The Inguinal Canal: Anatomy and Imaging Features of Common and Uncommon Masses

Priya R. Bhosale, MD • Madhavi Patmana, MD • Chitra Viswanathan, MD • Janio Szklaruk, MD, PhD

A variety of benign and malignant masses can be found in the inguinal canal (IC). Benign causes of masses in the IC include spermatic cord lipoma, hematoma, abscess, neurofibroma, varicocele, desmoid tumor, air, bowel contrast material, hydrocele, and prostheses. Primary neoplasms of the IC include liposarcoma, Burkitt lymphoma, testicular carcinoma, and sarcoma. Metastases to the IC can occur from alveolar rhabdomyosarcoma, monophasic sarcoma, prostate cancer, Wilms tumor, carcinoid tumor, melanoma, or pancreatic cancer. In patients with a known malignancy and peritoneal carcinomatosis, the diagnosis of metastases can be suggested when a mass is detected in the IC. When peritoneal disease is not evident, a mass in the IC is indicative of stage IV disease and may significantly alter clinical and surgical treatment of the patient. A combination of the clinical history, symptoms, laboratory values, and radiologic features aids the radiologist in accurately diagnosing mass lesions of the IC. Supplemental material available at radiographics.rsna.org/cgi/content/full/28/3/819/DC1.

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 Abbreviations: AJCC = American Joint Committee on Cancer, IC = inguinal canal

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Introduction
Radiology plays an important role in the detection, diagnosis, staging, and surveillance of disease in oncologic patients. Another, and perhaps less acknowledged, role of radiologic interpretation is the serendipitous encounter of neoplastic and nonneoplastic masses during routine interpretation. Computed tomography (CT) and magnetic resonance (MR) imaging are the primary modalities used in evaluating pelvic disease and are essential tools in detecting inguinal tumors.

This article reviews the anatomy of the inguinal canal (IC) and describes the clinicopathologic features of the common and uncommon masses found in the IC, knowledge of which is the basis for accurate radiologic interpretation and diagnosis. The imaging characteristics of benign processes, primary neoplasms, and metastases of the IC are demonstrated by using CT and MR imaging.

Normal Anatomy of the IC
The IC is a short, narrow, diagonal passage in the lower anterior abdominal wall measuring approximately 4 cm in length that is lined by the aponeuroses of three muscles: the external oblique, internal oblique, and transversus abdominis muscles (Fig 1). The IC has openings at either end: the deep and superficial inguinal rings. The deep inguinal ring is an oval gap in the transversalis fascia and lies 1 cm superior to the inguinal ligament and lateral to the inferior epigastric vessels (Fig 2). The superficial inguinal ring is a triangular opening in the aponeurosis of the external oblique muscle (Fig 3).

The anterior wall of the IC is formed mainly by the aponeurosis of the external oblique and internal oblique muscles, and the posterior wall is formed mainly by the transversalis fascia and the conjoint tendon. The superior wall is formed by...
the internal oblique and transversus abdominis muscles, and the inferior wall is formed by the superior surface of the inguinal ligament.

In males, the IC transmits the spermatic cord, which includes the vas deferens, the testicular artery, and the genital branch of the genitofemoral nerve, from the pelvic cavity to the scrotum (Fig 4). In females, the IC transmits the round ligament of the uterus and the ilioinguinal nerve to the labia majora (1).

**Herniation of Normal Anatomic Structures**

Hernias usually develop from abnormalities that cause high intraabdominal pressures, resulting in nonclosure of the processus vaginalis (2). Risk factors include Marfan syndrome, elevated maternal estrogen levels, and metabolic changes (ie, collagen degeneration). In adults, alterations in the connective tissue ultrastructure cause weakening of the elastic and collagen fibers and may be a basis for inguinal hernia formation (3). Inguinal hernias may be classified depending on whether they are medial (direct) or lateral (indirect) to the inferior epigastric artery. Indirect hernias descend along the spermatic cord from deep to the superficial inguinal ring.

Bowel hernias may manifest as fluctuant, soft, palpable masses in the IC. Approximately 6.7% of all inguinal hernias contain colon in adults, and 0.4% contain bladder (Fig 5; see also Movie 1 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). Approximately 2.9% of inguinal hernias contain the ovaries (4). The appendix in an IC hernia accounts for 1% of all hernias (Fig 6; see also Movie 2 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). Acute appendicitis (Amyand hernia) manifests in the IC in 0.13% of all cases of appendicitis (5).
At CT, a contrast material–filled bowel loop may be seen. Discrete valvulae conniventes are visible in small bowel loops (Fig 7; see also Movie 3 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). Hastral markings can be identified in colonic loops (Fig 8; see also Movie 4 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). Tracing the course of the bowel loops aids in differentiating the small bowel from the colon or appendix. Care should be taken to identify signs of strangulation such as bowel wall thickening, coexisting inflammatory changes, the whirl sign, the beak sign, or the presence of free air, which is an indication of bowel perforation (6). Surgical resection is the treatment of choice for appendicitis, bowel incarceration, and strangulation.

IC hernias that contain ovaries are usually seen in children younger than 5 years old (7). Herniated ovaries may undergo torsion and can be associated with salpingitis. At CT and MR imaging, ovaries appear as round or ovoid low-attenuation soft-tissue masses with follicles (Fig 9; see also Movie 5 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1) (7). Treatment involves surgical retraction of the ovaries into the pelvic cavity followed by herniorrhaphy.

Cryptorchidism is a common congenital anomaly at birth, occurring in 1.8%–3.8% of term males (8). In this condition, the testis can be found in any position along its usual line of descent; however, 80% will be located in the inguinal region just outside the IC (9). Later risks associated with cryptorchidism include infertility and malignancy. At MR imaging, testes have low signal intensity on T1-weighted images and high signal intensity on T2-weighted images, with homogeneous contrast enhancement (Fig 10; see also Movie 6 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). At CT, testes are isodense to soft tissue and show contrast enhancement. Treatment is orchiopexy (8). Following the path of the gonadal vessels confirms that the visualized structure in the IC represents either an ovary or a testicle.

**Benign Processes**

**Spermatic Cord Lipoma**

Lipomas of the spermatic cord are usually incidentally found during inguinal hernia repairs and are considered true lipomas only if they are confined to the IC and have no connection with the
A hypothesis suggests that lipomas are formed as a result of fatty deposition in the gubernacular remnant (11). Cord lipomas are fatty masses lateral or inferior to the spermatic cord, whereas fat-containing hernias occur anteromedial to the cord. In a series of 280 hernia repairs, there was an 11% prevalence of cord lipomas associated with indirect hernias. The overall prevalence of cord lipomas was 22.5% (10).

At gross examination, pathologic specimens appear as fatty masses, half of which are typically larger than 4 cm in length (11,12). At MR imaging, their signal intensity is similar to that of fat on T1- and T2-weighted images (Fig 11; see also Movie 7 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). At CT, the attenuation is less than −20 HU. Lipomas are usually asymptomatic but can cause pain and discomfort. Resection is the treatment of choice if the patient is clinically symptomatic (12).

Figure 9. Herniated ovaries in a 55-year-old woman with lymphoma. (a) Axial contrast-enhanced CT image shows bilateral IC hernias containing ovaries (arrows). (b) Coronal diagram shows an IC hernia containing an ovary (black arrow). White arrow = fallopian tube, red arrow = ovarian ligament.

Figure 10. Cryptorchidism in a 65-year-old man with colon cancer. (a) Coronal T1-weighted MR image shows a low-signal-intensity mass in the IC (arrow), which represents a testicle. (b) On an axial T2-weighted MR image, the testicle has high signal intensity (arrow).

Figure 11. Spermatic cord lipoma in a 64-year-old man with a history of prostate carcinoma. Axial T2-weighted MR image shows a mass of fat signal intensity (arrow) lateral to the left spermatic cord. The mass represents a lipoma.
clinical symptoms of pain, fever, and leukocytosis confirm the diagnosis. Primarily, treatment consists of draining the abscess with concomitant antibiotic therapy.

**Hematoma**

Hematomas within the IC can occur as a result of warfarin therapy, trauma, surgery, catheter placement, or a neoplasm (13,14). Clinically, they manifest as pain and swelling (13). At CT, hematomas generally appear as hyperattenuating masses in the IC, with an attenuation greater than 30 HU (Fig 12). At MR imaging, hematomas can have a variable appearance (15). At follow-up, hematomas usually resolve without therapy. If a hematoma is clinically symptomatic, treatment includes drainage and antibiotic therapy.

**Abscess**

A number of pathologic entities can lead to abscess formation in the IC, such as incarcerated inguinal hernia, perforated Amyand hernia, diverticulitis, or Meckel diverticulum (16). Clinical findings include abdominal cramping, an irreducible groin mass, fever, and leukocytosis. The clinical symptoms can be less localizing, resulting in delayed diagnosis. At CT, abscesses are low-attenuation masses with ring enhancement. At MR imaging, abscesses typically have low signal intensity on T1-weighted images and high signal intensity on T2-weighted images and can exhibit a thin rim of peripheral enhancement (Fig 13; see also Movie 8 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1) (17). Heterogeneous attenuation or signal intensity with associated inflammatory changes in the surrounding fat and clinical symptoms of pain, fever, and leukocytosis confirm the diagnosis. Primarily, treatment consists of draining the abscess with concomitant antibiotic therapy.

**Neurofibroma**

Neurofibromas are associated with neurofibromatosis type 1 or type 2 (von Recklinghausen disease). Neurofibromatosis type 1 is a spectrum of abnormalities including café-au-lait skin patches, axillary oringuinal freckles, bone dysplasias, central nervous system tumors, and solitary and plexiform neurofibromas. Solitary neurofibromas are associated with neurofibromatosis type 1 in 37% of cases (18). Neurofibromas in the IC arise from the genitofemoral or ilioinguinal nerve. Symptoms may include a palpable mass, dull aching pain, or sensory disturbance (19). At gross examination, neurofibromas contain mucin, myxoid stroma, fibrous tissue, and central collagen fibers.

At CT, neurofibromas may appear as low-attenuation masses that enhance after administration of iodinated contrast material (Fig 14; see also Movie 9 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). At MR imaging, plexiform neurofibromas have low signal intensity on T1-weighted images and high signal intensity with central low signal intensity (target sign) on T2-weighted images and enhance after administration of gadolinium contrast material (20). Indicators of malignant transformation

**Figure 12.** Hematoma in a 35-year-old man with a mass in the IC after surgical resection of a lipoma. Axial CT image shows a mass with high attenuation (58 HU) in the right IC (arrow). The mass represents a hematoma.

**Figure 13.** Abscess in a 66-year-old man with rectal adenocarcinoma. Sagittal T2-weighted MR image shows a mass of heterogeneous intermediate signal intensity (arrow) extending into the left IC. The mass represents an abscess.
Varicoceles represent abnormal dilatation of the pampiniform plexus in the spermatic cord and are of two types. Primary varicoceles are due to impaired drainage of the internal spermatic vein from incompetent valves and occur most commonly on the left (14). Secondary varicoceles result from increased pressure on the testicular vein produced by disease processes such as hydronephrosis, cirrhosis, abdominal neoplasms, and nutcracker phenomenon due to compression of the left renal vein between the superior mesenteric artery and the aorta (21–24). Patients with cirrhosis may develop a left varicocele due to splenorenal shunting from portal hypertension (23). Long-standing hydronephrosis and hydronephrosis and hydronephrosis can lead to varicocele formation from pressure on the testicular vein due to the angle of drainage into the renal vein (14).

Clinical symptoms include pain, a soft palpable mass, and infertility. Incidental varicoceles are present in 40% of infertile men (25). A noncompressible varicocele raises suspicion for an underlying retroperitoneal malignant process (14). At CT, varicoceles appear as enhancing tubules in the IC (Fig 15; see also Movie 10 at radiographics.rsna Journal of the Radiological Society of North America. At

Figure 14. Neurofibromas in a 46-year-old man with a history of neurofibromatosis. (a) Axial CT image shows low-attenuation masses in the left hemipelvis that extend into the inguinal region with involvement of the ilioinguinal nerve (arrow). The masses represent plexiform neurofibromas. (b) Coronal diagram shows a neurofibroma (arrow) arising from the ilioinguinal nerve.

Figure 15. Varicocele in a 35-year-old man with a right-sided extraadrenal paraganglioma that caused obstruction of the right gonadal vein. CT image shows an enhancing serpentine mass in the right IC (arrow). The mass is due to engorgement of the pampiniform plexus and represents a right varicocele.

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Desmoid Tumor

Desmoid tumors are associated with Gardner syndrome, familial adenomatous polyposis, and surgical scars (27). These tumors are rare and represent 3.5% of all fibrous tissue tumors (28). The most common location of solitary occurrence is the anterior abdominal wall (29). Desmoid tumors of the inguinal region can manifest as pain, a mass, or edema of the lower extremities (28). At CT, desmoid tumors may appear as a low-attenuation soft-tissue mass and enhance homogeneously after administration of contrast material. At MR imaging, desmoid tumors may have low signal intensity on T1-weighted images and low or heterogeneous signal intensity on T2-weighted images and usually enhance after administration of gadolinium contrast material (Fig 16) (30). Treatment is usually surgical resection; however, given the high recurrence rate, neoadjuvant chemotherapy and radiation therapy can be valuable (31).

Air and Bowel Contrast Material

The discovery of air or bowel contrast material in the IC is usually the result of gastrointestinal tract perforation. Air in the IC may produce palpable crepitus. At CT, air appears black (−1000 HU) (Fig 17; see also Movie 11 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). At MR imaging, air has low signal intensity on both T1- and T2-weighted images. Extravasation of bowel contrast material can result in an acute, enlarging, palpable mass in the groin (Fig 18; see also Movie 12 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). Treatment should be directed at the underlying cause.

MR imaging, characteristics may vary depending on the rate of flow within the dilated vessels, but in general there is intermediate signal intensity on T1- and T2-weighted images (26). Vascular embolization or surgery is the treatment of choice. In the presence of a secondary varicocele, the underlying cause should be treated (21).

**Figure 16.** Desmoid tumor in a 33-year-old man. (a) Axial T1-weighted MR image shows a low-signal-intensity mass (arrow) in the right IC. (b) Axial fat-saturated gadolinium-enhanced T1-weighted MR image shows homogeneous enhancement of the mass (arrow). (c) Axial T2-weighted MR image shows the low-signal-intensity mass (arrow).
characteristics and are located in the IC anterior and medial to the spermatic cord. At MR imaging, they have low signal intensity on T1-weighted images and high signal intensity on T2-weighted images and do not enhance with gadolinium contrast material. Treatment for the primary process is usually surgical; in case of a secondary process, treatment is aimed at the underlying cause (33).

Hydrocele
A hydrocele is a fluid collection that occurs in the IC as a result of congenital nonclosure of the processus vaginalis. Secondary causes may include trauma, infection, or a neoplasm. Two types of congenital hydroceles have been described: the encysted subtype has no communication with the peritoneum or tunica vaginalis, whereas the funicular subtype communicates with the peritoneum at the internal ring (32).

Symptoms of hydrocele include groin swelling and a fluctuant palpable mass. At CT, both encysted hydroceles (Fig 19; see also Movie 13 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1) and funicular hydroceles (Fig 20; see also Movie 14 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1) have fluid attenuation characteristics and are located in the IC anterior and medial to the spermatic cord. At MR imaging, they have low signal intensity on T1-weighted images and high signal intensity on T2-weighted images and do not enhance with gadolinium contrast material. Treatment for the primary process is usually surgical; in case of a secondary process, treatment is aimed at the underlying cause (33).
Liposarcomas often manifest as a palpable, painless, slow-growing soft-tissue mass. At gross examination, liposarcomas are multilobulated, well-circumscribed, fat-containing masses and may show fat necrosis or expansion of the fibrous interlobular septa with increased cellularity (38). At CT, well-differentiated liposarcoma often appears as a large mass of fat attenuation (>75% of the lesion) intermixed with non-lipomatous thick septa or soft-tissue attenuation nodules (Fig 22; see also Movie 16 at radiographics.rsnajnls.org/cgi/content/full/28/3/819/DC1) (38). At MR imaging, these masses have high signal intensity on both T1- and T2-weighted images with little enhancement. Dedifferentiation of liposarcomas manifests as heterogeneously enhancing nonfatty components with calcification (39). Imaging findings are nonspecific, and biopsy is usually required for a definitive diagnosis. Unless dedifferentiation occurs, well-differentiated liposarcomas have no metastatic potential. Treatment involves radical excision of the tumor with or without adjuvant radiation therapy or chemotherapy (40).

Burkitt Lymphoma
Burkitt lymphoma is a high-grade B-cell non-Hodgkin lymphoma that makes up 60% of pediatric lymphomas. Although most cases are due to the chromosomal translocation t(8;14), it is believed that the Epstein-Barr virus plays a role in the endemic type (41). Gonadal and spermatic cord involvement is rare and has been reported in 5% of male patients with Burkitt lymphoma (42,43). CT demonstrates thickening of the
The peak prevalence is at 15–34 years, but it may occur outside this age group (48,49). Germ cell tumors represent 95% of all testicular tumors, arise from spermatogenic cells, and are further classified into seminomatous and nonseminomatous germ cell tumors (50). Risk factors include a history of contralateral testicular cancer, cryptorchidism, exposure to carcinogens, trauma, mumps orchitis, and epididymitis (49,51,52). Patients present with a painless, swollen, hard testis, although pain may occur due to intratumoral hemorrhage.

Testicular Carcinoma
Testicular cancer is a rare malignancy that accounts for only 1% of all neoplasms in men (48).
Sarcoma

Soft-tissue sarcomas are uncommon tumors that arise from the embryonic mesoderm (54). The prevalence of sarcomas of the genitourinary tract is less than 5% of total sarcomas, and the spermatic cord is a common site (55). Sarcomas usually manifest as a firm palpable mass of the IC or scrotum, are typically treated with surgical excision, and have a high propensity for recurrence (56). At CT, sarcomas appear as enhancing masses infiltrating into the spermatic cord and may extend through the IC into the abdomen or vice versa (Fig 25; see also Movie 18 at radiographics.rsnajnls.org/cgi/content/full/28/3/819/DC1). Imaging findings are nonspecific, and biopsy is usually required for definitive diagnosis. Treatment includes local excision, radiation therapy, and chemotherapy. Despite therapy, there is a high propensity for recurrence (56).

Metastases

Metastases from Alveolar Rhabdomyosarcoma and Monophasic Sarcoma

Rhabdomyosarcoma is the most common soft-tissue sarcoma in children and adolescents less than 20 years old. Metastases to the IC are rare, and the prognosis is poor (57,58). Clinical examination may reveal a painful tender mass in the IC. At CT, metastatic rhabdomyosarcoma can appear as an enhancing infiltrating mass involving the spermatic cord (Fig 26; see also Movie 19 at radiographics.rsnajnls.org/cgi/content/full/28/3/819/DC1). Treatment includes radical inguinal orchiectomy with combined chemotherapy (59).

Monophasic synovial sarcoma is the fourth most commonly occurring sarcoma, accounting for 8%–10% of all sarcomas (60). At MR imaging, this tumor has low signal intensity on T1-weighted images and high signal intensity on T2-weighted images (Fig 27). Treatment consists of surgical resection and neoadjuvant chemotherapy.

Pseudomyxoma Peritonei

Pseudomyxoma peritonei is a rare condition characterized by gelatinous ascites from mucinous adenocarcinoma arising from different anatomic sites, including the appendix and ovary (61). The myxomatous appearance is due to fibroblastic and vascular proliferation incited by mucin; at gross examination, it may manifest as a firm white mass (62–64). Abdominal pain and distention are a common presentation (62). Isolated deposits can be found in herniated sacs in the absence of widespread peritoneal disease (65).

At CT, peritoneal spread can appear as soft-tissue nodularity or enhancement along peritoneal surfaces. Peritoneal deposits can herniate into the IC, manifesting as fluid attenuation masses (Fig 28; see also Movie 20 at radiographics.rsnajnls.org/cgi/content/full/28/3/819/DC1). At MR imaging, the mucin has intermediate to high signal intensity on T1-weighted images and high signal intensity on T2-weighted images (66). Treatment encompasses cytoreduction with debulking surgery, which includes appendectomy, oophorectomy, and omentectomy, followed by intraperitoneal chemotherapy (67).

Metastases from Prostate Cancer

Prostate cancer is the most common malignancy in males and the second most common cause of deaths (68,69). Approximately 95% of prostate cancers are adenocarcinomas. Scrotal spread occurs via the lymphatics; according to AJCC staging, it is considered stage IV disease and carries a poor prognosis (70). At CT, IC metastases appear as soft-tissue attenuation masses and enhance with intravenous contrast material (see Movie 21 at radiographics.rsnajnls.org/cgi/content/full/28/3/819/DC1). Chemotherapy and radiation therapy, hormone therapy, and immunotherapy are currently being used to treat prostate cancer.
Figure 26. Metastases in a 12-year-old boy with alveolar rhabdomyosarcoma. Axial CT image obtained with intravenous contrast material shows an enhancing mass in the right IC and a soft-tissue mass in the left IC (arrows).

Figure 27. Metastasis in a 35-year-old woman with monophasic sarcoma. (a) Axial T1-weighted MR image shows a low-signal-intensity mass in the right IC (arrow). (b) Axial T2-weighted MR image shows that the mass has high signal intensity (arrow). (c) Axial gadolinium-enhanced T1-weighted MR image shows enhancement of the mass (arrow).

Figure 28. Pseudomyxoma peritonei in a 61-year-old man with appendiceal adenocarcinoma. Axial CT image obtained with intravenous contrast material shows a low-attenuation mucinous deposit in the right IC (arrow). The mucinous deposit represents pseudomyxoma peritonei.
Metastases from Wilms Tumor
Wilms tumor is the most common renal tumor among children less than 4 years old and is the fifth most common pediatric tumor (71). There are two forms of Wilms tumor: the sporadic form and the familial form. Of the two forms of Wilms tumor, the familial form is associated with genetic syndromes including Beckwith-Wiedemann syndrome, hemihypertrophy, congenital aniridia, Denys-Drash syndrome, and trisomy 18 mutation (72,73). It is characterized by abnormal proliferation of the metanephric blastema cells (74).

Inguinal and scrotal Wilms tumors are extremely rare; to our knowledge, only case reports have been published in the literature. The proposed route of metastatic Wilms tumor is via the spermatic vein to the spermatic cord (75). At CT, metastatic tumor in the IC can appear as an enhancing round soft-tissue mass (Fig 29) (76,77). Local excision of tumor followed by orchiectomy and chemotherapy is the treatment of choice (77,78).

Metastases from Carcinoid Tumor
Carcinoid tumors are neuroendocrine tumors derived from enterochromaffin (Kulchitsky) cells that secrete serotonin and most commonly arise in the submucosa of the gastrointestinal and bronchopulmonary tracts; however, these tumors can arise from other organs (79). Most carcinoid tumors are sporadic, but they occur in 10% of patients with multiple endocrine neoplasia type 1 (80). The large bowel is the most frequent primary site for metastases to the IC (81). The overall 5-year survival rate is 70%–80% regardless of tumor site or stage (82). At CT, metastases appear as round soft-tissue attenuation enhancing masses (see Movie 22 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). Surgery is curative for primary tumors. Palliative therapy includes somatostatin analogs, interferon alpha, and chemotherapy (83).

Metastases from Melanoma
A cancer of the melanocytes, melanoma is the number one cause of mortality from all skin cancer–related deaths, yet accounts for only 4% of all skin cancers (84,85). The 5-year survival of metastatic melanoma is 14% (84,85). Although metastatic spread to the IC is rare, melanoma is an aggressive disease and frequently manifests as systemic metastases. At CT, metastases appear as nonspecific, enhancing, soft-tissue attenuation masses (see Movie 23 at radiographics.rsna.org/cgi/content/full/28/3/819/DC1). Melanoma metastases to the IC are considered stage IV disease on the basis of the revised AJCC staging system (45). Treatment options include both medical (adjuvant chemotherapy, radiation therapy, interferon alpha, melanoma vaccines) and surgical (primary tumor resection and lymph node dissection) therapies (86).
Metastases from Pancreatic Cancer
Pancreatic adenocarcinoma is the fifth leading cause of cancer death in the United States. Pancreatic cancer metastases to the IC and spermatic cord may manifest as an increase in frequency of urination (87). Pancreatic metastases are more likely to occur in the setting of peritoneal carcinomatosis and are considered stage IV disease according to the AJCC staging criteria (45). The average survival subsequent to the diagnosis of metastasis is 9.1 months (88). At CT and MR imaging, metastases of pancreatic cancer to the IC can appear as enhancing masses (see Movie 24 at radiographics.rsnaajnl.org/cgi/content/full/28/3/819/DC1). Treatment is usually palliative and includes chemotherapy.

Conclusions
A myriad of masses can be found in the IC. The causes vary from benign to malignant processes. The benign processes include iatrogenic, traumatic, infectious, and inflammatory conditions. Sometimes, a definitive diagnosis can be made on the basis of appropriate imaging findings. In other instances, a combination of clinical history with imaging features will lead to the correct diagnosis. In patients with a known malignancy and peritoneal carcinomatosis, the diagnosis of metastases can be suggested when a mass is detected in the IC. When peritoneal disease is not visualized, a mass in the IC may significantly alter the clinical and surgical treatment of the patient, since it indicates stage IV disease with a poor prognosis. Unfortunately, in some cases a definitive diagnosis cannot be made and a biopsy is required. In conclusion, a combination of clinical history, symptoms, laboratory values, and radiologic features will aid the radiologist in accurately diagnosing mass lesions in the IC.

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Page 828
A malignant tumor of mesenchymal origin, liposarcoma is one of the most common soft-tissue sarcomas. Liposarcomas make up 7% of all paratesticular sarcomas, 12% of which occur in the IC (37). Although 20% of liposarcomas originate in the retroperitoneum, only 0.1% manifest as incidental inguinal hernias (37).

Page 830
Scrotal spread occurs via the lymphatics; according to AJCC staging, it is considered stage IV disease and carries a poor prognosis (70).

Page 686
Most carcinoid tumors are sporadic, but they occur in 10% of patients with multiple endocrine neoplasia type 1 (80).
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Shipping Address (cannot ship to a P.O. Box) Please Print Clearly

Name __________________________________________
Institution _________________________________________
Street ___________________________________________
City ____________________  State _____  Zip  ___________
Country ___________________________________________
Quantity __________________ Fax _____________________
Phone: Day _______________ Evening _______________
E-mail Address _____________________________________

Additional Shipping Address* (cannot ship to a P.O. Box)

Name __________________________________________
Institution _________________________________________
Street ___________________________________________
City ____________________  State _____  Zip  ___________
Country ___________________________________________
Quantity __________________ Fax _____________________
Phone: Day _______________ Evening _______________
E-mail Address _____________________________________

* Add $32 for each additional shipping address

Payment and Credit Card Details

Enclosed: Personal Check ___________

Credit Card Payment Details

Checks must be paid in U.S. dollars and drawn on a U.S. Bank.

Credit Card: ___ VISA ___ Am. Exp. ___ MasterCard
Card Number _____________________________________
Expiration Date _________________________________
Signature: ______________________________________

Please send your order form and prepayment made payable to:

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P.O. Box 751903
Charlotte, NC 28275-1903

Note: Do not send express packages to this location, PO Box.
FEIN #:541274108

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Invoice Address Please Print Clearly

Please complete invoice address as it appears on credit card statement
Name _________________________________________
Institution _______________________________________
Department _______________________________________
Street ___________________________________________
City ____________________  State _____  Zip  ___________
Country ___________________________________________
Phone ______________________________________ Fax __________________
E-mail Address _____________________________________

Cadmus will process credit cards and Cadmus Journal Services will appear on the credit card statement.

If you don’t mail your order form, you may fax it to 410-820-9765 with your credit card information.

Signature __________________ Date __________________

Signature is required. By signing this form, the author agrees to accept the responsibility for the payment of reprints and/or all charges described in this document.
# Black and White Reprint Prices

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## Color Reprint Prices

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## Tax Due

Residents of Virginia, Maryland, Pennsylvania, and the District of Columbia are required to add the appropriate sales tax to each reprint order. For orders shipped to Canada, please add 7% Canadian GST unless exemption is claimed.

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410-820-9765 (FAX number)

baynardr@cadmus.com (e-mail)