Incidental Findings During Routine Antepartum Obstetrical Sonography

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The standard for performing an antepartum obstetrical sonogram primarily involves the examination of the fetus; however, both the American Institute of Ultrasound in Medicine (AIUM) and American College of Radiology (ACR) guidelines suggest the evaluation of maternal structures as well. The authors present 35 incidental findings that were discovered on routine antepartum obstetrical sonography. These include abdominal wall, gastrointestinal, reproductive, urinary, and vascular anomalies in the maternal structures. A review of the literature demonstrates that many of these findings have clinical significance, which highlights the wisdom of the AIUM and ACR guidelines, and it also stresses the importance of seeking and reporting them.

Key words: incidental findings, obstetrical ultrasound, ACR guidelines, AIUM guidelines

The standard for performing an antepartum obstetrical sonogram primarily involves the examination of the fetus to evaluate fetal growth, anatomy, weight, presentation, well-being, and possible birth defects. The guidelines written by the American Institute of Ultrasound in Medicine (AIUM) and American College of Radiology (ACR) also suggest the “evaluation of the uterus, adnexal structures, and cul-de-sac” in the first trimester and of the “uterus (including the cervix) and adnexal structures” during the second and third trimesters to determine the presence of incidental findings, such as myomas, adnexal masses, and uterine abnormalities, which may be of clinical significance. This study reviews incidental findings detected outside the scope of
We reviewed cases collected over a 10-year period and present 35 incidental findings, including abdominal wall, gastrointestinal, reproductive, urinary, and vascular anomalies. Although case reports describing incidental findings have been described in the literature, the current review presents a much larger collection than previously reported.

### Materials and Methods

Over a period of 10 years, we collected incidental findings during routine antepartum obstetrical examinations. The findings presented are not typically part of a routine sonogram. For instance, common findings such as corpus luteum cyst, fibroid previa, uterine window, or hydronephrosis were excluded because they are reasonably expected findings. However, if a renal anomaly was revealed in the process of looking for hydronephrosis in a pregnant patient, the case was included. Thirty-five cases of incidental findings are presented.

### TABLE 1
Incidental Findings in 35 Routine Obstetrical Sonography Cases

<table>
<thead>
<tr>
<th>System</th>
<th>Incidental Finding</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal wall</td>
<td>Midline hernia</td>
<td>2</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>Cavernous hemangioma</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>of the liver</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crohn disease</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gallbladder polyp</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Gallbladder stone</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Pancreatic cyst</td>
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</tr>
<tr>
<td></td>
<td><strong>Subtotal:</strong></td>
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</tr>
<tr>
<td>Reproductive</td>
<td>Ovarian cystadenocarcinoma</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gartner’s duct cyst</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Krukenberg tumor</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Pseudocyesis</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sertoli tumor</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal:</strong></td>
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<tr>
<td>Urinary</td>
<td>Ureterocele</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ectopic pelvic kidney</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Renal cyst</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ureteral polyp</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ureteral stent</td>
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<td></td>
<td><strong>Subtotal:</strong></td>
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</tr>
<tr>
<td>Vascular</td>
<td>Abdominal aortic aneurysm</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Distended iliac vein</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Pelvic varices</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Pelvic phlebolith</td>
<td>1</td>
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<tr>
<td></td>
<td><strong>Subtotal:</strong></td>
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</tr>
<tr>
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<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal:</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>35</strong></td>
</tr>
</tbody>
</table>

FIGURE 1. Diastasis recti abdominis complicated by hernia. In the process of characterizing the small fibroid, a midline herniation with $12 \times 28 \times 18$ mm of content was found. With sonography-guided palpation, this was the source of the vague abdominal pain reported by the patient.
FIGURE 2. Transverse and parasagittal images in two different patients with cavernous hemangioma. While examining the fundal extent of the placenta, note was made in these two patients of hepatic cavernous hemangiomas.

FIGURE 3. Parasagittal image of gallbladder polyps. During a routine obstetrical anomaly survey, incidental note of gallbladder polyps was made.

FIGURE 4. Parasagittal image of gallstones. During a 14-week scan for an abnormal triple screen, gallstones were noted (left of the image). The placenta is on the right of the image.

Unfortunately, because of software conversions and incompatibilities between picture archiving and communication systems (PACs), not all cases could be retrieved or reviewed. By the very nature of “incidental finding,” it is not possible to estimate the number of missed diagnoses, and we suspect that the number of cases is an underestimation.

Because the extra views obtained were not ordered by the referring physician, and oftentimes the number of images and the extent of the views would not have met the requirements for a complete examination, the patients were not charged for the extra views.

Results

The 35 incidental findings included 2 abdominal wall, 8 gastrointestinal, 7 vascular, 2 miscellaneous, 11 urinary, and 5 reproductive anomalies (Table 1). Two patients had midline diastasis recti abdominis complicated by hernia (Figure 1a,b). Eight cases of gastrointestinal anomalies were found. They include cavernous hemangioma of the liver (Figure 2a,b), gallbladder polyp (Figure 3), gallbladder stone (Figure 4), a pancreatic cyst (Figure 5), and Crohn’s disease (Figure 6). Seven cases of vascular system anomalies were observed, including aortic aneurysm (Figure 7), pelvic varices (Figure 8a–c), distended iliac vein (Figure 9), and
phlebolith. In addition, an accessory spleen and bilateral pleural effusion were noted.

Eleven cases of urinary tract anomalies were discovered, including pelvic kidney (Figure 10a-c), ureterocele (Figure 11), ureteral mass (Figure 12), and renal cyst. In addition, a previously placed ureter stent that was not mentioned in a patient history was incidentally found. Evidence of previous medical procedures should not be misinterpreted as anomalies with clinical significance.

The AIUM and ACR guidelines suggest visualization of the uterus, adnexal structures, and cul-de-sac. We present five cases of reproductive anomalies, including cystadenocarcinoma (Figure 13), Gardner duct cyst (Figure 14), Krukenberg tumor (Figure 15), and Sertoli tumor (Figure 16), which reinforce the importance of routinely visualizing the structures of the reproductive tract during pregnancy. A case of pseudocyesis is also included.

**Discussion**

**ABDOMINAL WALL**

Two patients had midline abdominal wall hernias (Figure 1a,b). These were found in the process of investigating abdominal discomfort, a common obstetrical complaint. In one case, the hernia was a 20-mm midline rectus muscle dehiscence with approximately 50 mm of content. The patient underwent a term cesarean section and later had repair of the hernia. In the second case, investigation of a uterine fibroid revealed the midline hernia measuring $12 \times 28 \times 18$ mm.

Patients with midline abdominal wall hernias present with sharp, recurrent abdominal pain, which may worsen with movement, and a small midline mass. Midline hernias are believed to derive from an aperture for a perforating blood vessel within the linea alba in which properitoneal

![Figure 5](image-url) Transverse image of a pancreatic cyst. A pregnant patient with pain was referred for assessment of fetal well-being. A pancreatic cyst was identified.

![Figure 6](image-url) Crohn disease. This patient complained of ill-defined lower abdominal pain, attributed to ligamentous stretching. A very thick loop of bowel (8.3 mm) correctly reoriented the discomfort to the presence of Crohn disease.

![Figure 7](image-url) Transverse view of abdominal aortic aneurysm. Although we routinely crop the depth of the field of view to include only the uterus, a short review with greater depth at the onset of the examination allows us to observe the great vessels. In this case, a $36 \times 42$-mm aortic aneurysm is observed.
fat becomes incarcerated. Abdominal viscera rarely herniates through the defect. Another hypothesis associates midline abdominal wall hernias with the intrinsic weakness of the fascial fibers within the linea alba. Diastasis recti abdominis is a condition in which there is midline separation of the rectus abdominis muscle that leads to weakening of the linea alba and possible hernia formation. It is commonly seen in pregnant women, with a peak incidence of 66% in the third trimester. Spontaneous resolution of the diastasis often occurs, and abdominal exercises have been found to prevent the development of rectus abdominis diastase during pregnancy.7

GASTROINTESTINAL SYSTEM

There were two cases of cavernous hemangioma of the liver (Figure 2a,b). One was found as the sonographer “peeked” at the gallbladder in a patient complaining of vague upper abdominal pain. Although such “quick peeks” are not requested or billed for, they reveal several anomalies. A 23 × 35-mm hemangioma was visualized in that patient. Another patient with a history of systemic lupus erythematosus presented with edema. As the right kidney was investigated for hydronephrosis, a cavernous hemangioma of the liver measuring 13 × 17 mm was noted.

FIGURE 8. Transvaginal and transabdominal images of pelvic varices. Two of the three patients were referred for pelvic pain.

FIGURE 9. Transverse transabdominal image of a distended iliac vein. An obstetrical patient referred for routine scan was found to have a distended iliac vein. Note the worrisome incomplete filling of the vein. After “augmentation,” the vein finally filled.
FIGURE 11. Transabdominal image of an ureterocele. While investigating mild gestational hydronephrosis, the ureter was traced down to the bladder and a more serious cause of obstruction was recognized: a ureterocele.

FIGURE 12. Transvaginal image of a ureteral mass. A patient with left flank pain and hydronephrosis was examined. In the course of following the ureter, a mass was visualized, which was thought to be a calculus within the ureter. Doppler flow was noticed within the “stone,” and therefore we corrected the diagnosis to ureteral polyp. On a follow-up sonogram, the lesion disappeared and thus represented a stone rather than a polyp. The flow within the polyp was probably a twinkling artifact.
Cavernous hemangiomas are common, often asymptomatic, benign tumors of the liver composed of cavernous, endothelium-lined, blood-filled channels. Rupture during pregnancy and labor has been reported. The sizes of the reported ruptured hemangiomas were 2 cm and 10 cm, the larger of which resulted in maternal...
death. Thrombocytopenia, as well as enlargement of multiple cavernous hemangiomas suggesting malignancy, has also been documented during pregnancy. Trastek et al., however, believe that growth of hemangiomas is due to ectasia rather than infiltrative, neoplastic growth and should not be an indication for surgery.

Two cases of gallbladder polyps were found (Figure 3). Four polyps ranging between 2 and 6 mm were identified in one case, and the patient was advised to seek further medical attention postpartum. The polyps were not removed after delivery. A single polyp in the second case measured 4 mm.

Polypoid lesions of the gallbladder, most of which are asymptomatic, affect approximately 5% of pregnant women. The etiology of gallbladder polyps is varied: they can arise from an inflammatory reaction of the gallbladder wall caused by gallstones; they can be aggregates of lipid-filled macrophages known as cholesterol polyps; they can be benign lesions such as adenomyoma, papilloma, fibroma, lipoma, and hemangioma; or they can be malignant lesions such as adenocarcinoma. Most cholesterol polyps present pathologically as multiple lesions with a mean diameter of 4 mm. Approximately 4% to 14% of gallbladder polyps are malignant, most of which are greater than 10 mm. Resection is recommended in symptomatic patients whose polyps are solitary and greater than 10 mm in diameter, associated with gallstones, or with polyp growth on serial sonography. Gallbladder polyps have also been associated with obstructive jaundice, hemobilia, and acute pancreatitis due to the impaction of cholesterol polyps at the sphincter of Oddi.

Two patients had gallstones (Figure 4). In one case, the patient was referred at 14 weeks because of an abnormal triple screen test, and gallstones were found incidentally. Pregnancy has been found to be a risk factor for the development of gallstones. Ko et al. found that gallbladder sludge or stones are found in approximately 5% of women by the second trimester, 8% by the third trimester, and 10% by 4 to 6 weeks postpartum. A study by Valdivieso et al. found gallstones in approximately 12% of puerperal women. Complications of gallstones include cholecystitis, pancreatitis, choledocholithiasis, and cholangitis. Gallbladder disease is the most common nonobstetrical cause of maternal hospitalization within 60 days postpartum, accounting for 19% of hospitalizations.

One patient had an 11-mm cyst within the body of the pancreas (Figure 5). The patient complained of right upper quadrant pain and was referred for a sonogram. Cystic lesions of the pancreas can explain abdominal pain in pregnant patients, but more critically, patients with pancreatic cysts are at risk for pancreatic cancer. The lesion must be differentiated between a benign lesion (including simple cysts, serous cystadenomas, cystic papillary tumors, and lymphoepithelial cysts) and premalignant or malignant lesions (including mucinous cystic neoplasms, intraductal papillary mucinous neoplasms, cystic neuroendocrine tumors, and cystadenocarcinomas). Although it may be tempting to dismiss pancreatic cysts, a study by Fernández-del Castillo et al. demonstrated that 17% of patients with asymptomatic pancreatic cysts had in situ or invasive cancer, and 42% had a premalignant lesion. In a study by Goh et al., of 109 patients who underwent surgical resection of a cystic lesion of the pancreas, 14% of asymptomatic cysts and 35% of symptomatic cysts were malignant. The size of the cyst in asymptomatic patients had no correlation with its potential for malignancy.

One case of Crohn disease is reported (Figure 6). The patient complained of right lower quadrant pain, and after a pelvic examination, an ovarian cyst was suspected. On sonography, multiple ovarian follicles were noted bilaterally. Incidentally, a large loop of bowel was observed with a wall thickness of approximately 8.3 mm. After further questioning, the patient was found to have Crohn disease, which is an inflammatory bowel disease that involves any portion of the digestive tract but most often occurs in the ileum, the cecum, and the colon. Risk for low birth weight neonates, preterm birth, and fetal loss is increased if active disease is present during conception and pregnancy. In cases of disease exacerbation with intraperitoneal sepsis requiring surgery, the fetal mortality rate is high. Crohn disease presenting for the first time in pregnancy is associated with a maternal mortality of 4%, maternal morbidity of 40%, and a fetal mortality of 38%. A normal outcome occurs in approximately 24% of these pregnancies. Having
recently lost the wife of one of our colleagues in the early postpartum period from Crohn disease complications, we are particularly sensitized to the findings.

**VASCULAR SYSTEM**

One case of abdominal aortic aneurysm measuring $36 \times 42$ mm was discovered in a second-trimester sonogram (Figure 7). Mild enlargement of the aorta is termed **ectasia**, whereas an aortic aneurysm is commonly defined as vessel dilation greater than 1.5 times the size of the normal aorta (or 40 mm). Patients with abdominal aortic aneurysm present with abdominal and back pain and often have a palpable, pulsatile abdominal mass, but 17% are asymptomatic. Rupture of abdominal aortic aneurysm postpartum has been reported; one case measured 35 mm. Robinson reports a fatal case of dissecting abdominal aortic aneurysm in pregnancy. Rupture occurs in 29% of cases and is associated with a 50% to 70% mortality rate. With small abdominal aneurysms (less than 6 cm in diameter), rupture occurs in 15% to 20% of cases within five years of diagnosis. Manotaya and Manothaya report the repair of a 9-cm abdominal aneurysm during pregnancy.

Three cases of pelvic varices were found (Figure 8a-c). In one case, a patient with a history of endometrial polyps was examined by sonogram, and pelvic varices were incidentally observed on the uterine surface. In a second case, a patient complained of pelvic pain and was referred for a sonogram at 27 weeks of gestation. Sonography revealed unilateral renal agenesis in the fetus and, incidentally, pelvic varices in the mother. The remainder of the pregnancy was normal, and a vaginal delivery occurred without complication.

Pregnancy is associated with a higher risk for the development of varicose veins, likely due to physiological changes that include plasma volume expansion resulting in venous distension, hormonal changes, increased intra-abdominal pressures, and compression of the inferior vena cava by the gravid uterus. Several cases of pelvic varices have been reported in the literature. Cervical varices often present as vaginal bleeding and may escalate to premature delivery or spontaneous abortion. There is high maternal morbidity due to hemorrhage requiring transfusions and hysterectomy, but spontaneous resolution of the varices may occur after delivery. Utero-ovarian varices have been reported to rupture during pregnancy, presenting as acute abdominal pain without vaginal bleeding. Similarly, rupture of utero-ovarian veins may cause preterm birth and severe hemorrhage requiring hysterectomy. In an older review, maternal mortality was approximately 50% in cases of uterine varix rupture and increased to 76% when the rupture occurred during labor. In addition, ovarian varices may cause partial obstruction of the proximal ureter, resulting in hydronephrosis and caliectasis, which is known as ovarian vein syndrome. Thrombosis of varicose veins has been reported postpartum.

One case of pelvic phlebolith was incidentally visualized. Phleboliths are calcified intravenous blood clots that may result from changes in coagulation or fibrinolytic activity, from local venous damage, or a combination of these factors. Abdominal straining from normal acts of coughing or defecation can significantly raise venous pressure, which may damage the vessels, resulting in thrombosis. Phleboliths are a common finding, present in plain abdominal radiographs in approximately half of adults. They occur more often in women, more often on the left, and they increase in number with advancing age. The appearance of phleboliths on sonography can mimic ureteral stones, but the use of Doppler can distinguish between the two by determining the presence or absence of venous flow. Pelvic phleboliths are generally considered to be harmless, but on rare occasions, they have been associated with venous thrombosis.

Two cases of distended iliac veins measuring approximately 20 mm were found (Figure 9). In one case, Doppler flow indicated that the lumen of the distended iliac vein was incompletely filled. In the second case, the patient had a normal vaginal delivery and no complications of pregnancy. Venous distension may result from plasma volume expansion during pregnancy or from compression of the venous system at a more proximal location by the gravid uterus. Venous thrombosis of the lower extremities and pulmonary embolism has
been reported as a complication of iliac vein compression by the pregnant uterus.60

MISCELLANEOUS

One case of an accessory spleen was diagnosed. An accessory spleen, occurring in approximately 10% to 30% of patients in autopsy studies, is an anatomic variant with little clinical significance. However, it is important to be aware of these variants to interpret the findings correctly and avoid mistaking them for a clinically significant abnormality. Approximately 20% of accessory spleens are located at the tail of the pancreas, where they can be mistaken for hypervascular pancreatic tumors.61 A rare case of an accessory wandering spleen causing intestinal obstruction in a pregnant woman has been reported in the literature.62

One case of bilateral pleural effusion was diagnosed during a routine obstetric sonogram. Further tests revealed no infection or malignancy in the pleural fluid. Upon further questioning, the patient reported chest and back pain with a cough a few weeks prior, and the finding was considered a postviral pleural effusion. Pleural effusions have a wide range of etiologies. They are most often a result of hydrostatic and oncotic pressure imbalance, inflammation, infection, abnormalities in lymphatic drainage, or malignancy, but they may also be present due to pleural scarring from previous infections. Other rarer causes of pleural effusion include urinotherapy due to obstructive uropathy.63 It has been reported during pregnancy due to ureteral obstruction by the gravid uterus.64,65 Chylothorax can present as pleural effusion, its main cause being malignancy, especially non-Hodgkin lymphoma. Pleural effusions can also be a complication of pancreatitis, esophageal perforation, biliopleural fistula, and gastropleural fistula. In addition, pleural effusion can be a result or complication of other medical procedures such as central venous catheter placement peritoneal dialysis, spinal cord surgery causing a duopleural fistula or subarachnoidopleural fistula, and ventriculopleural shunt.63 Thus, when a pleural effusion is found, it is important to investigate the cause.

URINARY SYSTEM

Six cases of pelvic kidney were found. The diagnosis of pelvic kidney is relatively straightforward in the first trimester (Figure 10a,b) but may be less apparent in the second trimester (Figure 10c). Pelvic kidney is the most common congenital renal anomaly with an incidence of 5 to 20 per 10,000 liveborn infants and results from the failed ascent of the kidney during the eighth week of development. Renal blood supply shifts from the external and internal iliac vessels to the aorta during the ascent; therefore, ectopic kidneys are associated with vascular anomalies.66,67 Renal ectopia has been associated with other genitourinary anomalies, including uterine abnormalities (unicornuate, bicornuate, or absent uterus), vaginal anomalies (vaginal atresia or vaginal duplication), and urinary anomalies (duplication of the bladder, duplication of the urethra, and ectopic ureter).68–73 Most cases of pelvic kidney are asymptomatic, but pelvic kidney can be associated with malrotation, which causes obstructive hydronephrosis, and with vesicoureteric reflux, which results in pain or infection.67,74 In addition, a pelvic kidney is susceptible to trauma during obstetric and gynecologic operations.75

Two cases of a renal cyst were incidentally visualized. In one case, the patient was referred for a sonographic examination at 28 weeks of gestation because of gestational diabetes and to obtain a fetal biophysical profile. Sonography revealed a clear, 130-mm, thin-walled cyst in the left upper quadrant between the spleen, tail of the pancreas, anterior pole of the right kidney, and adrenal gland. There was no history of hypertension. The second patient was referred for a sonogram because of abdominal pain at 17 weeks of gestation. A simple renal cyst was noted on the lower pole of the right kidney measuring 20 × 16 × 24 mm.

Simple renal cysts, which likely originate from the distal convoluted or collecting ducts,76 are found in 5% to 10% of the population, and the incidence increases with age.77,78 They are usually asymptomatic, do not harm the kidney, and require no treatment once diagnosed. Complications may, however, arise in cases of expanding simple cysts.
that obstruct caliceal and pelvic outflow.\textsuperscript{79,80} Renal cysts may become infected\textsuperscript{81} and have also been associated with hypertension.\textsuperscript{82} The proposed mechanism is that segmental renal ischemia occurs because of cyst expansion, resulting in activation of the renin-angiotensin system, and subsequent arterial hypertension.\textsuperscript{83} Surgical removal of the cyst or percutaneous aspiration results in a significant decrease in blood pressure in most patients.\textsuperscript{84} In addition, simple renal cysts have been reported both to progress\textsuperscript{85,86} and are associated with\textsuperscript{87} renal cell carcinoma. Ooi et al.\textsuperscript{88} report two cases of simple renal cysts, the sonographic characteristics of which were classified as category 1 according to Bosniak.\textsuperscript{89} Category 1 lesions, which are benign simple cysts that appear thin-walled and contain no septations or calcifications by sonography or computed tomography, do not require further evaluation or surgery unless signs or symptoms develop. Both cysts in the series by Ooi et al.\textsuperscript{88} were associated with cystic renal cell carcinomas, and one case resulted in death.

A ureterocele was noted in one patient (Figure 11). Ureteroceles, with a reported incidence of 0.8 to 2 per 10,000 liveborn infants, are often ectopic and associated with duplex systems.\textsuperscript{90} In adults, the condition is rare and frequently asymptomatic,\textsuperscript{91} but prolapse may occur, resulting in urethral obstruction\textsuperscript{90,92} and subsequent renal failure due to hydronephrosis.\textsuperscript{93} With infection, the obstructed system may lead to sepsis.\textsuperscript{94} More common complications of ureteroceles in adults include dysuria and recurrent urinary tract infections.\textsuperscript{91,95} In pregnancy, urinary tract infections can cause complications, including polyhydramnios, amnionitis, preeclampsia, intrauterine growth retardation, fetal sepsis, and premature birth.\textsuperscript{96,97}

One case of distal ureteral mass was reported (Figure 12). The patient had a history of kidney reflux, renal stones, and chronic pyelonephritis. The left ureteral polyp, measuring 4.4 mm, demonstrated shadowing as well as vascularization by color Doppler. A follow-up sonogram did not visualize the polyp, and further tests could not demonstrate a ureteral obstruction, polyp, or stone. The original diagnosis was incorrect. A calculus was mistaken for a polyp, and the color Doppler “flow” was probably a twinkling artifact.

Fibroepithelial polyps of the ureter are benign mesodermal tumors composed of a fibrous core and covered by a normal urothelium. They may be caused by chronic inflammation related to the presence of urinary calculi.\textsuperscript{98} Patients often present with hematuria and/or flank pain.\textsuperscript{99} Ureteral polyps may cause complications such as ureteropelvic junction obstruction, resulting in pain and hydronephrosis,\textsuperscript{100,101} and can be mistaken for transitional cell carcinoma.\textsuperscript{99,102} There have been reports of transitional cell carcinoma arising from the epithelium covering a ureteral fibroepithelial polyp,\textsuperscript{103,104} but the microscopic findings suggest that the fibroepithelial polyp alone could not predispose one to carcinomatous transformation.\textsuperscript{104}

**REPRODUCTIVE SYSTEM**

A case of ovarian cystadenocarcinoma was found incidentally (Figure 13). The patient had a history of chronic hypertension and was examined at 31 weeks’ gestation for a biophysical profile. A 19-cm left adnexal mass, which was primarily cystic with an 81-mm solid portion and septations, was observed. The left kidney was also found to be small and echogenic, consistent with a dysplastic kidney. A cesarean section was performed at 33 weeks’ gestation for preterm labor, and a left salpingo-oophorectomy revealed a stage Ic mucinous cystadenocarcinoma. The patient received three courses of chemotherapy consisting of carboplatin and taxol. Three years later, the patient has no evidence of recurrence.

A cystadenocarcinoma is a malignant neoplasm often found in the ovaries. It is derived from a glandular epithelium in which cystic accumulations of retained secretions are formed. The incidence of cystadenocarcinoma is approximately 0.5 in 10,000 deliveries\textsuperscript{105} and has been associated with virilization\textsuperscript{106} and pseudomyxoma peritonei.\textsuperscript{107} Sayedur Rahman et al.\textsuperscript{105} examined pregnant women with cystadenocarcinoma and found that half of all patients present with abdominal pain, and a third of all patients were
asymptomatic. Ovarian cystadenocarcinoma has been treated during pregnancy with salpingo-oophorectomy or chemotherapy.\textsuperscript{108–111} The prognosis is good for stage I disease\textsuperscript{105} but not for high-stage cystadenocarcinomas.\textsuperscript{112}

A Gartner’s duct cyst was observed in one patient (Figure 14). The patient presented with pelvic pain, and sonography demonstrated bilateral ovarian follicles as well as a 20-mm Gartner’s duct cyst. Her history was significant for a Gartner’s duct cyst that had been drained. A sonographic examination performed a few months later demonstrated enlargement of the Gartner’s duct cyst to 47 × 31 mm.

During normal female reproductive development, the mesonephric ducts regress because of the absence of testosterone, and rudimentary structures remain, known as epoophoron, paroophoron, and Gartner’s duct. Gartner’s cysts are often small and asymptomatic and have been reported to occur in as many as 1% of women.\textsuperscript{113} They are associated with other genitourinary malformations such as vaginal ectopic ureter, renal anomalies, bicornuate uterus, and urinary-vaginal fistulas.\textsuperscript{114–122} Therefore, if a Gartner’s duct cyst is visualized, it is important to examine other structures in the genitourinary tract to identify other possible anomalies. Gartner’s cysts may be misdiagnosed as ectopic ureteroceles and improperly treated.\textsuperscript{121,123} Complications of Gartner’s cysts may occur. A large Gartner’s duct cyst has been associated with pyonephrosis and urinary retention in a pregnant patient with a single ectopic ureter.\textsuperscript{124} Infection of a Gartner’s duct cyst during pregnancy may present as fever and abdominal pain.\textsuperscript{125}

One case of Krukenberg tumor was found incidentally (Figure 15). The patient had a family history of breast, uterine, pancreatic, and colon cancer. She complained of pelvic and abdominal pain at 14 weeks’ gestation and was referred for a sonographic examination. The examination revealed maternal ascites, an enlarged common bile duct (7 mm), and a 15 × 10-cm solid vascular mass possibly arising from the left ovary. A left salpingo-oophorectomy was performed, and pathology reported a carcinoma with signet-ring cell morphology that had most likely metastasized from a primary site in the gastrointestinal tract. The primary tumor was not found during the pregnancy. The patient began chemotherapy with leucovorin, fluorouracil, and oxaliplatin. A cesarean section was performed at 37 weeks’ gestation.

A Krukenberg tumor is a mucocellular carcinoma of the ovary that is often metastatic from the gastrointestinal tract and is characterized by the presence of signet-ring-like cells and areas of mucoid degeneration. The incidence of Krukenberg tumors in all ovarian cancer is approximately 18%.\textsuperscript{126} Gastric cancer has been reported as the most frequent primary source of Krukenberg tumor,\textsuperscript{126,127} and the mean diameter of the tumor in 120 cases analyzed by Kiyokawa et al.\textsuperscript{127} is 10 cm. Patients often present with persistent gastrointestinal pain as well as symptoms mimicking the early nausea and vomiting of pregnancy, which masks a gastric carcinoma and delays early diagnosis.\textsuperscript{128,129} Ascites,\textsuperscript{127} fetal asphyxia,\textsuperscript{128} and virilization of both the mother and the fetus\textsuperscript{130,131} have also been reported in association with Krukenberg tumors. The prognosis worsens when the primary tumor has metastasized to the ovary, and most patients die within one year.\textsuperscript{128,132}

One case of pseudocyesis was diagnosed. The patient claimed to have a positive pregnancy test, but no gestational sac or ectopic pregnancy was found. A miscarriage was considered as the possible diagnosis. One year prior, the patient had had a similar episode with a positive hCG but no evidence of intrauterine pregnancy. Again, a possible spontaneous abortion was considered as the diagnosis. The patient had a history of three full-term pregnancies, amenorrhea, and multiple ovarian cysts measuring between 10 and 25 mm, the largest of which appeared “complex” by sonography. Although a patient may be convinced that she is pregnant, one of the unexpected findings of obstetric sonography is the absence of a fetus.

Pseudocyesis is a rare condition in which a person has a false belief of being pregnant that is associated with objective signs of pregnancy, including abdominal enlargement, reduced menstrual flow,
amenorrhea, subjective sensation of fetal movement, nausea, breast engorgement and secretions, and labor pains at the expected date of delivery.\textsuperscript{133} Investigation of underlying psychiatric disorders may be warranted as schizophrenia,\textsuperscript{134,135} and depression,\textsuperscript{133,136} have been reported in association with pseudocyesis. Pseudocyesis may be the presenting sign of a medical illness and has been reported in association with alcohol-induced liver failure,\textsuperscript{137} systemic lupus erythematosus,\textsuperscript{138} gastric adenocarcinoma,\textsuperscript{139} persistent corpus luteum,\textsuperscript{140} pituitary tumor,\textsuperscript{141} thyroid dysfunction,\textsuperscript{142} hyponatremia,\textsuperscript{143} bronchogenic carcinoma,\textsuperscript{144,145} and cholecystitis.\textsuperscript{134} Therefore, it is important to determine whether the patient’s symptoms are due to a medical condition that the patient explains as pregnancy.

One case of Sertoli cell tumor was found (Figure 16). The patient was referred for a routine sonogram at 6 weeks’ gestation. A $90 \times 95$-mm complex right adnexal mass with internal echoes, septations, thick walls, and a thick, irregular, solid component on the posterior and medial sides was visualized. Increased Doppler flow was found throughout the mass. At 14 weeks’ gestation, a right salpingo-oophorectomy was performed. The mass was determined to be a stage Ia Sertoli cell tumor, and no further therapy was required. The patient is doing well after four years.

A Sertoli cell tumor is a neoplasm of gonadal stromal origin composed purely of Sertoli cells in a tubular arrangement. Sertoli cell tumors are rare, composing approximately 4\% of Sertoli-Leydig tumors,\textsuperscript{146} which account for less than 0.5\% of all ovarian tumors.\textsuperscript{147} Sertoli tumors have been reported in association with increased production of estrogens,\textsuperscript{148} resulting in menstrual abnormalities, postmenopausal bleeding, or precocious puberty,\textsuperscript{146} and more rarely with increased production of progesterone.\textsuperscript{147} Patients often present with pelvic pain, metrorrhagia, endometrial hyperplasia, or virilization, but approximately 10\% are asymptomatic.\textsuperscript{149} Overall, Sertoli cell tumors follow a low-malignant course and have a fair prognosis.\textsuperscript{148,149} Most Sertoli cell tumors are stage I and clinically benign, but approximately 10\% can become clinically malignant.\textsuperscript{150} Distant metastasis to the lung\textsuperscript{151} and spleen\textsuperscript{150} has been reported.

**Conclusions**

As these cases demonstrate, it is important for the sonographer and physician to be aware that nonobstetrical findings may be identified during an antepartum obstetric examination that affects the health of the mother and/or fetus. These cases highlight the wisdom of the AIUM and ACR guidelines regarding the visualization of maternal structures. Although many of the incidental findings are secondary, some, such as ovarian cystadenocarcinoma, Krukenberg tumor, and Sertoli tumor, are significant and require prompt medical attention. In a symptomatic patient, it may be necessary to expand the examination beyond the pelvis to explore the cause. However, in other cases, a coexisting condition may be asymptomatic and unknown by the referring physician. Incidental findings, although not common and not often critical, may alter the patient management or may require further dedicated scans, and thus should not be ignored.

This case series does not advocate scanning the entire patient or performing all possible examinations; rather, it suggests that sonographers should be aware of possible additional findings during an obstetric sonogram.

**References**


