphysis and involving a portion of the rectus muscle medially. The lateral aspects were mobilized and the external inguinal ring was encountered, and prosthetic tubing as well as the spermatic cord were identified. The spermatic cord was found to be directly involved in the mass. The tubing and spermatic cord were isolated, and the prosthetic tubing was ligated with a free tie and metal clips to preserve the rigidity of the penile cylinders.

Posteriorly, the reservoir balloon was dissected bluntly off of the bladder, and the lesion was lifted anterior and medially, away from the iliac/femoral vessels laterally. The gonadal vessels and vas deferens were identified and ligated. The left inguinal mass, left spermatic cord, and penile prosthesis reservoir were then removed en-bloc. A small segment of lateral rectus fascia and internal oblique fascia were inseparable from the mass and were removed with the specimen (Fig. 2).

With the assistance of general surgery, the floor of the inguinal canal

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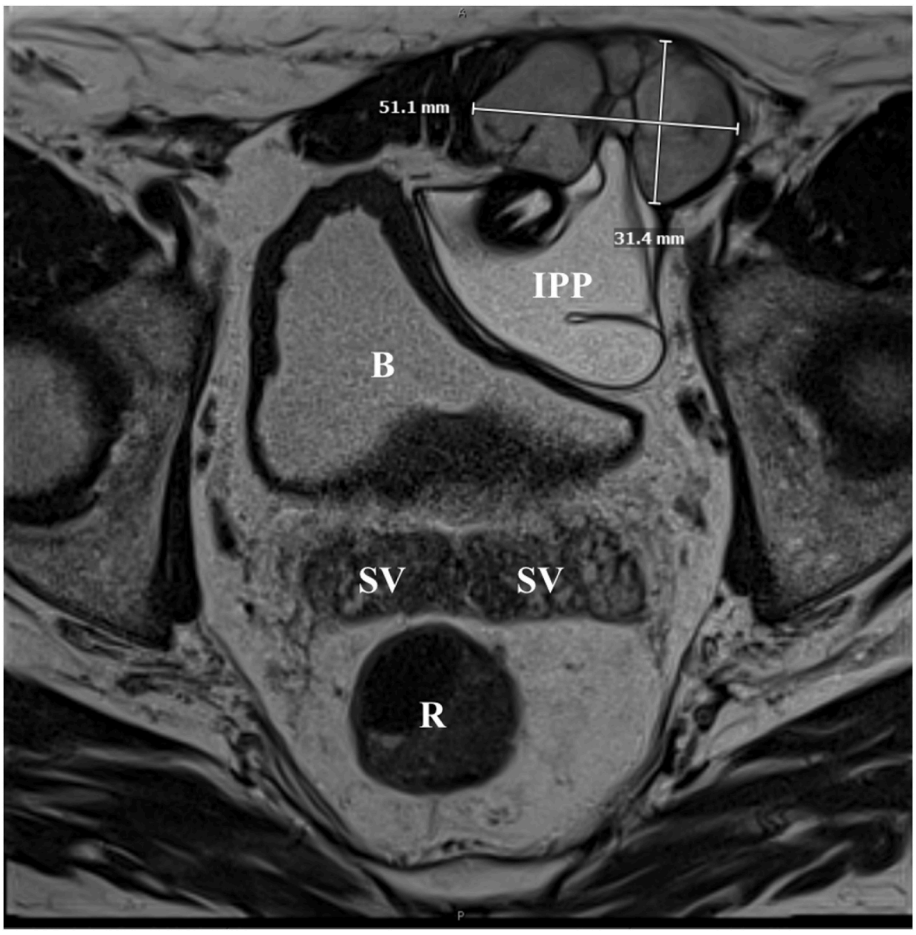

Fig. 1. Axial T2 MRI with bladder (B) and IPP reservoir (IPP) to the patient's left and mass (measured) involving reservoir and tubing directly anterior. The seminal vesicles (SV) and rectum (R) are posterior.

was repaired by suturing the conjoint tendon and internal oblique fascia to the floor of the inguinal canal. A relaxing incision in the internal oblique was made to ensure a tension-free repair. The inguinal canal was then reinforced with placement of 10 cm × 15 cm absorbable mesh.

Postoperatively, the patient was discharged on postoperative day one after passing a void trial without other complications.

Final pathology of the mass revealed a 7.1 cm dedifferentiated extraskeletal myxoid chondrosarcoma with foci of low grade chondrosarcoma (Fig. 3A and B) and surrounding high-grade round cell sarcoma (Fig. 3C) with immunohistochemistry stains positive for vimentin, INI-1, CD56, BCL-2, focally positive for CD99, GFAP, and minimally positive for S100 (Fig. 3D cartilaginous component, and focally single cells positive), and NUT1 (Fig. 3E). Ki-67 proliferative index was 30 % (Fig. 3F). Further workup including next-generation sequencing (NGS) revealed CIC::NUTM1 fusion at a sarcoma center and was reclassified as CIC::NUTM1 fusion sarcoma, high grade. No intratesticular pathology was found. He was subsequently referred to medical and radiation oncology for additional management, with plans to start chemotherapy with vincristine, actinomycin, and cyclophosphamide (VAC).

4. Discussion

NGS of this patient's tumor revealed a CIC::NUTM (CIC: Capicua transcriptional repressor, NUTM: *NUT* midline) fusion. NUT midline carcinoma is a locally aggressive, poorly-differentiated carcinoma generally found in the head and neck, while CIC fusion sarcomas are generally found in the trunk region.[3] These fusion tumors are part of a subclass of *EWSR1*-negative small round cell tumors,[4] which are similar to Ewing sarcoma but have been recently shown to be a separate molecular entity.

There are very few cases of NUTM::CIC fusion sarcomas reported overall in the adult literature, but this pathology has previously been reported in young and pediatric populations (N = 6).[3,5] It was first reported as a novel mutation in 2018.[3] In general, these sarcomas have aggressive features and poor overall survival, with 40 % of patients presenting with metastatic disease.[6] This particular fusion mutation causes an overexpression of *PEA3* genes, which is associated with resistance to MAPK inhibitors and promotion of metastases.[5] In a review of 115 patients with any CIC fusion sarcoma, there was an overall metastatic rate of 53 % with the majority to the lung, and 43 % 5-year OS.[4] Patients who received neoadjuvant chemotherapy fared worse than those who had surgery followed by chemotherapy/radiation ($p = 0.025$), however this was likely due to selection bias with a large portion of these patients presenting with metastatic disease. When stratified for localized disease, there was a trend for improved overall survival with surgery and adjuvant chemotherapy. Overall, these tumors tend to be less chemosensitive than Ewing sarcoma seen with high relapse rates and short duration of treatment response. Treatment patterns are currently based on Ewing sarcoma standards as NUTM::CIC tumors have not yet been incorporated into NCCN guidelines for sarcoma.[4,5,7]

Wide local excision of these lesions is necessary for negative margins and often requires reconstruction with tissue flaps, or in this case, mesh placement for repair of the inguinal canal. This was done with the use of absorbable mesh for presumed postoperative radiotherapy. In our patient with high-risk features, he will begin adjuvant treatment of

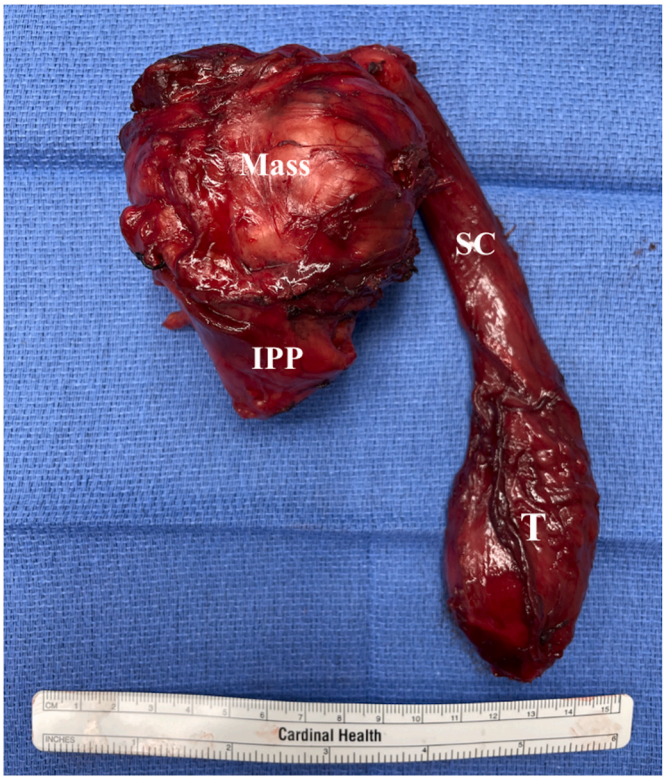

Fig. 2. Final specimen with mass (labeled) adjacent to IPP reservoir. Left spermatic cord (SC) and testicle (T) were also removed.

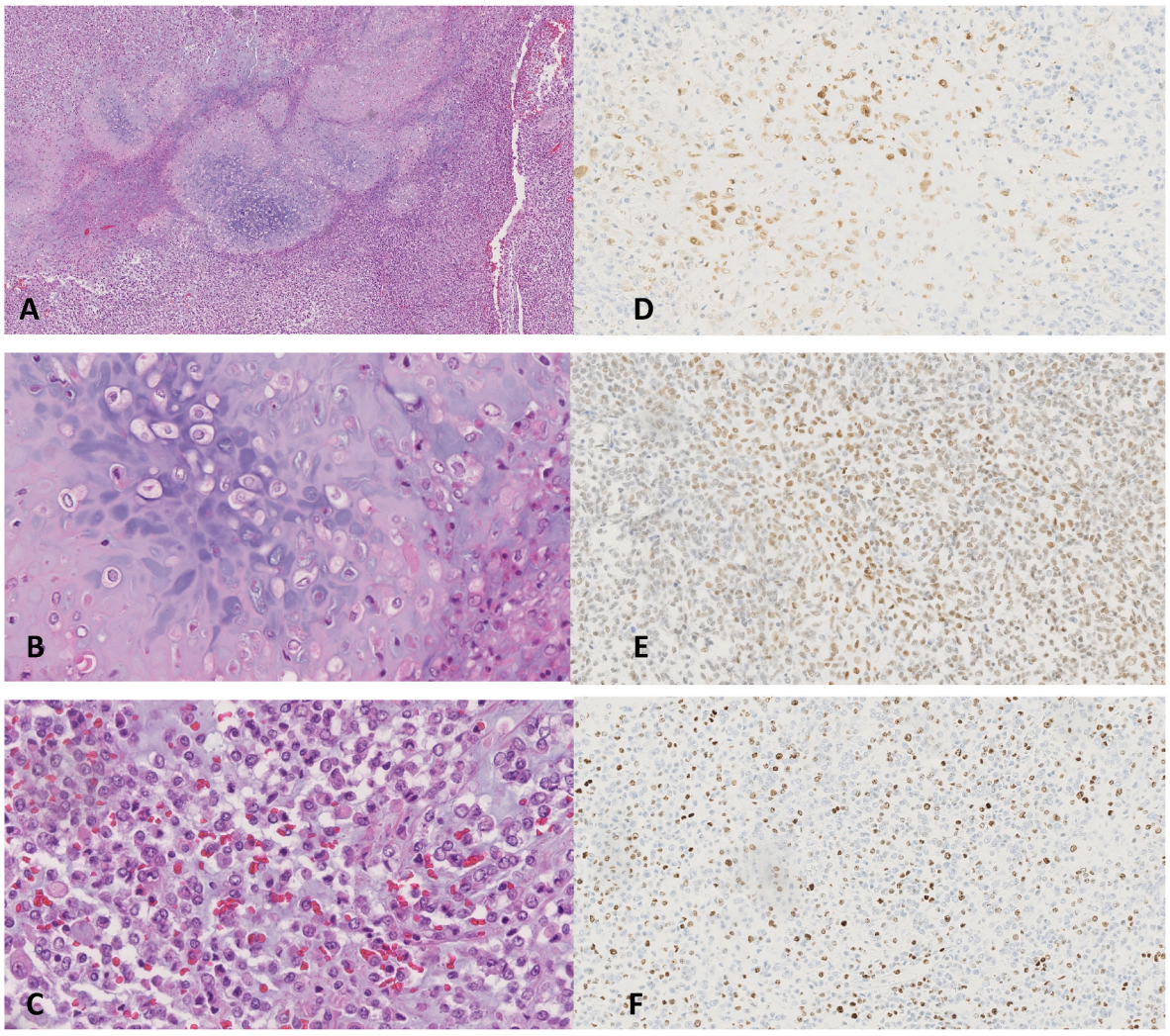

Fig. 3. Histologic examination of the mass showing islands of chondrosarcoma (A, 50x) (B, 200x), surrounded by high grade round cell sarcoma (C, 200x). By immunohistochemistry, chondrosarcoma component is positive for S-100 (D, 200x), and round cell sarcoma is positive for NUT (E, 200x). Ki-67 was high in the round cell sarcoma component (F, 200x).

chemotherapy. There is no correlation in the literature between device placement and surrounding sarcoma, and this is likely an unfortunate concomitant pathology requiring a complex surgical intervention. On review, this is the first such reported case of tumor encasing an IPP in the literature.

5. Conclusion

This is a rare case of NUTM::CIC fusion sarcoma involving an IPP requiring complicated extirpative surgery with removal of IPP reservoir and subsequent adjuvant multimodal treatment.

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Abbreviations:

BCL:: B-cell lymphoma
CD##: Cell differentiator ##
CIC: Capicua transcriptional repressor
GFAP: Glial fibrillary acidic protein
HbA1c: Hemoglobin A1c
INI51: Integrase interactor
IPP: Inflatable penile prosthesis
MRI: Magnetic resonance imaging
NCCN: National Comprehensive Cancer Network
NUTM: NUT midline carcinoma
PEA: Polyoma enhancer activator
PET: Positron-emission tomography
PSA: Prostate-specific antigen
PIRADS: Prostate Imaging Reporting & Data System
TRUS:: Transrectal ultrasound