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Oligorecurrent prostate cancer presenting as isolated testicular metastasis: a rare case report

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Testicular metastasis from prostate cancer is extremely rare, and on conventional radiological imaging, features can be non-specific, making diagnosis challenging. We report a case of a 63-year-old man with locally advanced prostate adenocarcinoma initially treated with radiotherapy and a 3-year course of androgen deprivation therapy. During follow-up, a rising PSA level prompted further evaluation. Conventional imaging revealed a heterogeneous lesion in the left testis. The patient underwent a left radical orchiectomy. Histological and immunohistochemical analysis confirmed a high-grade metastatic prostate adenocarcinoma. Postoperatively, the PSA level decreased to 0.04 ng/ml and remained stable for at least 2 years under active surveillance with PSA monitoring. This case demonstrates the potential of radical orchiectomy as a metastasis-directed approach for isolated testicular metastasis from castration-sensitive prostate cancer, delaying the need for systemic treatment. Further studies are needed to clarify its place in clinical practice.

KEYWORDS
case report, metastasis-directed therapy, prostate cancer, PSA, testis

1 Introduction

Prostate cancer is the second most diagnosed cancer among men worldwide and the most frequently diagnosed cancer in 118 countries, with an estimated 1.5 million new cases (1). About 75% of patients are diagnosed with localized prostate cancer. However, despite radical treatment, distant metastases develop in 2%–56% of cases (2). Prostate cancer spreads through both lymphatic and hematogenous pathways. Early dissemination most commonly occurs via the lymphatic system to the regional pelvic lymph nodes. Hematogenous spread predominantly results in bone metastases, which represent the most common site of distant spread and occur in approximately 80–90% of patients with metastatic disease. The liver and lungs are the next most frequent metastatic sites, whereas distant lymph nodes and adrenal glands are less commonly involved (3–5). The cornerstone of treatment for progressing, hormone-sensitive metastatic prostate cancer is androgen deprivation therapy (ADT) (2).

Prostate cancer metastasis to the testis is an extremely rare phenomenon, occurring in 0.18–0.5% of all metastatic cases (3, 6). This rarity has been attributed to the unique anatomical and physiological characteristics of the testes. The lower temperature creates an unfavorable microenvironment for the survival and proliferation of tumor cells, whereas the blood–testis barrier, which physiologically protects spermatozoa, plays an indirect protective role by limiting tumor cell invasion into the testes (7).

In this report, we present a 63-year-old man who developed an isolated prostate cancer metastasis to the left testis after external beam radiation therapy, high-dose-rate brachytherapy, and a 3-year course of ADT.

2 Case presentation

A 63-year-old man was initially diagnosed with locally advanced prostate cancer (cT3bN1M0) in 2019. Histopathological analysis of prostate biopsy revealed prostate adenocarcinoma with Gleason score 7 (4 + 3), International Society of Urological Pathology (ISUP) grade group (GG) 3 cancer, with six out of eight biopsy cores positive (right lobe 4/4, left lobe 2/4), and tumor tissue comprising up to 90% of the volume of both lobes. The PSA level was 11.8 ng/ml. Multiparametric prostate MRI demonstrated invasion to the seminal vesicles and neurovascular bundles, as well as abnormal lymph nodes along the external iliac vessels bilaterally. No evidence of distant metastases was detected on chest and abdominopelvic CT scan or bone scintigraphy. The multidisciplinary tumor board recommended pelvic external beam radiation therapy (50 Gy/25 fractions), high-dose rate brachytherapy (9 Gy/2 fractions), and a 3-year course of ADT with a GnRH analogue, triptorelin. The PSA reached a nadir of 0.07 ng/ml during an active treatment period.

In 2022, 5 months after completing the 3-year course of ADT, routine follow-up revealed a rise in the PSA level to 3.28 ng/ml. The chest and abdominopelvic CT, prostate multiparametric MRI, and bone scintigraphy showed no signs of local recurrence or skeletal involvement but detected a heterogeneous contrast-enhancing lesion in the left testis. Physical examination revealed an enlarged, firm, and irregular left testis, testicular ultrasound demonstrated a heterogeneous mass. Testicular cancer serum markers (LDH, hCG, AFP) were within normal limits. Differential diagnosis consisted of a second primary tumor and a metastatic lesion. The patient underwent a left radical orchiectomy. Histopathological examination revealed an extensive 20 × 10 × 50 mm tumor within a fibrotic stroma, comprising cribriform growth with comedo-necrosis resembling prostate adenocarcinoma, Gleason score 9 (4 + 5), ISUP GG 5 (Figure 1). Immunohistochemical analysis with positive prostatic-specific acid phosphatase (PSAP) marker confirmed metastatic prostate adenocarcinoma in the testis (Figure 2). Following the surgery, the PSA level decreased to 0.04 ng/ml. PSA levels were initially monitored by a urologist every 1–3 months and later every 6 months during follow-up, with additional measurements every 2 months performed by a general practitioner (Figure 3). Two years after orchiectomy, the PSA level remains stable, with a slight increase to 0.38 ng/ml with PSA doubling time of 5.4 months, and a testosterone level of 3.91 nmol/l.

3 Discussion

We report a case of isolated testicular metastasis from prostate cancer managed with surgical metastasis-directed therapy (MDT) alone following multidisciplinary tumor board discussion, with ADT deferred in accordance with the patient's strong preference to postpone systemic treatment, followed by a favorable biochemical response, with PSA decreasing to 0.04 ng/ml after surgery.

Isolated testicular metastasis from prostate cancer is a rare clinical finding. We reviewed the limited number of reported cases over the past decade (Table 1) (8–21). Most cases describe testicular metastases developing metachronously following definitive treatment of the primary tumor, including radical prostatectomy or radiotherapy with ADT. The time interval between the initial diagnosis and development of testicular metastasis varies widely, ranging from several years to more than two decades.

The clinical manifestation of testicular metastasis is often asymptomatic and is detected during active radiological imaging for biochemical recurrence (10–12, 16, 17, 20, 21). A similar scenario occurred in our case, where initial radiological imaging incidentally revealed a mass in the left testis. Subsequent testicular ultrasound demonstrated a heterogeneous lesion with non-specific features, raising the possibility of either a primary testicular tumor or metastatic prostate cancer. Given the elevated PSA level and the patient's oncological history, metastatic prostate cancer was considered the most likely diagnosis in this case and should be an important consideration in the differential diagnosis in similar clinical settings. However, a primary testicular

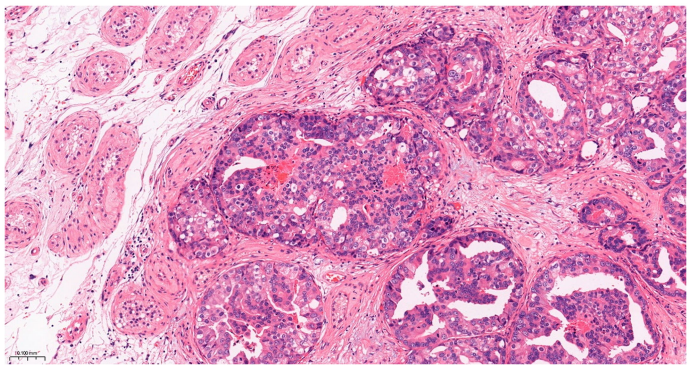


FIGURE 1
Histopathological examination by hematoxylin & eosin: Testicular tissue infiltration by metastatic prostatic acinar adenocarcinoma, Gleason score 9 (4 + 5).

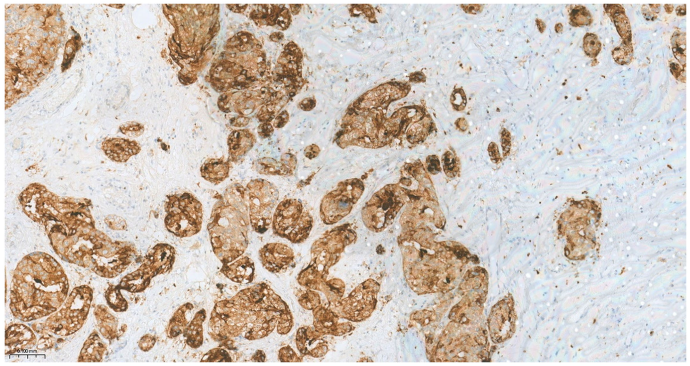


FIGURE 2
Immunohistochemical examination: Moderately strong diffuse cytoplasmic reaction with PSAP marker, confirming prostatic tissue origin.

tumor could not be excluded, with spermatocytic tumor consistent with the patient's age and normal levels of testicular cancer serum markers. When symptoms are present, patients may report testicular enlargement, induration, swelling, or pain. In some cases, testicular metastases may mimic benign conditions such as hydrocele (15) or orchitis (9, 16), which may challenge diagnosis-making. Testicular ultrasound remains the first-choice imaging modality for evaluating testicular lesions.

Recent reports highlight the growing role of 68-Gallium prostate-specific membrane antigen (^{68}Ga-PSMA) PET/CT in the evaluation of metastatic prostate cancer (11, 12, 16, 17, 20–22). This imaging modality has demonstrated superior diagnostic accuracy compared with conventional imaging techniques, particularly for the early detection of low-volume metastases in advanced prostate cancer (23). Given its high sensitivity and specificity, ^{68}Ga-PSMA PET/CT can detect metastatic lesions even in rare sites, such as the testes, enabling more precise MDT. A key limitation of our case is the absence of ^{68}Ga-PSMA PET/CT imaging at the time of biochemical recurrence. At that time, this imaging modality was not available in our country. The absence of PSMA-based imaging may have limited the detection of possible micrometastatic disease and, therefore, could have influenced staging accuracy as well as subsequent treatment decisions.

The primary treatment for testicular metastasis is surgical removal. Radical orchiectomy serves both therapeutic and diagnostic purposes, as histological analysis of the surgical specimen contributes to determining the origin of the mass. The microscopic architecture of testicular metastasis often resembles the primary tumor structure, although final confirmation requires immunohistochemical analysis with prostate-specific markers.

Currently, there is no standardized approach regarding postoperative management following orchiectomy for isolated testicular metastasis. In many reported cases, surgery is supplemented by adjuvant ADT, which is pharmacological in most cases; rarely, bilateral orchiectomy is performed (11). However, several reports have demonstrated that MDT alone may provide meaningful disease control in selected patients. Bonetta et al. reported a patient who declined ADT after radical orchiectomy and remained in remission,

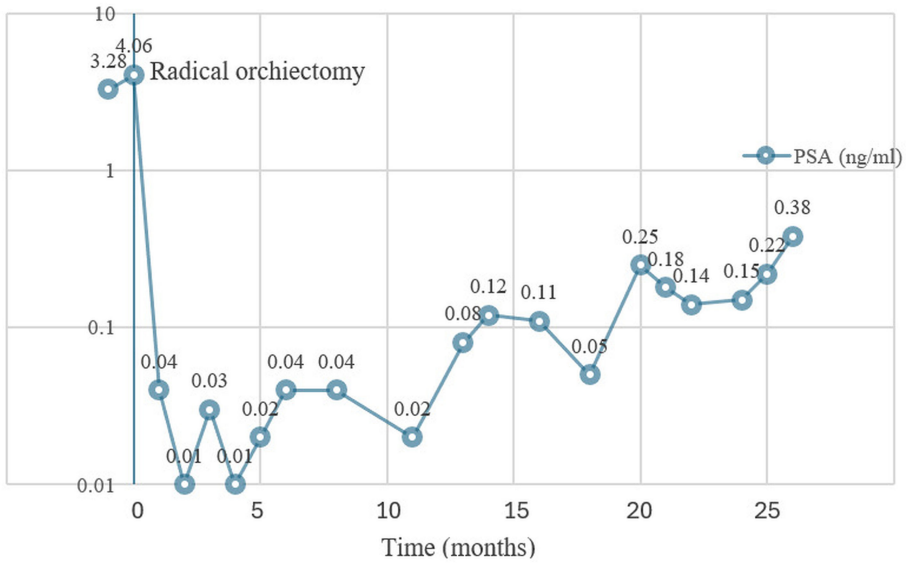


FIGURE 3
Timeline of PSA levels during active biochemical surveillance by PSA monitoring after radical orchiectomy.

TABLE 1 Summary of cases reported in the literature over the past decade.

No.	Study	Age	Primary cancer characteristics	Timing from initial diagnosis to metastasis	Hormonal status	Management	Adjuvant ADT	Outcomes
1	Shinn et al. (2015) (8)	68	pT3aN0M0, ISUP GG 1	15 years	Off ADT	Radical orchiectomy, L	Yes	N/A
2	Lee et al. (2017) (9)	60	cT3bN0M1, ISUP GG 3	Synchronously	Off ADT	Radical orchiectomy, R	No	Disease progression
3	Bonetta et al. (2017) (10)	58	pT3bN0M0, ISUP GG 5	2.5 years	Off ADT	Radical orchiectomy, L	No	Biochemical control achieved
4	Abou Heider et al. (2019) (11)	79	pT3bN0M0, ISUP GG 3	16 years	On ADT	Bilateral radical orchiectomy	Yes	Biochemical control achieved
5	Gupta et al. (2021) (12)	69	pT3bN1M0, ISUP GG 3	8 years	Off ADT	ADT	N/A	N/A
6	Fortier et al. (2022) (13)	64	ISUP GG 1	22 years	On ADT	Radical orchiectomy, R	Yes	Biochemical control achieved
7	DiMarco et al. (2022) (14)	79	cT2aN0M0, ISUP GG 1	12 years	Off ADT	Radical orchiectomy, R	Yes	Biochemical control achieved
8	Robinson et al. (2024) (15)	67	cT3bN0M0, ISUP GG 5	10 years	Off ADT	Radical orchiectomy, L	Yes	Biochemical control achieved
9	Rienzo et al. (2024) (16)	70	ISUP GG 5	N/A	Off ADT	Radical orchiectomy, R	N/A	Biochemical control achieved
10	Tabibi et al. (2025) (17)	61	cT2cN0M0, ISUP GG 5	4 years	Off ADT	Radical orchiectomy, L	Yes	Biochemical control achieved
11	Waraich et al. (2025) (18)	82	cT2bN0M0, ISUP GG 3	15 years	Off ADT	Radical orchiectomy, L	Yes	Biochemical control achieved
12	Chang et al. (2025) (19)	63	pT3aN0M0, ISUP GG 4	1.5 years	N/A	Radical orchiectomy, L	N/A	N/A
13	Semmler et al. (2025) (20)	66	pT3bN0M0, ISUP GG 4	2 years	Off ADT	Radical orchiectomy, L	No	Disease progression
14	Gutjahr-Holland et al. (2025) (21)	62	ISUP GG 2	4 years	Off ADT	Radical orchiectomy, R	No	Biochemical control achieved

maintaining a PSA of 0.01 ng/ml at 5 years (11). Gutjahr-Holland et al. reported a case that closely resembled ours and involved the use of radical orchiectomy as MDT without concurrent ADT, with close PSA monitoring every 3 months (21). In a small case series reported by de Oliveira Taveira et al., five patients with isolated testicular metastasis were managed with surveillance following orchiectomy. After a median follow-up of 33 months, 3 of the 5 patients were still under surveillance, while 2 experienced disease progression requiring treatment escalation (22). However, active surveillance by PSA monitoring carries certain risks and considerations and therefore requires a high level of patient understanding and cooperation. Semmler et al. reported a case in which postoperative ADT was initially withheld; however, one year later the patient developed lymph node metastases, requiring initiation of systemic therapy combined with chemotherapy (20). A similar clinical scenario was reported by Lee et al., in which bone metastasis developed after 2 years of active surveillance and ultimately progressed to castration-resistant prostate cancer. Ongoing clinical trials such as STOMP and ORIOLE have investigated MDT, including surgery or stereotactic body radiotherapy, in castration-sensitive oligometastatic prostate cancer, suggesting that MDT can delay or postpone the need for ADT in selected patients with oligorecurrent disease. However, it remains an experimental strategy, and further phase III results and large randomized studies are required to define its optimal timing, clinical role, and long-term efficacy (24–26).

4 Conclusions

Isolated testicular metastasis from prostate cancer represents an exceptionally rare clinical phenomenon for which

standardized management guidelines are lacking. This case report demonstrates the potential of radical orchiectomy as MDT approach for isolated testicular metastasis, delaying the need for systemic treatment.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material. Further inquiries can be directed to the corresponding author.

Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

KV: Conceptualization, Data curation, Methodology, Project administration, Visualization, Writing – review & editing, Writing – original draft. RJ: Conceptualization, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

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Generative AI statement

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fonc.2026.2000713/full#supplementary-material

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