

Case 10

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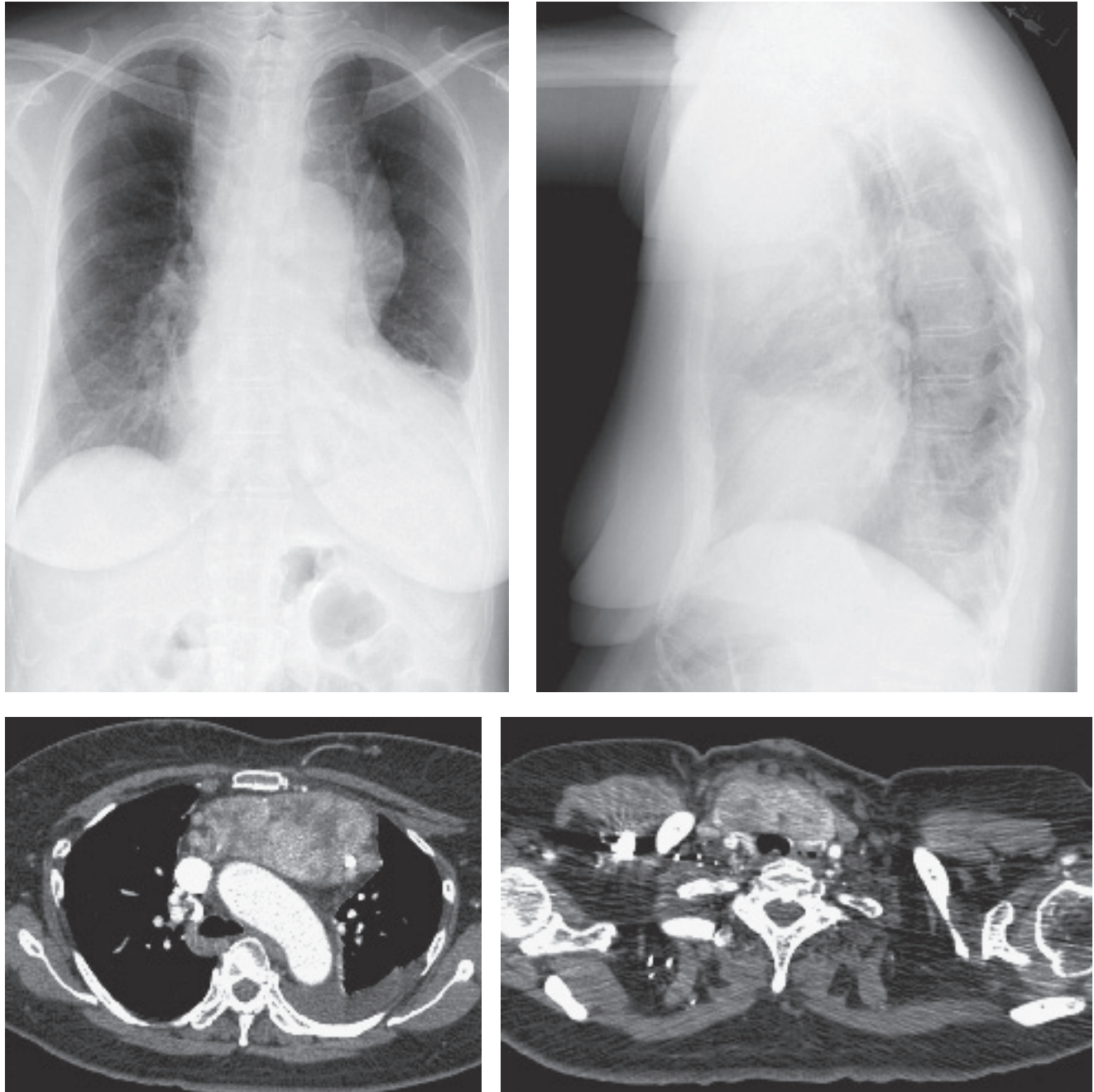


Fig. 10.1 (A) Posteroanterior radiograph shows a lobulated mediastinal mass that does not silhouette the aortic arch. (B) Lateral radiograph shows that the retrosternal clear space is obscured. Enhanced axial computed tomography images reveal (C) a heterogeneously enhancing anterior mediastinal mass with coarse foci of calcification that is contiguous with (D) the thyroid gland.

■ Clinical Presentation

A middle-aged woman presents for an employment physical (**Fig. 10.1**).

■ Key Imaging Finding

Anterior mediastinal mass

■ Top 3 Differential Diagnoses

- **Lymphoma.** Lymphoma is a primary neoplasm of the lymphoreticular system that is divided into two main types: Hodgkin disease (HD) and non-Hodgkin lymphoma (NHL). Although HD is the less common of the two types, it is more likely to involve the thorax (up to 85% of HD cases as compared with 40 to 50% of NHL cases). Of the HD cases with thoracic involvement, nearly all (98%) involve superior mediastinal nodes (i.e., aortopulmonary, prevascular, and paratracheal). The percentage of superior mediastinal node involvement in HD is so high that normal superior mediastinal nodes in the setting of thoracic involvement make HD unlikely. Calcification does not occur prior to treatment. In HD, the anatomical extent of disease correlates well with prognosis. In contrast, prognosis of NHL is better predicted by histopathologic classification.
- **Thymic lesion.** The normal thymus increases from birth to puberty, after which it begins to involute over a 5- to 15-year period. Thymic tissue is progressively replaced by fat. By the age of 60, little thymic tissue remains. Abnormalities of thymic origin can be due to several processes. The thymus itself may be abnormally enlarged, as in

thymic hyperplasia or rebound, or abnormally infiltrated, as in lymphoid follicular hyperplasia. Several masses and tumors can arise from the thymus, including thymoma, thymic carcinoma, thymic carcinoid, cysts, lipomas, and lymphoma. Thymomas (most common) most often occur in the third and fourth decades of life and may be associated with myasthenia gravis.

- **Thyroid lesion.** Thyroid masses account for ~10% of mediastinal masses. The majority (80%) are in the anterior mediastinum. Mediastinal masses of thyroid origin are almost always contiguous with the thyroid. A truly ectopic mediastinal mass without a connection to the thyroid is possible but uncommon. Radiographically, mediastinal thyroid masses often cause tracheal deviation. On computed tomography, normal thyroid tissue has a characteristic appearance, being high attenuation relative to adjacent soft tissue on noncontrast studies and enhancing avidly postcontrast. Calcifications may be present, but in the end, differentiation between goiter and thyroid carcinoma is difficult unless lymphadenopathy or metastasis is present.

■ Additional Differential Diagnoses

- **Germ cell neoplasm (GCN).** GCNs, which account for ~10% of primary mediastinal masses, arise from primitive germ cells that have arrested in the mediastinum during embryologic migration. The majority of such neoplasms are located in the anterior mediastinum and present during the second through fourth decades of life. GCNs can be benign or malignant, but the majority (80%) are

benign. They include teratomas, seminomas, embryonal carcinoma, yolk sac tumors, choriocarcinoma, and mixed cell types. Imaging findings are broad. Solid and cystic components may be present. Teratomas, which contain elements of all germinal layers, can include skin, hair, fat, and bones if well differentiated.

■ Diagnosis

Thyroid lesion (goiter)

✓ Pearls

- HD presents as noncalcified mediastinal adenopathy involving the anterior and superior mediastinum.
- Thyroid lesions include thymomas (most common), invasive thymomas, carcinomas, lipomas, and cysts.
- Thyroid lesions are contiguous with the thyroid gland, result in tracheal deviation, and avidly enhance.
- GCNs most commonly present in the second through fourth decades of life; the majority are benign.

Suggested Readings

Collins J, Stern EJ. Chest Radiology: The Essentials. Philadelphia: Lippincott Williams & Wilkins; 2007
 Reed JC. Chest Radiology: Plain Film Patterns and Differential Diagnoses. St. Louis: Mosby; 1991

Webb WR, Higgins CB. Thoracic Imaging. Philadelphia: Lippincott Williams & Wilkins; 2005

Case 48

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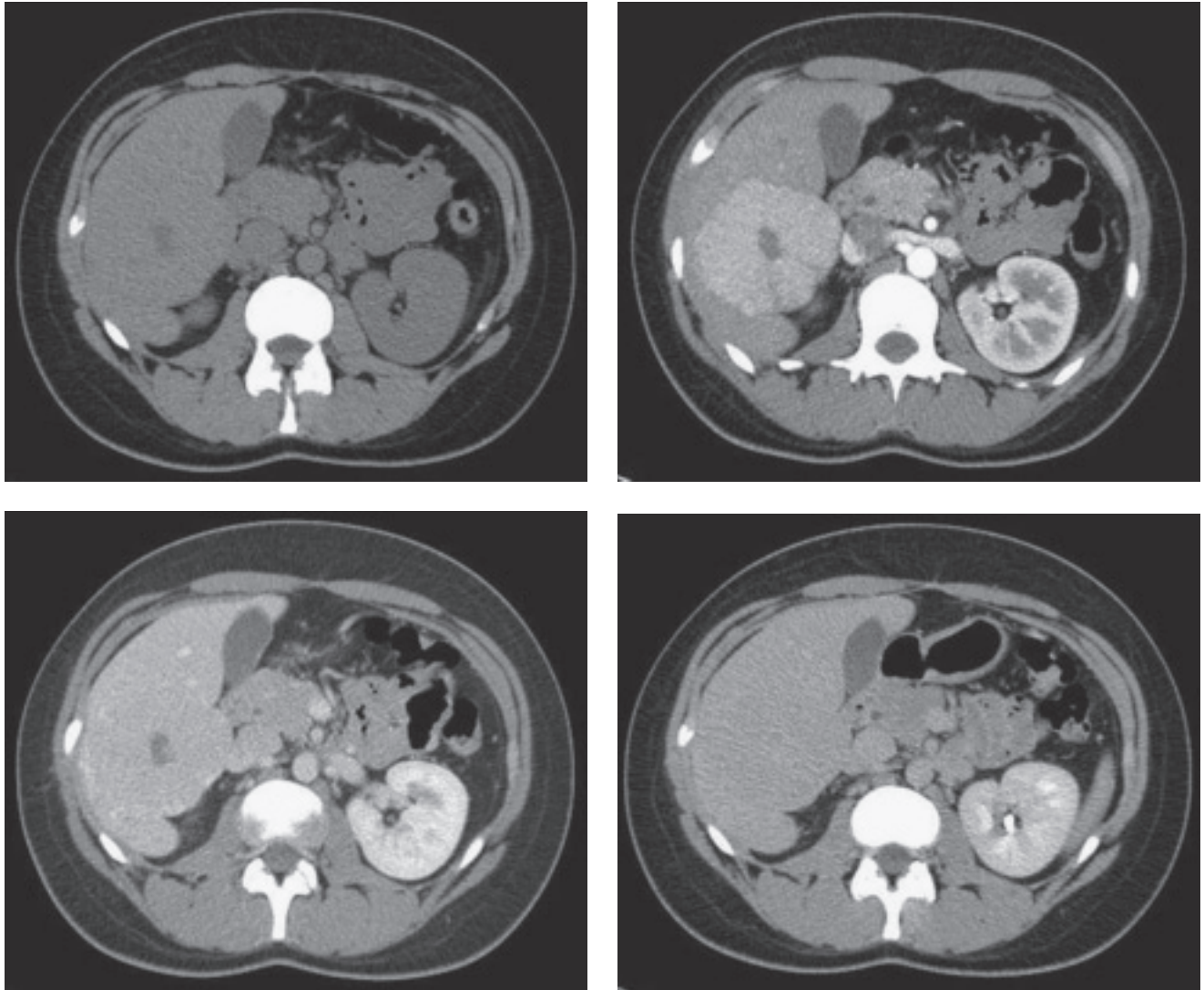


Fig. 48.1 (A) Unenhanced axial CT image demonstrates an isodense mass within the right hepatic lobe with a central region of low density. (B) The mass demonstrates homogeneous increased enhancement on arterial phase imaging with a central hypodense scar. (C) On venous phase imaging, the mass is isodense to surrounding hepatic parenchyma with maintenance of the central hypodense scar. (D) On delayed imaging, the central scar fills in, with the entire lesion now isodense to surrounding hepatic parenchyma.

■ Clinical Presentation

A 19-year-old woman presents with vague abdominal discomfort (**Fig. 48.1**).

■ Key Imaging Finding

Hypervascular liver mass

■ Top 3 Differential Diagnoses

- **Hemangioma.** Hemangiomas are the most common neoplastic hepatic lesion and second most common benign lesion following simple cysts. The classic imaging findings are initial discontinuous nodular peripheral enhancement in the arterial phase with delayed central filling. Smaller hemangiomas may demonstrate flash-filling during the arterial phase, and larger lesions may have central regions of fibrosis or cystic changes. On magnetic resonance imaging (MRI), hemangiomas are hyperintense on T2- and hypointense on T1-weighted imaging with similar enhancement patterns as seen with computed tomography. On ultrasound, most hemangiomas are well-circumscribed hyperechoic lesions.
- **Focal nodular hyperplasia (FNH).** FNH is an uncommon hepatic lesion that typically presents in young women (75%). The lesion is composed of hepatocytes and classically contains a central low-density scar. On arterial phase imaging, there is homogeneous enhancement of the lesion with a low-density central scar, which fills in on delayed imaging. The central scar is hyperintense on T2-weighted MRI. Because FNH is composed of hepatocytes, it may demonstrate uptake of sulfur colloid (other hepatic lesions demonstrate cold defects) on scintigraphy.
- **Hepatocellular carcinoma (HCC).** HCC is the most common primary hepatic malignancy with an increased incidence in patients with chronic liver disease. Patients may present with a single lesion, multiple lesions, or diffuse hepatic involvement. The lesions are typically hypodense and demonstrate increased arterial phase enhancement due to increased blood supply from the hepatic artery. Portal or hepatic vein invasion is common. Diagnosis can be difficult in cirrhosis with regenerating nodules. MRI can be helpful in these instances because HCC typically displays increased T2 signal intensity. Clinically, HCC is associated with elevated alpha fetoprotein. Fibrolamellar HCC is a rare variant that presents in younger patients. The lesion demonstrates peripheral arterial phase enhancement with a central low-density scar that does not fill in on delayed imaging (in contrast to FNH). The central scar in fibrolamellar HCC is hypointense on T2-weighted imaging, whereas the central scar in FNH is hyperintense on T2-weighted imaging.

■ Additional Differential Diagnoses

- **Hepatic adenoma.** Hepatic adenomas are benign lesions predominantly seen in women (90%). Most often they are solitary, but they may occasionally be multiple, especially in patients with glycogen storage disease. Hepatic adenomas have an increased frequency and risk of rupture with the use of oral contraceptives. Adenomas are typically hypervascular; internal hemorrhage can lead to heterogeneity.
- **Hypervascular metastases.** Hypervascular metastases are usually multiple but may rarely present as a solitary mass. Tumors that classically result in hypervascular metastases are melanoma, renal cell carcinoma, thyroid carcinoma, choriocarcinoma, pheochromocytoma, islet cell tumors, and sarcomas.

■ Diagnosis

Focal nodular hyperplasia

✓ Pearls

- Hemangiomas demonstrate peripheral, nodular, discontinuous enhancement on arterial phase imaging.
- Central scars are most commonly seen with FNH and HCC (especially the fibrolamellar variant).
- Hepatic adenomas are associated with oral contraceptives and are prone to hemorrhage.

Suggested Readings

Blachar A, Federle MP, Ferris JV, et al. Radiologists' performance in the diagnosis of liver tumors with central scars by using specific CT criteria. *Radiology* 2002;223(2):532–539

Kamel IR, Lawler LP, Fishman EK. Comprehensive analysis of hypervascular liver lesions using 16-MDCT and advanced image processing. *AJR Am J Roentgenol* 2004;183(2):443–452

Case 129

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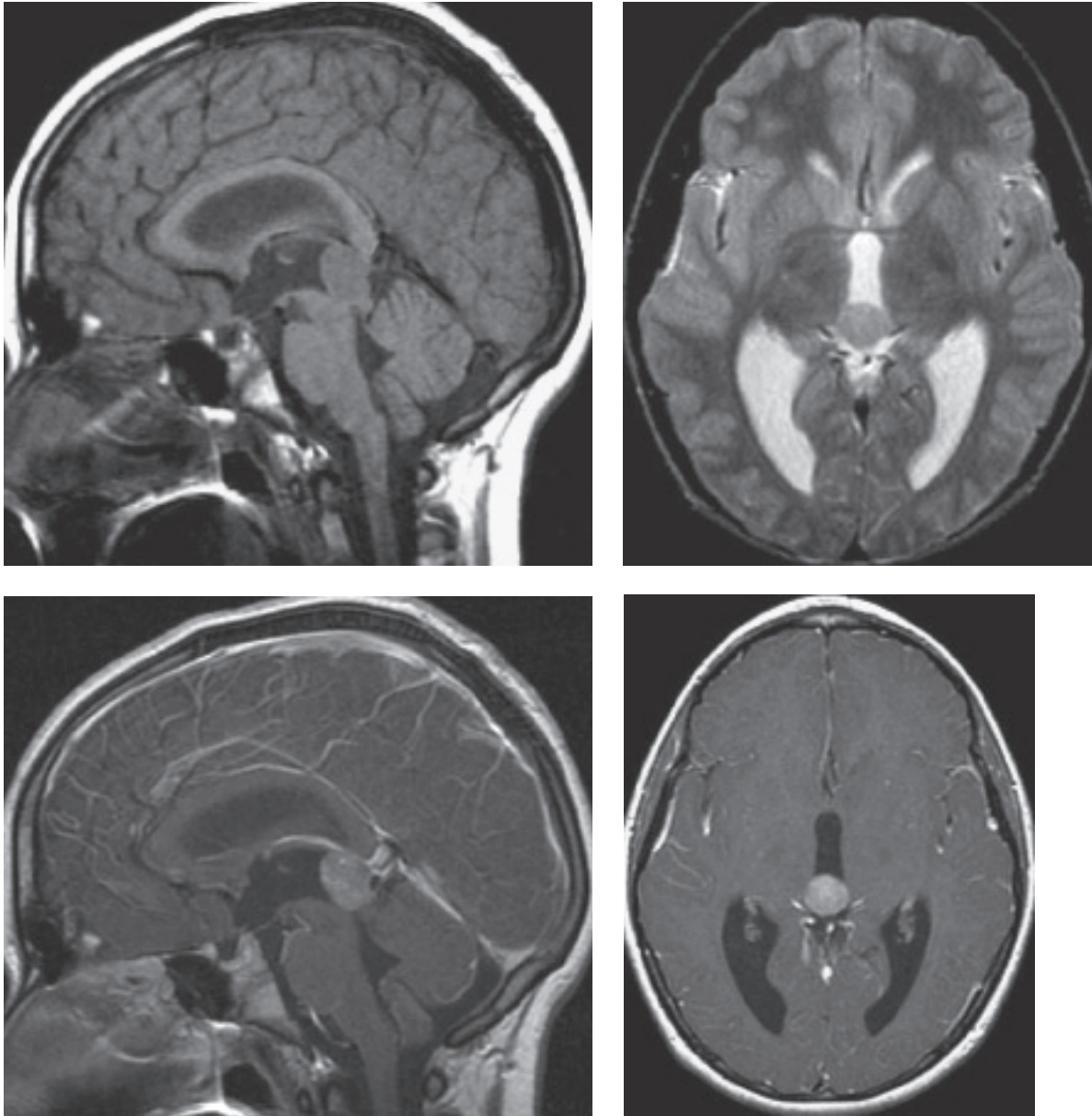


Fig. 129.1 (A) Sagittal T1, (B) axial T2 fast spin echo, and (C) sagittal and (D) axial T1 postgadolinium images demonstrate a pineal region mass that is intermediate in signal intensity on both T1- and T2-weighted sequences with homogeneous enhancement. There is mass effect on the tectal plate with obstructive hydrocephalus at the level of the cerebral aqueduct.

■ Clinical Presentation

A 56-year-old man presents with occasional headaches (**Fig. 129.1**).

■ Key Imaging Finding

Pineal region mass

■ Top 3 Differential Diagnoses

- **Pineal cyst.** Pineal cysts are common and usually discovered incidentally. Simple cysts follow fluid signal intensity on magnetic resonance imaging (MRI) and lack enhancement. The cysts may demonstrate increased signal intensity on T1-weighted sequences due to high protein content or hemorrhage. The internal cerebral veins should be closely inspected, as large cysts may result in occlusion of these vessels. Although peripheral calcifications and mild enhancement may occur with simple cysts, these findings should raise suspicion for a more malignant process. Cysts may be followed with serial imaging to ensure stability.
- **Germ cell tumor (GCT).** GCTs are the most common malignant neoplasms of the pineal gland, with germinomas (also referred to as seminomas) representing >60% of cases. Most cases occur in adolescent and young adult male patients. Presenting symptoms are usually secondary to mass effect, resulting in obstructive hydrocephalus, Parinaud syndrome (paralysis of upward gaze), or endocrine dysfunction. Germinomas are hyperdense on unenhanced computed tomography (CT) scans due to the high nuclear-to-cytoplasmic ratio and may contain calcifications centrally. On MRI, germinomas are usually intermediate in signal intensity on T1- and T2-weighted sequences with avid enhancement following gadolinium administration. On occasion, germinomas may appear cystic. Because cerebrospinal fluid (CSF) dissemination is common, the entire spine must be imaged to evaluate for drop metastases. Other GCTs are teratomas, yolk sac tumors, and choriocarcinomas. Teratomas will typically have macroscopic fat. Yolk sac tumors may be cystic and are associated with elevated levels of alpha fetoprotein. Choriocarcinomas have a propensity to bleed and are associated with elevated levels of human chorionic gonadotropin.
- **Pineal cell tumor.** Tumors of pineal cell origin are pineoblastomas and pineocytomas. Pineoblastomas are more malignant and occur in a younger patient population, with a peak incidence within the first 10 years of life. Seeding of the CSF is common. Pineocytomas have a peak incidence in the 3rd and 4th decades of life and are generally less aggressive. Presenting symptoms are usually due to mass effect resulting in obstructive hydrocephalus, Parinaud syndrome, or endocrine dysfunction. On imaging, the tumors closely resemble one another. On average, pineoblastomas are larger at the time of presentation. Both are hyperdense on unenhanced CT due to the high nuclear-to-cytoplasmic ratio. When calcifications occur in pineal cell tumors, they are along the periphery in an “exploded” pattern. On MRI, pineal cell tumors are of intermediate signal intensity on T1- and T2-weighted sequences, with avid enhancement following gadolinium administration. As with GCTs, the spine must be imaged to evaluate for drop metastases.

■ Additional Differential Diagnoses

- **Meningioma.** Meningiomas are the most common extra-axial intracranial tumors. They may occur along the margin of the tentorium, mimicking a pineal gland mass. The pineal gland and internal cerebral veins are often displaced superiorly. On noncontrast CT, meningiomas may be hyperdense; calcification is common. Enhancement pattern is typically homogeneous with a dural tail.
- **Tectal plate glioma.** Tectal plate gliomas are low-grade neoplasms which may cause aqueductal stenosis with associated hydrocephalus. When large, they may compress the pineal gland and mimic a pineal origin mass. They often present in childhood. The lesions are typically hyperintense on T2 sequences and rarely enhance. Treatment is geared toward CSF diversion in cases of obstructive hydrocephalus.

■ Diagnosis

Pineal germinoma

✓ Pearls

- Pineal cysts are often asymptomatic and incidentally found; no internal enhancement should be seen.
- GCTs are the most common pineal gland neoplasms and commonly result in CSF dissemination.
- Pineal cell tumors are the second most common neoplasms and may also result in CSF dissemination.
- Large tentorial meningiomas and tectal plate gliomas may mimic pineal origin masses.

Suggested Readings

Barkovich AJ. Pediatric Neuroimaging. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2005

Grossman RI, Yousem DM. Neuroimaging: The Requisites. Philadelphia: Elsevier; 2003

Case 177

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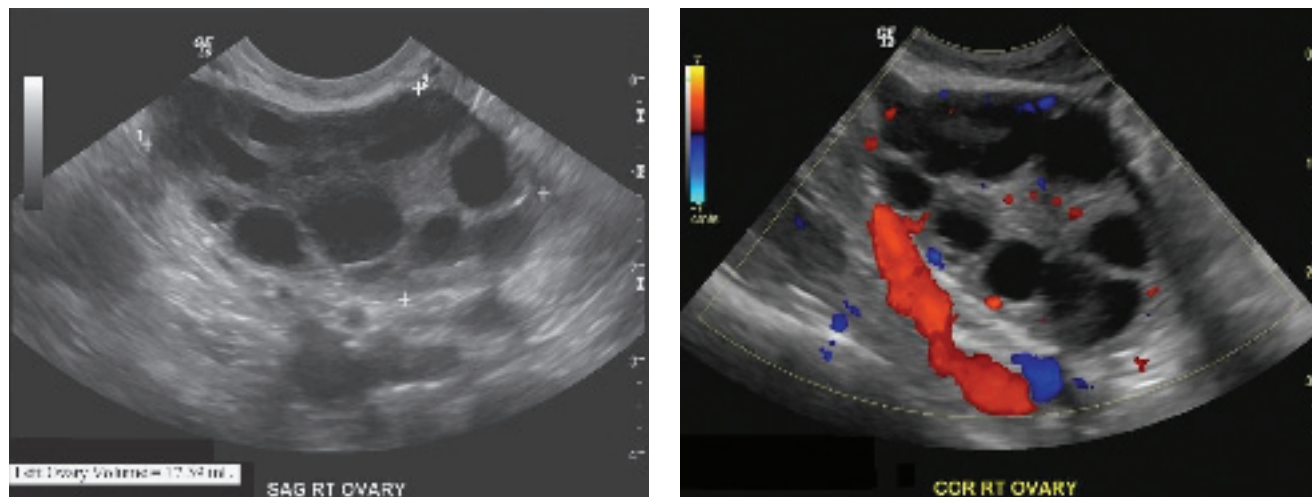


Fig. 177.1 (A) Sagittal gray scale and (B) color sonographic images through the left ovary demonstrate an enlarged ovary with multiple peripheral follicles. Flow is demonstrated within the ovary. Arterial and venous waveforms (not shown) were normal.

■ Clinical Presentation

Premenopausal patient; history otherwise withheld (**Fig. 177.1**).

■ Key Imaging Finding

Enlarged ovary with multiple peripheral follicles

■ Top 3 Differential Diagnoses

- **Ovarian torsion.** Ovarian torsion is the result of the ovary twisting about its vascular axis. Torsion is most common in premenopausal patients but may occur at any age when a pathologic lead point (e.g., an ovarian mass) is present. Patients typically present with severe pelvic pain. As the torsion occurs, venous outflow is first decreased, resulting in an enlarged ovary (>12 mL) with heterogeneous echotexture. As the edema progresses, arterial inflow is decreased. Hemorrhage, necrosis, and infarction may occur if left untreated. The presence of flow within the ovary is of limited diagnostic value, as the mere presence of flow does not exclude torsion. In cases of intermittent torsion, the ovary may actually be hyperemic. The absence of flow, however, is highly suggestive of torsion. Torsion may present sonographically as an enlarged edematous ovary with peripheral follicles.
- **Polycystic ovarian syndrome (PCOS).** PCOS, also referred to as Stein–Leventhal syndrome, is a clinical syndrome consisting of obesity, hirsutism, amenorrhea or irregular menses, and infertility. The syndrome is associated with a variety of endocrine disturbances, including increased androgen production. Classic sonographic findings consist of enlarged ovaries with multiple peripheral follicles (10 or more) of similar size (usually <5 mm) in a “string of pearls” configuration. The ovaries may have a thick echogenic capsule. Treatment is directed at restoring fertility through fertility medications.
- **Ovarian hyperstimulation syndrome (OHS).** Ovarian stimulation from fertility medications results in the maturation of multiple follicles during the menstrual cycle. Rarely, the ovaries may be overstimulated, resulting in enlarged ovaries with numerous enlarged peripheral follicles, ascites, and pleural effusions, referred to as OHS. When severe, the condition may be life-threatening due to fluid and electrolyte imbalances. The syndrome typically occurs when the dosage of medications is increased, and the ovaries may be massively enlarged (up to 15–20 cm). Treatment consists of correcting electrolyte imbalances and discontinuing fertility medications.

■ Diagnosis

Polycystic ovarian syndrome

✓ Pearls

- Ovarian torsion must be considered with enlarged ovaries and pain; flow does not exclude the diagnosis.
- PCOS presents clinically with obesity, hirsutism, irregular menses, and infertility.
- Ultrasound findings in PCOS include enlarged ovaries with peripheral follicles in a “string of pearls” configuration.
- OHS presents with enlarged ovaries with peripheral follicles, ascites, and pleural effusions.

Suggested Readings

Jeong YY, Outwater EK, Kang HK. Imaging evaluation of ovarian masses. *Radiographics* 2000;20(5):1445–1470

Middleton WD, Kurtz AB, Hertzberg BS. *Ultrasound: The Requisites*. St. Louis, MO: Mosby; 2004