AMSER Case of the Month
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Viet Le, MS4

Penn State College of Medicine

Sosamma T. Methratta, MD

Penn State Health Milton S. Hershey Medical Center

PennState College of Medicine

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Patient Presentation

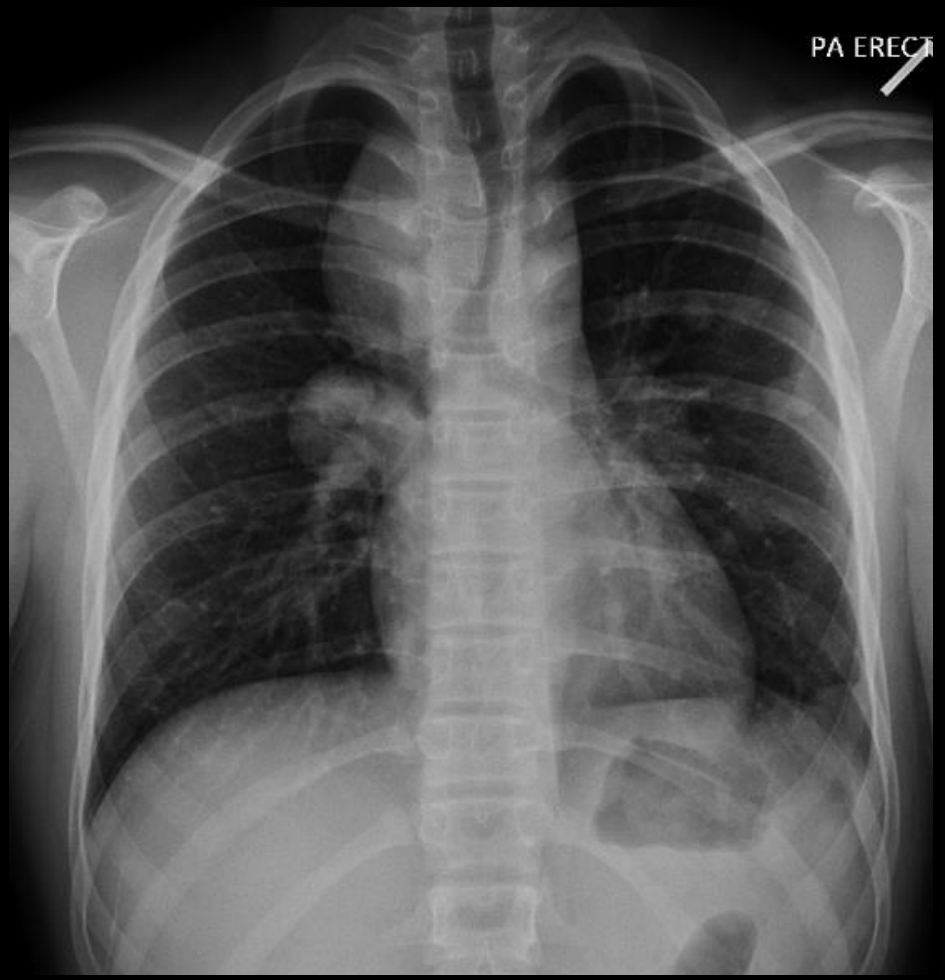
- HPI : 14-year-old male who presented with a 2-day history of chills, right sided chest pain, and a 1-day history of intermittent fever.
- FHx: None.
- Relevant PMH and Meds: None.

What Imaging Should We Order?

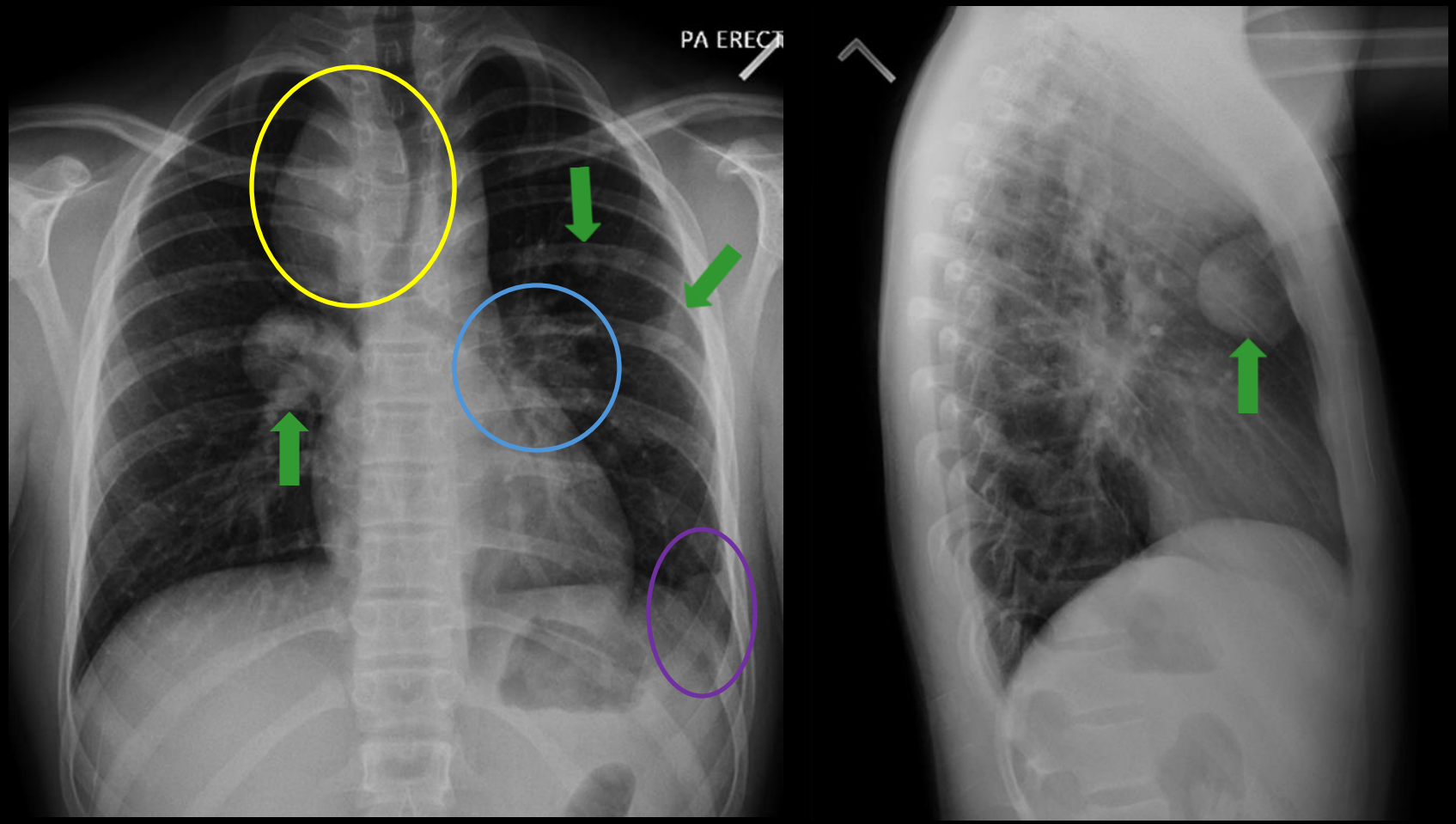
ACR Appropriateness Criteria

Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
Fever, unknown origin, initial imaging	3198743	Radiography chest	<0.1 mSv ☢	<0.03 mSv [ped] ☢	May be appropriate
		MRI whole body without and with IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate
		MRI whole body without IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate
		FDG-PET/MRI whole body	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	May be appropriate
		FDG-PET/CT whole body	10-30 mSv ☢☢☢☢	3-10 mSv [ped] ☢☢☢☢	May be appropriate
		US abdomen	0 mSv O	0 mSv [ped] O	Usually not appropriate
		3-phase bone scan whole body		3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		Bone scan and WBC scan whole body		3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		MRI chest without and with IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate
		MRI chest without IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate
		CT paranasal sinuses with IV contrast	0.1-1mSv ☢☢	0.3-3 mSv [ped] ☢☢☢	Usually not appropriate
		CT paranasal sinuses without IV contrast	0.1-1mSv ☢☢	0.3-3 mSv [ped] ☢☢☢	Usually not appropriate
		CT abdomen and pelvis with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT abdomen and pelvis without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT chest with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT chest without and with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT chest without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT neck with IV contrast	1-10 mSv ☢☢☢	0.3-3 mSv [ped] ☢☢☢	Usually not appropriate
		CT neck without and with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT neck without IV contrast	1-10 mSv ☢☢☢	0.3-3 mSv [ped] ☢☢☢	Usually not appropriate
		CT paranasal sinuses without and with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT abdomen and pelvis without and with IV contrast	10-30 mSv ☢☢☢☢	10-30 mSv [ped] ☢☢☢☢☢	Usually not appropriate
		Fluoride PET/CT whole body	10-30 mSv ☢☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate

Findings (unlabeled)



Findings (Labeled)



There is a right paratracheal mass with leftward shift of the trachea and tracheal narrowing. (yellow circle)

In addition, there is a left hilar adenopathy (blue circle) and pulmonary nodules/masses in both lungs (green arrows) There is also a small left pleural effusion (purple)

Findings Upon Admission

Physical Exam

- Left Testicle – Soft and atrophic
- Right Testicle – Firm, nontender, and multinodular

Pertinent Labs

- LDH : 658 (H)
- AFP : 981.2 (H)
- Beta-hCG : 4,856 (H)

Ultrasound of the Scrotum (unlabeled)

Ultrasound of the Scrotum (labeled)

Complex right scrotal mass compatible with primary testicular neoplasm.

ACR Appropriateness Criteria - New Testicular Mass by Ultrasound

Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
Testicular cancer, pure seminoma, post orchiectomy, initial staging	3194918	Radiography chest	<0.1 mSv ☢	<0.03 mSv [ped] ☢	Usually appropriate
		MRI abdomen and pelvis without and with IV contrast	0 mSv O	0 mSv [ped] O	Usually appropriate
		CT abdomen and pelvis with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually appropriate
		MRI abdomen and pelvis without IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate
		MRI head without and with IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate
		CT abdomen and pelvis without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	May be appropriate
		CT chest with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	May be appropriate
		CT chest without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	May be appropriate
		US abdomen and retroperitoneum	0 mSv O	0 mSv [ped] O	Usually not appropriate
		US scrotum	0 mSv O	0 mSv [ped] O	Usually not appropriate
		MRI head without IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate
		Bone scan whole body	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT chest without and with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT abdomen and pelvis without and with IV contrast	10-30 mSv ☢☢☢☢	10-30 mSv [ped] ☢☢☢☢☢	Usually not appropriate
		FDG-PET/CT whole body	10-30 mSv ☢☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate

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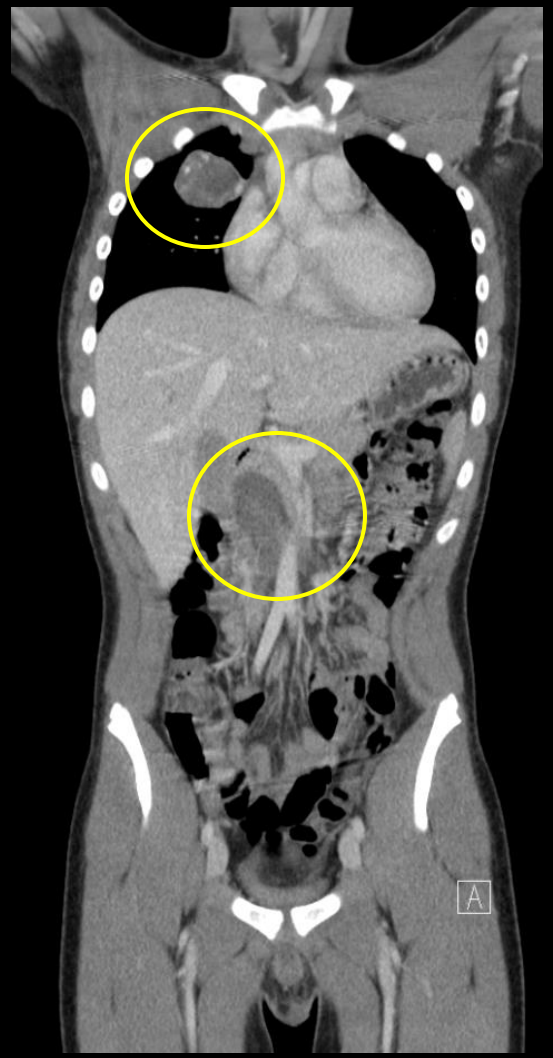
Another Possibility at this Point

Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
esticular cancer, nonseminoma, post orchiectomy, initial staging	3194920	Radiography chest	<0.1 mSv ☢	<0.03 mSv [ped] ☢	Usually appropriate
		MRI abdomen and pelvis without and with IV contrast	0 mSv O	0 mSv [ped] O	Usually appropriate
		CT abdomen and pelvis with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually appropriate
		CT chest with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually appropriate
		MRI abdomen and pelvis without IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate
		MRI head without and with IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate
		CT abdomen and pelvis without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	May be appropriate
		CT chest without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	May be appropriate
		US abdomen and retroperitoneum	0 mSv O	0 mSv [ped] O	Usually not appropriate
		US scrotum	0 mSv O	0 mSv [ped] O	Usually not appropriate
		MRI head without IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate
		Bone scan whole body	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT chest without and with IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate
		CT abdomen and pelvis without and with IV contrast	10-30 mSv ☢☢☢☢	10-30 mSv [ped] ☢☢☢☢☢	Usually not appropriate
		FDG-PET/CT whole body	10-30 mSv ☢☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually not appropriate

Further Imaging… (Unlabeled)

Further Imaging… (Labeled)



Complex right scrotal mass + similar appearing masses above and below the diaphragm. Involvement includes, the mediastinum, lungs, and retroperitoneal lymph nodes.

The patient underwent right radical orchiectomy and at pathology ...

Metastatic Mixed Germ Cell Tumor of the Testis

70% Embryonal Carcinoma
25% Yolk Sac Tumor
5% Teratoma

Case Discussion

- The differential for testicular masses is broad and can divided into neoplastic and non-neoplastic.
- As such it is important for radiologists to be familiar with the differential for these masses and the subsequent work-up.
- A thorough history, biopsy, and tumor markers are often needed to make a definitive diagnosis.

Case Discussion

Differentials for Testicular Mass

Neoplastic

Common

Seminoma (40-50% of testicular malignancies

Non-Seminomatous Germ Cell Tumors

- Testicular teratoma
- Testicular epidermoid
- Testicular choriocarcinoma
- Testicular embryonal cell carcinoma
- Testicular yolk sac tumor
- Testicular mixed germ cell tumor

Uncommon

- Sex cord stromal tumors (~ 2% of testicular malignancies)
  - Leydig cell tumor
  - Sertoli cell tumor
  - Metastases to the testes (leukemia, lymphoma)

Non-Neoplastic

- Testicular cysts
- Tubular ectasia of the rete testes
- Focal orchitis
- Intratesticular hematoma
- Ischemia/infarction (e.g testicular torsion)
- Testicular adrenal rest
- Focal granulomatous disease
- Supernumerary testes
- Varicocele
- Testicular abscess

Mixed Germ Cell Tumor of the Testis with Metastasis

- These are tumors composed of two or more types of germ cell tumor and fall under the category of “non-seminomatous germ cell tumors” .
- Overall, they account for 10% of all testicular cancers.
- Genetic and environmental factors can play a role in the development of mixed germ cell testicular neoplasm.
- In patients with germ cell neoplasm of the testis, there are often increased hormone markers such as AFP and Beta-hCG. The degree of elevation gives insight into the prognosis of the cancer.
- This patient’s systemic symptoms and overall imaging findings are diagnostic of metastatic disease. Metastases most commonly occur to the lymphatic system followed by lung, liver and bone.
- Although malignant testicular cancer is rare in children, it is important to keep it in mind when there is high clinical suspicion.

Imaging Findings

Embryonal Cell Carcinoma

- Ultrasound: hypoechoic heterogeneous mass lesion with ill-defined borders and involvement of the tunica albuginea with an abnormal contour of the testis.
- MRI: heterogeneous signal intensity lesion with areas of hemorrhage and necrosis.

Yolk Sac Tumor

- Ultrasound: diffusely enlarged heterogeneous testis.
- MRI: heterogeneous testicular mass lesion with post-contrast heterogeneous enhancement, with areas of hemorrhage/necrosis.

Teratoma

- Ultrasound: cystic with internal echogenicity of the fluid representing a mixture of mucinous or sebaceous material with or without hair follicles. Solid components are present of variable echogenicity, including hyperechoic and shadowing fatty components.
- CT: can see enlarged lymph nodes and evaluate for potential metastatic spread.

Because this tumor is mixed, it could have some or all of these imaging findings. Imaging findings for mixed germ cell tumor is nonspecific and the whole clinical picture is needed to make a diagnosis.

References

- Behr GG, Morani AC, Artunduaga M, Desoky SM, Epelman M, Friedman J, Lala SV, Seekins J, Towbin AJ, Back SJ. Imaging of pediatric testicular tumors: A COG Diagnostic Imaging Committee/SPR Oncology Committee White Paper. Pediatr Blood Cancer. 2023 Jun;70 Suppl 4(Suppl 4):e29988. doi: 10.1002/pbc.29988. Epub 2022 Oct 2. PMID: 36184829; PMCID: PMC10646825.
- Feldman DR, Bosl GJ, Sheinfeld J, Motzer RJ. Medical treatment of advanced testicular cancer. *JAMA*. 2013;310(13):1396-1397. doi:10.1001/jama.2013.278040
- Ross JH, Rybicki L, Kay R. Pediatric testicular tumors: the Johns Hopkins experience. *Urology*. 2002;59(4):553-557.
- Taskinen S, Fagerholm R, Aronniemi J, Rintala R, Taskinen M. Testicular tumors in children and adolescents. *J Pediatr Urol*. 2006;2(2):134-138.
- McGlynn KA, Quraishi SM, Graubard BI, Weber JP, Rubertone MV, Erickson RL. Persistent organochlorine pesticides and risk of testicular germ cell tumors. *J Natl Cancer Inst*. 2008;100(9):663-671. doi:10.1093/jnci/djn101.
- Radiopaedia. Non-seminomatous germ cell tumours. *Radiopaedia.org*. Accessed May 31, 2025. https://radiopaedia.org/articles/non-seminomatous-germ-cell-tumours-2
- Radiopaedia. Testicular cancer. *Radiopaedia.org*. Accessed May 31, 2025. https://radiopaedia.org/articles/testicular-cancer
- Radiopaedia. Testicular embryonal cell carcinoma. *Radiopaedia.org*. Accessed June 6, 2025. https://radiopaedia.org/articles/testicular-embryonal-cell-carcinoma
- Radiopaedia. Testicular yolk sac tumour. *Radiopaedia.org*. Accessed June 6, 2025. https://radiopaedia.org/articles/testicular-yolk-sac-tumour
- Radiopaedia. Testicular teratoma. *Radiopaedia.org*. Accessed June 6, 2025. https://radiopaedia.org/articles/testicular-teratoma