RADIOLOGIC PATHOLOGIC CORRELATION / Gastrointestinal imaging

Urachal-colonic fistula: MR imaging and MDCT features

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Case presentation

A 39-year-old male, with a history of posterior urethral valves resulting in bilateral hydronephrosis and stage IV chronic renal insufficiency, as well as hypertension, hyperlipidemia, and gout, was referred to our institution with periumbilical pain, incomplete urinary bladder emptying, urinary urgency, and urinary frequency. Eight months earlier, he had one episode of serosanguineous drainage from his umbilicus that self-resolved. During that time, his urologist performed a bedside abdominal ultrasound that reportedly revealed no abnormalities. The patient was then in his usual state of health until two months prior to the current presentation, when he had an episode of left upper quadrant abdominal pain, mild nausea, and constipation that was successfully treated with docusate sodium.

On presentation at this hospital, the patient described periumbilical pain, as well as a sensation of incomplete urinary bladder emptying, urinary urgency, and urinary frequency. On examination, a palpable mass was noted below the umbilicus and to the left of midline. There was no overlying skin erythema. The phallus, urethra, testes, epididymis, and prostate were unremarkable. Bedside ultrasound reportedly demonstrated an infected urachal cyst or mass. Laboratory studies demonstrated a white blood cell count of 12.59 k/uL (reference range: 4.5–11), hematocrit of 34.7% (reference range: 43–52%), creatinine of 3.22 mg/dL (reference range: 0.7–1.4), blood urea nitrogen (BUN) of 51 mg/dL (reference range: 7–20), and urinalysis that demonstrated trace protein, but was negative for white blood cells, red blood cells, nitrates, and leukocyte esterase.

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The patient was started on levofloxacin for presumed infection. His pain improved significantly after the first dose of the medication and subsequently plateaued. Several weeks later, magnetic resonance imaging (MRI) of the abdomen and pelvis with intravenous contrast material was performed, and demonstrated a gas-containing mass situated at the dome of the bladder, possibly urachal in origin, and possibly communicating with the umbilicus (Fig. 1). The patient was subsequently scheduled for surgery to resect the urachal lesion.

Five days after the MRI and before the patient’s scheduled operation, the patient presented to clinic with rigors and a temperature of 38.4 degrees Celsius (101.1 degrees Fahrenheit). He was sent to the Emergency Department (ED) of this hospital for further evaluation. On examination in the ED, the patient was in no acute distress, and the abdomen was soft, minimally distended, and tender to palpation in the left lower quadrant. No rebound or guarding was present. Laboratory results demonstrated a white blood cell count of 8.62 k/ul, hematocrit of 32.0%, creatinine of 3.69 mg/dL, and of blood urea nitrogen of 67 mg/dL. Urinalysis was negative for white blood cells, red blood cells, nitrates, and leukocyte esterase. Non-contrast multidetector row computed tomography (MDCT) of the abdomen and pelvis demonstrated a fistula between the mass and the sigmoid colon (Fig. 2). Colonic diverticulosis was noted on MDCT and the possibility of a partially treated, complicated diverticulitis infecting the urachal remnant was raised an alternative differential consideration.

The patient was admitted and underwent a partial cystectomy with en bloc resection of the urachal lesion, umbilicus, a portion of the sigmoid colon, and bilateral lymphadenectomy. Pathology results were consistent with chronic and acute inflammation without evidence of malignancy (Figs. 3–5). The patient was discharged without complications, but was briefly readmitted for an ileus. After the readmission, the patient has had no additional complications to date.

**Discussion**

**Anatomy and embryology**

The urachus is the fibrous remnant of a fetal canal that connects the anterior urinary bladder to the umbilicus [1]. It is comprised of two embryonic structures: the allantois more cranially and the cloaca more caudally. The structure lies within the midline anterior abdominal wall, between the transversalis fascia anteriorly and the parietal peritoneum posteriorly. In the vast majority of instances, by 17 weeks

![Figure 1](image1.png) **Figure 1.** Axial T2-weighted MRI image at the level of the urinary bladder demonstrates a T2 heterogeneous mass with air fluid levels (short arrow) situated at the left anterolateral urinary bladder dome with associated bladder wall thickening (long arrow).

![Figure 2](image2.png) **Figure 2.** Sagittal non-contrast CT image of the pelvis demonstrates a fistulous connection (arrow) between the urachal lesion and the sigmoid colon.

![Figure 3](image3.png) **Figure 3.** En bloc gross resection specimen demonstrates a partial cystectomy (long arrow), urachus (short arrow), and umbilicus (asterisk).
post-conception, the canal becomes obliterated and the urachus becomes the median umbilical ligament [2].

In rare situations, however, the urachus fails to completely involute, resulting in one of four types of persistent urachal abnormalities: patent urachus, urachal cyst, umbilical-urachal sinus, and vesical-urachal diverticulum [1]. A patent urachus is a patent connection between the umbilicus and urinary bladder; it is the most common abnormality, seen in 50% of all urachal abnormalities. The prevalence of a patent urachus is 0.25—15 per 10,000 cases. An urachal cyst is a midline anterior abdominal wall structure with no connection between the urinary bladder and the umbilicus; urachal cysts represent 30% of urachal abnormalities and develop from the degeneration and desquamation of urachal epithelial cells. An umbilical-urachal sinus is a remnant outpouching associated with the umbilicus, and is seen in 15% of cases. An urachal diverticulum is an outpouching that arises superiorly from the anterior urinary bladder, and is the least common abnormality, seen in 3—5% of cases.

Urachal abnormalities have been described with posterior urethral valves or urethral atresia [3].

Clinical presentation

Urachal abnormalities are typically present during childhood and are very uncommon in adults. In adults, they may be present in the setting of an acquired abnormality such as infection. Men are twice as likely to be affected [1]. Typical presenting symptoms of a super-infected urachal cyst include fever, signs of sepsis, abdominal pain, midline periumbilical mass, dysuria, hematuria, and umbilical drainage. Infectious sources may be of vesicular, lymphatic, or hematogeneous routes [4]. Complications include abscess formation, rupture, and extension to the adjacent organs such as bowel. Laboratory abnormalities include an elevated white blood cell count and urinalysis with features suggestive for infection.

Radiologic evaluation

Imaging evaluation of infected urachal cysts may include MDCT, MRI, cystography, and ultrasound. An infected urachal cyst appears on MDCT as an irregular, typically midline or slightly off-midline, mass-like lesion along the anterior abdominal wall, in close proximity to the dome of the bladder, with peripheral wall enhancement, surrounding fat stranding, and sometimes gas locules. Calcifications are not commonly seen. On MR imaging, the lesion will typically appear heterogeneous on T1- and T2-weighted MR images, and will typically demonstrate enhancement on post-contrast images. On ultrasound, the lesion will appear as a midline anterior abdominal wall structure that demonstrates complex echogenicity, including thickened walls, debris, internal septations, and possibly shadowing gas locules [1]. If performed, a cystogram may demonstrate a communication between the collection and the urinary bladder.

Imaging, including MDCT and MR imaging, only have 61% sensitivity and 43% specificity for determining the presence of a urachal neoplasm versus a complex cyst [5]. Diagnosing an infected urachal remnant from an urachal neoplasm therefore requires tissue diagnosis, specifically from percutaneous biopsy or resection.

Pathologic correlation

The normal urachus appears on histology as tubules separated by fibrous cords. The structure includes an inner epithelial layer comprised of stratified, columnar, or urothelial cells, a middle connective tissue layer, and an outer smooth muscle layer that is contiguous with the detrusor muscle. Inflammatory/infectious changes will feature the presence of neutrophils, lymphocytes, and macrophages. The most common type of urachal neoplasm is adenocarcinoma.

Differential considerations

The primary differential consideration for an infected urachal cyst is a urachal carcinoma. Urachal neoplasms are rare, representing 0.2% of all bladder cancers [6].
percent of these are adenocarcinomas, and typically present in men between 40–70 years of age. The location of these neoplasms is typically at the bladder dome in a midline or slightly off-midline position. Many patients have local invasion or metastatic disease on presentation. Prognosis depends on stage, with a five-year overall survival rate of 45% [6].

On MDCT, MR imaging, and ultrasound, urachal carcinomas may have a solid, cystic, or heterogeneous appearance. Features of a mucinous neoplasm may be present. The presence of calcifications favors the diagnosis of urachal neoplasm, and extravesical and metastatic spread is common. Imaging is neither sensitive nor specific for distinguishing between a complex urachal cyst and urachal malignancy, and, again, a histological sample is required for diagnosis [5].

Colo-urachal fistulas

In our case, a fistulous connection between the urachal lesion and the sigmoid colon was identified on cross-sectional imaging. A few scattered colonic diverticula were also present. Given that the patient had received antibiotics prior to cross-sectional imaging, the MR and CT imaging appearance demonstrated what was either a partially treated abscess originating from the urachus and extending to the sigmoid colon or, perhaps, a sigmoid diverticulitis that extended to the urachal remnant. Colo-urachal fistulas appear to be exceedingly rare, with only two described cases throughout the literature [7,8]. There is no definitive way to distinguish whether the infection began with a diverticulitis versus a primarily infected urachal cyst.

Treatment

As no current preoperative testing modality is sensitive and specific enough to differentiate an infected urachal cyst from a urachal neoplasm, treatment involves surgical resection [3]. In this case, the possibility of a complicated diverticulitis resulting in super-infection of a urachal structure also necessitated surgical resection. Broad-spectrum antibiotics are typically administered when signs of infection are present, and percutaneous drainage may be performed if a discrete abscess cavity is present [9]. Debate exists on whether a single stage excision, versus a two-staged procedure involving drainage followed by excision, is more efficacious. Both laparoscopic and open approaches have been employed [9]. Regional lymph nodes may be removed to assess for metastatic spread. In the case of a colo-urachal fistula, the involved segment of colon may also be resected.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References