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Case Report

Two-year follow-up of a thyroid cartilage metastasis from prostate cancer: A case report[☆]

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ABSTRACT

Few case reports describe metastatic prostate cancer to the thyroid cartilage. While earlier reports identified the metastatic lesions upon developing symptoms, more recent ones have detected them via prostate-specific membrane antigen positron emission tomography (PSMA PET). Herein, we report the case of a patient with metastatic castrate-resistant prostate cancer and a PSMA PET-detected lesion in the thyroid cartilage. Over the course of 2 years, he received multiple lines of chemotherapy and hormonal therapy, and his overall disease status fluctuated — some nodal and bony metastases resolved while others appeared anew. His thyroid cartilage lesion, however, slowly progressed in a consistent fashion with increasing uptake on successive PSMA PET images. Apart from mild dysphonia, the patient remained to be asymptomatic from this lesion, and no local therapies were used. To our knowledge, this is the first close follow-up of prostate cancer metastatic to the thyroid cartilage, shedding light on the course of such lesions and helping answer management-related questions, which are particularly relevant as more occult metastases are discovered in the PSMA PET era.

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Introduction

Prostate cancer is a prevalent malignancy in males that ranks as the third leading cause of death globally [1]. While it generally has a favorable course, documented cases of aggressive behavior and poor prognosis exist [2]. As part of the standard protocol for prostate cancer diagnosis, digital rectal examination (DRE), measurement of prostate-specific antigen (PSA) levels, and magnetic resonance imaging (MRI) are rec-

ommended [3]. Following diagnosis, it is critical to adequately stage the disease and plan the management accordingly [4].

The most common metastatic sites for prostate cancer are the: bone (84%), distant lymph nodes (10.6%), liver (10.2%), and thorax (9.1%) [5]. In the literature, few case reports describe metastatic lesions to the thyroid cartilage, with the first case published in 1954 [6]. Identifying both common and uncommon locations of metastases has increased since the implementation of prostate-specific membrane antigen positron emission tomography/computed tomography (PSMA PET/CT)

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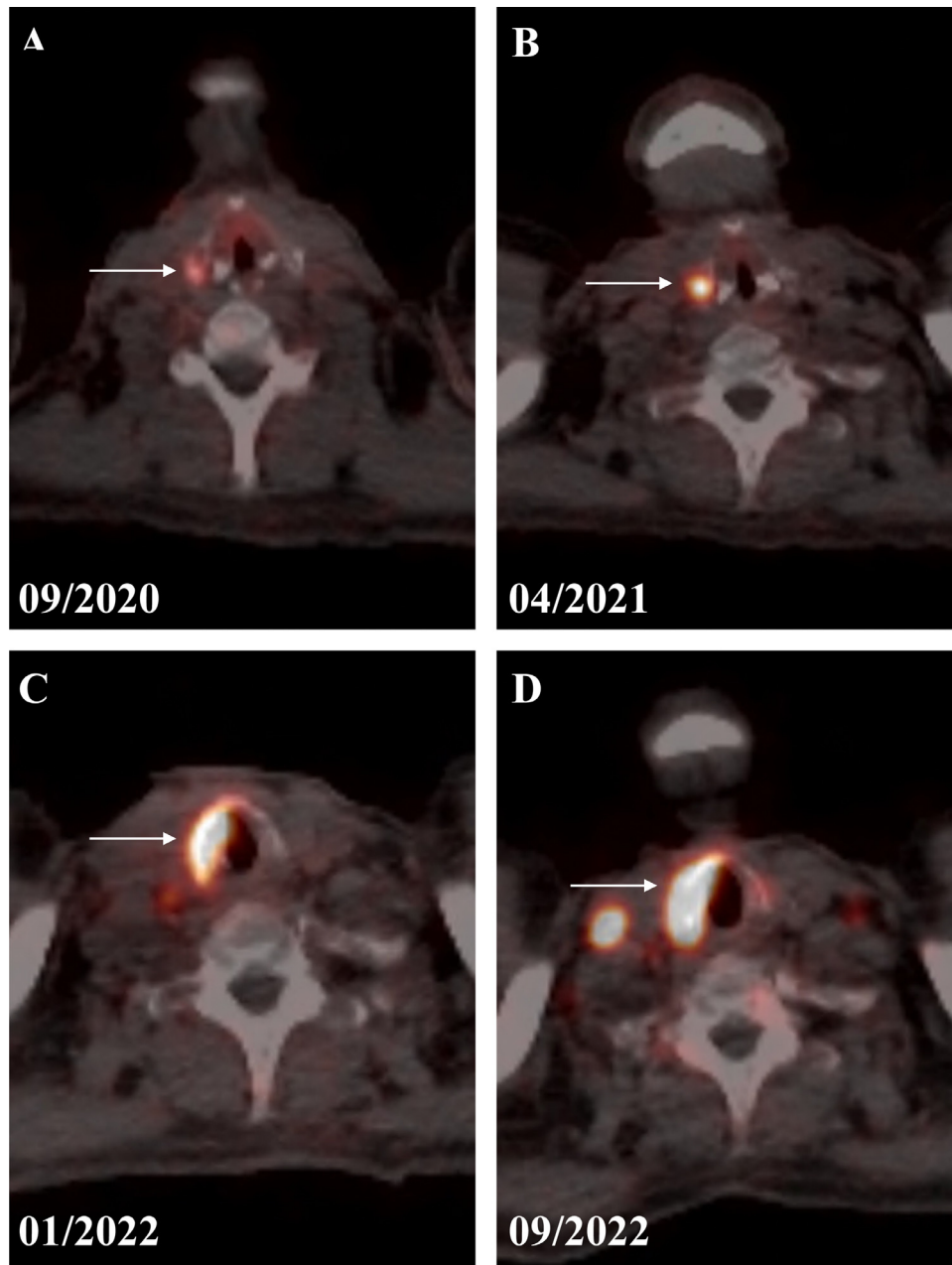


Fig. 1 – Fused axial ^{68}Ga -PSMA PET images show progressively increasing uptake in the thyroid cartilage.

scan which is highly sensitive [7]. Unfortunately, when the thyroid cartilage is involved, the patient's prognosis is expected to be poor as it indicates extensive metastases [7]. This report demonstrates the case of a patient with metastatic castrate-resistant prostate cancer who was diagnosed with a thyroid metastatic lesion via PSMA PET/CT and who was subsequently followed up for more than 2 years.

Case narrative

A man in his early 60s presented to the oncology clinic with a 2-month duration of urinary symptoms and unintentional

weight loss in 2018. Workup revealed a PSA level of 74, prostate adenocarcinoma involving both lobes with a Gleason score of 7(4+3), and a high volume of bone and nodal metastases. The latter were detected on fluorodeoxyglucose-positron emission tomography (FDG-PET) scan done at an outside institution. He was diagnosed with de-novo high-volume metastatic prostate cancer.

After 6 cycles of chemotherapy (Docetaxel) along with androgen deprivation therapy (ADT), his PSA reached a nadir of 0.17. Despite maintenance of ADT and suppression of testosterone, PSA levels started to rise in 2020, indicating that the patient's prostate cancer became castrate-resistant. A PSMA PET/CT scan showed multiple nodal and bone metastases along with a new radiotracer-avid lesion

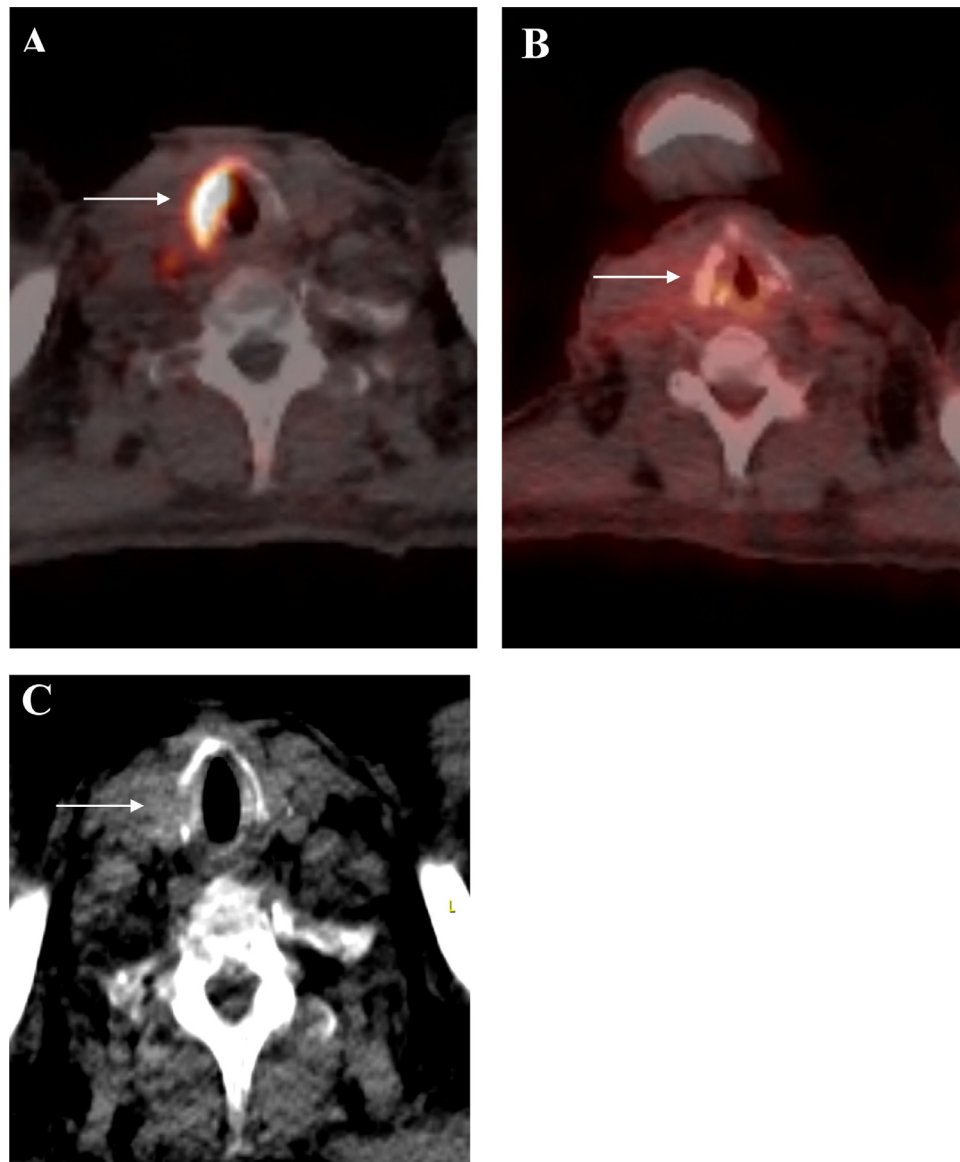


Fig. 2 – Fused axial ^{68}Ga -PSMA PET image (A) shows uptake in the thyroid cartilage versus the fused axial FDG PET image (B) which does not show uptake versus the lesion seen on CT scan (C) which can be challenging.

in the right thyroid cartilage with an SUV max of 6.5 (Fig. 1A).

Over the following months, the patient's disease slowly progressed despite adding enzalutamide to ADT. While some lesions resolved on imaging, others appeared anew, particularly in bone. The lesion in the thyroid cartilage demonstrated increased radiotracer uptake on PSMA PET/CT (Figs. 1B and C), but it remained nonavid on FDG PET (Fig. 2).

As of 2022, and in the setting of a rising PSA, the patient received 6 cycles of chemotherapy (Cabazitaxel). He also presented to the radiation oncology clinic for palliative radiotherapy of painful bone metastases. On his most recent PSMA PET/CT imaging, his thyroid cartilage lesion became further PSMA PET avid (Fig. 1D), and it remained largely asymptomatic, aside from mild dysphonia as per the patient.

Fig. 3 shows the progression of PSA over time and the treatment modalities the patient received.

Discussion

The thyroid cartilage is a rare site for metastases due to its poor vasculature. The pathophysiology is thought to include 3 steps: (1) cancer cells spread to hematopoietic foci within calcified cartilage, (2) cells proliferate to invade the perichondrium/periosteum, and (3) tumor extends to nearby soft tissues [8]. Symptoms may not arise until step 3, and it is unknown how long the first 2 steps may take.

A handful of case reports in the literature describe metastatic prostate cancer to the thyroid cartilage. The first report was in 1954, with the metastatic lesion discovered post-mortem on autopsy [6]. Over the next 60 years, only 6 articles were published on the topic. Some cases were discovered post-mortem [8], while others presented with a palpable cervical mass [9–13]. Of those, 1 patient had felt an anterior neck mass

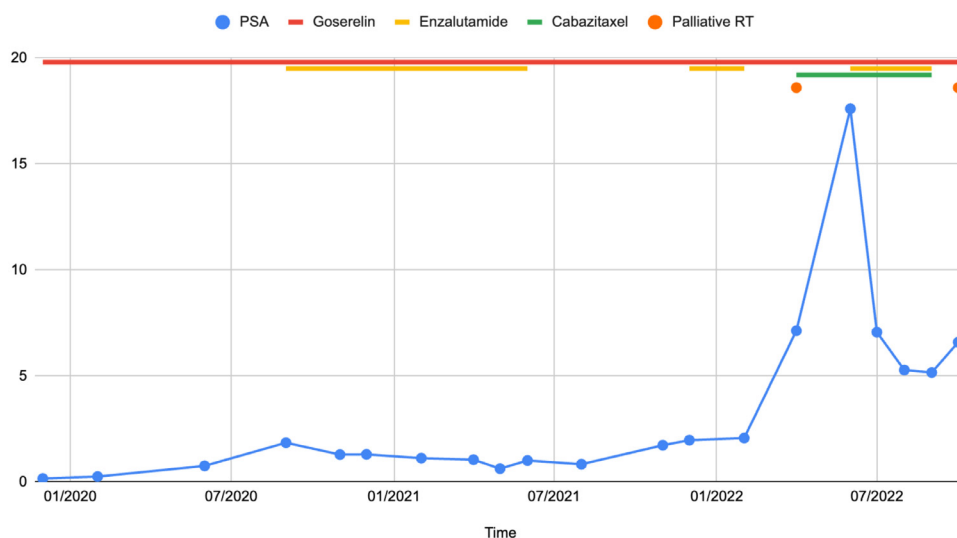


Fig. 3 – Variation of prostate specific antigen (PSA) with time along with the treatments the patient received since PSA nadir after first-line therapy.

N.B. Baseline PSA level was 74 ng/mL on December 2018. After first-line Docetaxel + ADT, it reached a nadir of 0.17 ng/dL on December 2019. Enzalutamide was not taken consistently due to unavailability.

for a year and a half prior to being diagnosed with metastatic prostate cancer [9], and another developed hoarseness and vocal cord paralysis 9 years after being treated for his prostate malignancy [11]. Finding prostate cancer cells in the thyroid cartilage was unpredictable — 1 patient had undergone both total laryngectomy and thyroidectomy for presumed thyroid cancer [10], while another had undergone a partial laryngectomy for suspected chondrosarcoma [13].

In 2019, Tupalli et al. [14] reported the case of a patient with newly diagnosed prostate cancer who, on staging PSMA PET CT, had uptake in the thyroid cartilage in addition to extensive skeletal metastases. Since then and in just 2 years, at least 9 patients were diagnosed in a similar fashion with the thyroid cartilage lesions detected only after the PSMA PET scan [7,15,16]. Imaging was done either for initial staging or following biochemical recurrence. The same could be said for our patients. Had it not been for the imaging, we would not have known about his thyroid cartilage metastasis, as he remained largely asymptomatic.

Among the recent case series, only 1 described the patient's course on follow-up [15]. He had a history of castrate-resistant prostate cancer with the thyroid cartilage as the solitary site of relapse. Despite receiving systemic treatments (Bicalutamide and Triptorelin), the lesion enlarged over the course of 5 months and further involved the surrounding soft tissues. Accordingly, radiotherapy was recommended [15]. As per a recent report, such lesions can significantly grow to then potentially compromise the airway [17]. Similarly, our patient was diagnosed with metastatic castrate-resistant prostate cancer. However, he had a much more extensive disease with significant nodal and bony metastases. And yet, his thyroid cartilage lesion very slowly progressed in comparison. This is particularly interesting given how his disease behaved in other skeletal areas. To the best of our knowledge, this is the first report to follow up for more than 2 years on a patient with metastatic

prostate cancer to the thyroid cartilage. With that, we provide successive PSMA PET images and supplement the literature in understanding the course of such lesions.

It is no surprise that metastases are detected earlier with the advent of PSMA PET. This modality uses a radio-tracer that binds to prostate-specific membrane antigen (PSMA), a transmembrane glycoprotein that is significantly expressed in prostate cancer cells. PSMA expression increases with increasing Gleason score and is upregulated with the rise of androgen independence [18]. In comparison to other PET modalities, mainly ^{18}F -choline(FCH)-PET, PSMA PET detects more lesions and at lower PSA levels with a 50% detection rate at a PSA level as low as 0.5 ng/mL [19]. Although no direct comparative studies exist between PSMA PET and the more common FDG PET, some studies such as the “MISTAR Trial” have shown that PSMA PET CT may be more sensitive in identifying disease burden in patients with metastatic castration-resistant prostate cancer (mCRPC) when compared to FDG-PET [20]. These findings highlight the potential of PSMA PET as a valuable imaging modality for prostate cancer diagnosis and management.

We foresee that more metastatic lesions to the thyroid cartilage will be detected as PSMA PET is more widely adopted. We also foresee more questions arising, such as: *When should metastatic thyroid cartilage lesions be managed? And how?* In these instances - as with all oncologic decisions - the patient's overall status is a key determinant. In case of obstruction, ensuring a patent airway is first and foremost [17]. In case of a symptomatic lesion, palliative treatment shall be attempted. Due to the challenging location of the thyroid cartilage, radiotherapy may be a more feasible option than surgery [15]. And lastly, in case of an asymptomatic lesion, as in our patient, management shall be determined by the overall tumor burden, with systemic treatments (hormonal and/or chemotherapy) or palliative care as options.

The high accuracy of PSMA PET imaging provides physicians with the ability to detect tumors earlier and intervene earlier. That said, PSMA PET has some limitations, with the possibility of false positive results leading to unnecessary biopsies or treatments [21]. Clinicians should remain prudent on how to interpret new findings on imaging and judiciously make treatment decisions.

Conclusion

Prostate cancer metastasis to the thyroid cartilage is rare with few reports in the literature. Herein, we presented the case of a patient with metastatic castrate-resistant prostate cancer and a PSMA PET-detected thyroid cartilage lesion. We followed up with the patient for over 2 years and noted the relatively slow progression of the thyroid cartilage lesion that remained minimally symptomatic not requiring any specific treatment. We anticipate this to shed light on the case-specific behavior of such lesions.

Patient consent

I am writing to confirm that I have obtained the patient's informed consent for the publication of the case report which includes details of his/her medical condition and treatment. The consent is an essential ethical requirement to ensure transparency and respect for the rights of a patient.

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