Case Report

Mixed germ cell tumor of the testis in a young adult: A case report

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ABSTRACT

Testicular germ cell tumors (TGCTs) are the most common solid malignancy in young men aged 15–35 years, with mixed germ cell tumors posing particular diagnostic and staging challenges due to their combined seminomatous and non-seminomatous composition. We report a 22-year-old male who presented with a 4-month history of progressive right scrotal swelling. Imaging revealed bilateral common iliac and paraaortic lymphadenopathy. He underwent right radical orchidectomy. Histopathology confirmed a mixed seminomatous–non-seminomatous germ cell tumor (90% seminoma, 10% embryonal carcinoma) with lymphovascular invasion, staged as pT2 (AJCC 8th Edition). This case underscores the importance of complete pre-operative tumor marker assessment, including serum alpha-fetoprotein, meticulous histopathological sampling, and a multidisciplinary approach for optimal management.

Key words: Embryonal carcinoma, Mixed germ cell tumor, Orchidectomy, Seminoma

Testicular germ cell tumors (TGCTs) account for approximately 95% of all testicular neoplasms and are the most common malignancy in males aged 15–35 years [1]. TGCTs are broadly classified into seminomas and non-seminomatous germ cell tumors (NSGCTs); a significant subset harboring elements of both categories is designated as mixed germ cell tumors (MGCTs). In these mixed forms, the non-seminomatous component predominantly governs clinical behavior and determines the therapeutic pathway [2]. Staging follows the American Joint Committee on Cancer (AJCC) TNM 8th Edition system, wherein lymphovascular invasion (LVI), retroperitoneal lymphadenopathy, and elevated serum tumor markers each play a pivotal role [1,3]. MGCTs with a dominant seminomatous component (≥90%) and a minor embryonal carcinoma element remain infrequently reported in the Indian literature [4,5].

We present this case to highlight real-world staging challenges and the value of a multidisciplinary approach in managing mixed TGCTs.

CASE REPORT

A 22-year-old male (IP No. 1146738, Biopsy No. 3139/26) presented to the Department of Surgery, Krishna Hospital and Medical Research Centre, Karad, with a 4-month history of progressive right-sided scrotal swelling. He had no prior history of radiotherapy or chemotherapy, and his past medical history was otherwise unremarkable.

On general examination, the patient was conscious, well-oriented, and hemodynamically stable. His vital signs were within normal limits: blood pressure 118/76 mmHg, pulse rate 82 beats/min, respiratory rate 18 breaths/min, temperature 98.6°F (37°C), and SpO_2 99% on room air. He appeared well-nourished with no pallor, icterus, cyanosis, clubbing, or peripheral lymphadenopathy. The right hemiscrotum was visibly enlarged, with a firm, non-tender, irregular mass palpable in the right testis; the left testis and epididymis were clinically normal. The spermatic cord was not thickened on palpation.

On baseline biochemical evaluation, serum tumor markers were partially assessed: beta-human chorionic gonadotrophin (β-hCG) was elevated at 49.96 IU/L, serum lactate dehydrogenase (LDH) was elevated at 179 U/L, and serum alpha-fetoprotein (AFP) was not assessed at the time of initial presentation, a notable omission that was subsequently flagged for urgent follow-up.

Scrotal ultrasonography demonstrated an enlarged right testis harboring two hypoechoic lesions measuring 58 × 30 mm and 28 × 19 mm, respectively, each demonstrating internal vascularity on color Doppler interrogation. The smaller lesion contained internal calcification. A few rounded right inguinal lymph nodes were identified, the largest measuring 8 × 5 mm. The spermatic cord appeared normal in calibre, vascularity, and echotexture. The overall appearances were considered consistent with a germ cell neoplasm requiring further evaluation.

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Subsequent contrast-enhanced computed tomography (CECT) abdomen and pelvis revealed two well-defined, oval, homogeneously enhancing lesions with internal non-enhancing foci within the right testis, the larger of which measured 4.1 × 4.7 × 6.1 cm. The right testis could not be identified separately from the dominant lesion. The right spermatic cord was mildly thickened, with engorged vasculature. No skin thickening was evident. Multiple enlarged lymph nodes with homogeneous enhancement were identified along the bilateral common iliac, inguinal, and paraaortic chains; the largest measured 15 × 9 mm in the left paraaortic region. The left testis was normal in appearance. The imaging pattern was considered more in keeping with a neoplastic rather than an infective etiology.

The patient underwent right radical orchidectomy. The surgical specimen comprised the right testis (6 × 5 × 4 cm), the epididymis (0.5 × 0.5 × 0.5 cm), and the spermatic cord (1 × 1.5 × 1 cm). The external surface was smooth and intact, with a glistening, greyish-brown appearance and prominent congested surface vessels (Fig. 1a).

Serial sectioning of the testis (Fig. 1b) disclosed a 4.5 × 4.5 × 4 cm well-circumscribed, encapsulated, firm-to-hard tumor with a uniform tan-colored cut surface. A second, smaller nodule measuring approximately 2 × 1.5 × 1 cm was identified separately, demarcated from the principal mass by an intervening strip of testicular parenchyma (arrow in Fig. 1); this smaller nodule showed central hemorrhagic necrosis on sectioning. The main large tumor did not exhibit overt necrosis or hemorrhagic foci. Importantly, the tumor respected anatomical boundaries, and there was no gross infiltration of the tunica albuginea, epididymis, spermatic cord, or scrotal wall. The surrounding testicular tissue was compressed and macroscopically unremarkable, albeit oedematous. The spermatic cord surgical resection margin appeared clear, with a clearance of 1.5 cm from the tumor edge. Regional lymph nodes were not submitted for histopathological review.

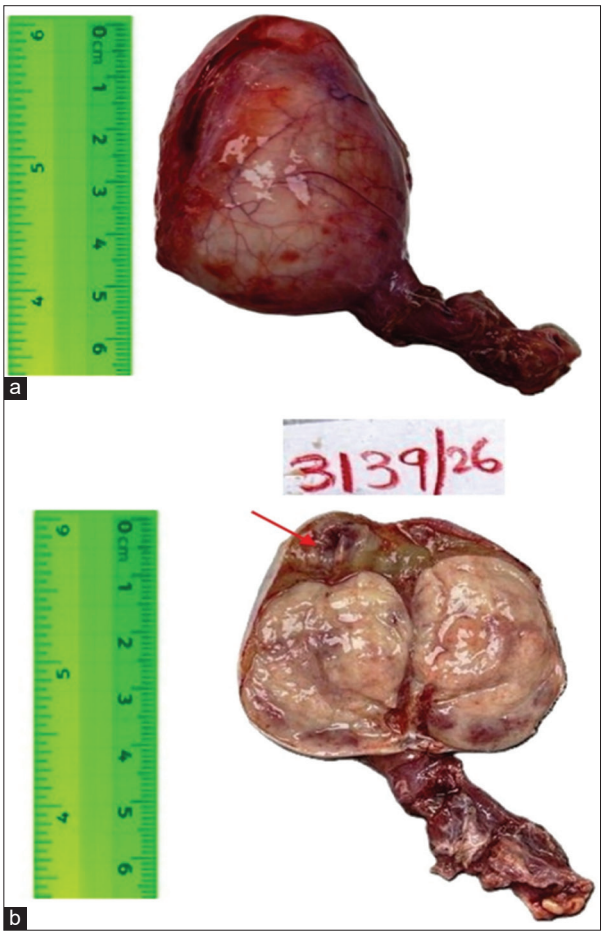

Figure 1: Gross specimen of the right orchidectomy. (a) The right testis demonstrates a well-circumscribed, encapsulated, congested, glistening external surface. (b) Serial sectioning of the testis reveals a tan-colored main tumor mass (4.5 × 4.5 × 4 cm) and a separate smaller nodule (arrow demarcation: 2 × 1.5 × 1 cm) with central hemorrhagic necrosis. The spermatic cord and epididymis are identified. The tunica albuginea remains intact

Multiple representative tissue sections were processed and examined microscopically. Sections from the testicular tumor revealed the histological hallmarks of a mixed seminomatous–NSGCT (Fig. 2a). The dominant component, constituting approximately 90% of the tumor volume, displayed the characteristic morphology of classic seminoma, sheets of uniform, polygonal cells with abundant clear cytoplasm, prominent central nucleoli, and a delicate fibrous stroma infiltrated by mature lymphocytes (Fig. 2b). The remaining 10% tumor exhibited features of embryonal carcinoma, characterized by pleomorphic cells arranged in solid nests, tubular structures, and papillary formations with frequent mitoses; this component was surrounded by a thick fibrovascular stroma.

Lymphovascular emboli were identified at scattered sites; however, the intratumoral lymphovascular emboli within the vascular channels were noted to be enveloped by thick fibrovascular tissue. The tumor demonstrated no involvement of the rete testis and epididymis (Fig. 2c). The tunica albuginea remained uninvolved. Both the base and the cut margin of the spermatic cord were free of tumor. Intratubular germ cell neoplasia of the surrounding parenchyma was not identified. Regional lymph nodes were not submitted for histopathological assessment. Final histopathological impression was right testis (radical orchidectomy) specimen showing mixed seminomatous–NSGCT, without assessable nodal involvement (regional lymph nodes not submitted). TNM Staging (AJCC 8th Edition): pT2 - tumor invades the epididymis and rete testis with LVI. N - Regional lymph nodes assessed radiologically; CECT revealed multiple enlarged nodes, consistent with clinical N1–N2. M - To be determined. S (Serum Markers) - β-hCG elevated (49.96 IU/L), LDH elevated (179 U/L), AFP not performed.

Urgent estimation of serum AFP. Positron emission tomography (PET) scan for complete systemic staging and surveillance planning. Multidisciplinary team review for consideration of adjuvant bleomycin, etoposide, and cisplatin (BEP) chemotherapy regimen.

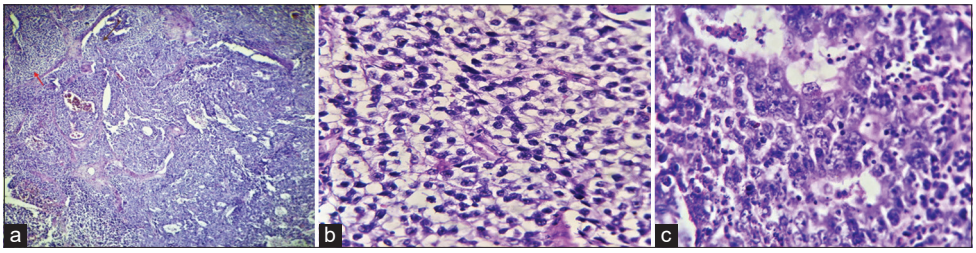

Figure 2: (a) Photomicrograph (Hematoxylin and Eosin, ×40) showing the seminomatous component (arrow) of the mixed germ cell tumor mixing with adjacent pleomorphic embryonal carcinomatous component; (b) Photomicrograph (Hematoxylin and Eosin, ×400) depicting sheets of uniform, polygonal cells with abundant clear cytoplasm, prominent central nucleoli, and a delicate fibrous stroma. (c) Photomicrograph (Hematoxylin and Eosin, ×400) illustrating lymphovascular invasion within the aggressive embryonal carcinoma component (10% of tumor volume). Highly pleomorphic cells form solid nests and tubular arrangements with irregular nuclei and prominent 2–3 nucleoli

DISCUSSION

TGCTs represent the most frequent malignancy among males in the second to fourth decades of life, with an estimated global annual incidence of 8–9 cases/100,000 men in high-incidence regions [1,6]. In the present case, the patient's age of 22 years, the unilateral testicular presentation, and the radiological and histopathological findings are entirely consistent with the established epidemiological and clinicopathological profile of this disease. Contemporary population-based data indicate that the incidence of TGCTs continues to rise at an annual rate of approximately 1–2% in most high-income countries, a trend attributed partly to improved detection and partly to as-yet poorly understood environmental and endocrine disruptors [4].

The dual histological composition of this tumor, predominantly seminoma with a minor embryonal carcinoma component, exemplifies the heterogeneity that characterises mixed GCTs. Importantly, when even a minor non-seminomatous element is present, the tumor is managed according to NSGCT protocols rather than pure seminoma guidelines [2,7]. The 2016 WHO Classification provides clear criteria for distinguishing and quantifying these individual components, underscoring the indispensability of thorough tumor sampling and systematic microscopic evaluation [2]. Advances in molecular pathology, including isochromosome 12p [i(12p)] detection, have further refined the classification of borderline or ambiguous cases and reinforced the genetic unity of the TGCT spectrum [5].

LVI, identified in this case, is a well-established independent adverse prognostic factor in TGCTs and confers upstaging to pT2 under the AJCC 8th Edition TNM system [1,8]. The detection of LVI in a clinical stage I NSGCT significantly elevates the risk of occult metastatic disease, estimates in the literature suggest a relapse risk approaching 50% with surveillance alone, and thus LVI is a principal criterion used to guide decisions regarding adjuvant chemotherapy versus active surveillance after orchidectomy [8,9]. A recent systematic review further confirmed that LVI, together with a predominance of embryonal carcinoma, constitutes the most reproducible histological predictor of relapse in clinical stage I disease [10].

The retroperitoneal lymphadenopathy demonstrated on CECT in this patient, including nodes along the bilateral common iliac vessels and paraaortic regions, the largest measuring 15 × 9 mm, raises the clinical stage to at least N1 and warrants careful multidisciplinary consideration of systemic treatment [6]. The primary drainage pathway of the right testis follows the lymphatic channels to the right interaortocaval, pre-caval, and right para-aortic nodes, which aligns with the pattern of nodal enlargement observed in this case [7].

A pertinent gap in the initial work-up was the absence of serum AFP measurement. AFP is predominantly secreted by yolk sac tumor elements and, to a lesser extent, by embryonal carcinoma; its elevation at baseline carries staging and surveillance implications [1]. Given that the embryonal carcinoma component constituted 10% of this tumor, baseline AFP was critically needed to complete the S-category assignment within TNM staging. This omission was subsequently flagged, and urgent AFP estimation was recommended as part of the post-operative management plan [1,9].

The rete testis involvement noted histologically is recognized as a potential adverse prognostic feature, though its independent significance remains a subject of debate in the contemporary literature [2]. The absence of tunica albuginea, tunica vaginalis, and spermatic cord involvement, together with clear surgical margins, reflects favorable local pathological clearance, notwithstanding the radiological evidence of regional lymphadenopathy.

In terms of systemic management, the BEP regimen remains the "gold-standard" adjuvant chemotherapy protocol for non-seminomatous and mixed GCTs with adverse features (which was started by the oncology department in our case) [4,9]. PET-computed tomography has an established role in the post-chemotherapy surveillance of residual seminomatous masses and is recommended for complete staging in mixed histology tumors [1,8]. Emerging evidence suggests that response-adapted treatment strategies, utilising real-time tumor marker decline and interim PET response, may further personalise management and reduce unnecessary treatment burden in intermediate-risk and poor-risk patients [11,12]. A multidisciplinary team approach encompassing urology, oncology, radiology, and

pathology remains essential to optimise outcomes in these young patients.

CONCLUSION

MGCTs of the testis, though rare as an absolute entity, represent an important clinical challenge in young men, given their aggressive biological behavior and staging complexity. This case underlines several key principles: the necessity of complete serum tumor marker assessment, including AFP, before definitive surgery; the prognostic weight of LVI in determining post-orchidectomy management; and the paramount importance of meticulous histopathological sampling to accurately characterise tumor composition. A coordinated, multidisciplinary approach, incorporating adjuvant BEP chemotherapy and PET scan-guided staging, offers the best prospect of cure and long-term disease control in such cases.

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