Calcified Pelvic Masses on Radiographs: A Case Report and Discussion

Maher Salahi, Heetabh Patel and Martha-Gracia Knuttinen

Abstract

Calcified pelvic masses are frequently detected on plain radiographs in the field of emergency radiology, particularly after trauma. While many of these findings are benign, a subset may be life-threatening if not accurately identified. The differential diagnosis depends on the location of the tumor and the patient’s gender and history of trauma. Diagnostic possibilities include aneurysms, musculoskeletal and female pelvic malignancies and more benign entities, such as heterotopic ossification or phleboliths. Considering the possibility of these lesions will help to accurately identify relevant findings on radiographs and effectively select the appropriate treatment plan for patients presenting to the emergency room with pain.

Key words: calcified pelvic masses, radiographs, aneurysm, pseudoaneurysm, heterotopic ossification

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Case Report

We herein present the case of a 34-year-old man with a remote history of a gunshot wound in the right groin who presented to our hospital with right buttock and leg pain. A pelvic radiograph showed numerous dense objects on the right superimposed on a faint ring-calcified lesion (Fig. 1). The pelvic radiograph findings were initially interpreted to be normal, with the exception of the presence of gunshot fragments. However, the patient’s pain persisted and a computed tomography (CT) scan was obtained to exclude the possibility of intra-articular loose bodies. Consequently, a large post-traumatic pseudoaneurysm was detected on CT (Fig. 2), and endovascular repair was subsequently performed.

Discussion

Calcified pelvic masses are relatively common in the adult population. In fact, approximately 50% of 40-year-olds exhibit phleboliths or calcification of the pelvic veins (1). While the radiographic appearance of phleboliths is fairly distinctive, other lesions appear with more variable features. Therefore, robust knowledge of the different possibilities would help clinicians to order the correct imaging studies and thus aid the radiologist in formulating the accurate diagnosis.

Before determining the differential diagnosis, obtaining the patient’s history is critical. If there is a history of trauma, for example, the possibility of aneurysms and heterotopic ossification should be considered in addition to entities commonly seen in patients with no history of trauma. Other factors include the patient’s gender and family history of malignancy. Table lists the differential diagnoses of individuals with and without a history of trauma.

In this article, we provide a brief overview of these conditions, so that referring physicians may be able to make the appropriate diagnosis when confronted with cases of calcified pelvic masses on plain films.

Tumors of the female pelvis

Epidemiology

Uterine leiomyomas (fibroids) are the most common pelvic tumors in women, with one study reporting myomas in 77% of uterine specimens obtained after hysterectomy (2). Myomas are clinically apparent in 12 to 25% of women during their reproductive years and are noted on pathologic exams in 80% of surgically excised uteri. Myomas are found no less frequently in women treated with hysterec-
known, associated risk factors for acquired genetic changes increases to 80% by age 50. Caucasian women, in contrast, myoma is 60% among African-American women, which indicated a general incidence of HO after total hip arthroplasty of approximately 53%, although the lesions are smaller and less numerous. Because most imaging techniques lack resolution beyond <1 cm, such examinations tend to underestimate the incidence of this condition, although small myomas may be of no clinical significance (3). A random sampling of women 35 to 49 years of age screened based on self-reporting, a medical record review though small myomas may be of no clinical significance (3). Despite this limitation, imaging techniques are commonly used to evaluate patients presenting with symptoms suggestive of myomas. Imaging includes ultrasound, CT, and MRI. However, the accuracy of these modalities may be limited for small myomas, which may be indistinguishable from other pelvic masses.

Table. Differential Diagnosis for Calcified Pelvic Masses on Plain Film.

| Trauma                        | No Trauma                      |
|-------------------------------|--------------------------------|
| Myositis Ossificans/heterotopic ossification | Leiomyomas (female)          |
| Aneurysm/pseudoaneurysm       | Teratomas (female)             |
| Gunshot fragments             | Chondrosarcoma                 |
| Leiomyomas (female)           | Synovial sarcoma               |
| Teratomas/dermoids (female)   | Aneurysmal bone cyst           |
| Chondrosarcoma                | Enchondroma                     |
| Synovial sarcoma              | Phleboliths and chronic appendagitis |
| Ureteral or bladder calculi   |                                |

Uterine sarcomas are relatively rare; the incidence was 3 to 7 per 100,000 persons from 1989 to 1999 (4). The median age at diagnosis is 60 years, and the prognosis varies somewhat based on the histological type (leiomyosarcoma, endometrial stromal sarcoma and undifferentiated endometrial sarcoma), although the general prognosis is relatively poor compared to that of other gynecologic malignancies.

Teratomas are the most common type of germ cell neoplasm in women, with most tumors being benign. These lesions also tend to affect younger populations, as most tumors arise in women between 10 and 30 years of age. The tumors can be divided into four categories: mature, immature, malignant and highly specialized. Most women with dermoid cysts (mature teratomas) are asymptomatic, with symptoms generally being related to the size of the mass.

Imaging

On radiographs, leiomyomas are typically located midline and exhibit areas of coarse calcification that occupy the majority of the mass. For further delineation, transvaginal sonography is the most readily available and least costly technique to help differentiate myomas from other pelvic conditions.

Teratomas are more difficult to differentiate on radiographs and are typically positioned laterally, near the iliac vessels. There may be densely calcified densities within the mass, such as teeth. Given the non-specific appearance, ultrasound may be used for further characterization. Teratomas have a very characteristic appearance on ultrasound, with a reported specificity of 98 to 100% (5). Although the definitive diagnosis is reserved until the time of surgical excision, the specificity of ultrasound makes it the first-line imaging technique for evaluating suspected teratomas and other ovarian tumors.

Heterotopic ossification

Epidemiology/etiology

Heterotopic ossification (HO) refers to the presence of bone in soft tissue, where bone does not normally exist. There are two versions of HO, with the acquired form being far more prevalent and usually occurring following traumatic events (fractures, direct muscular trauma, large joint replacement, etc.). HO includes specific post-traumatic variant myositis ossificans, in which patients exhibit soft tissue ossification at sites of trauma adjacent to long bones. Less commonly encountered sites of HO include abdominal incisions, wounds and the kidneys, uterus and GI tract. Most studies have indicated a general incidence of HO after total hip arthroplasty of approximately 53%, although the lesions are
often asymptomatic and of no clinical significance (6). While there is no exact trigger for HO, various associated risk factors have been identified:

- Twice as common in men than in women
- High-risk patients include men with bilateral hypertrophic osteoarthritis, patients with a history of HO or those with posttraumatic arthritis
- Moderate-risk patients include those with ankylosing spondylitis, Paget’s disease or unilateral hypertrophic osteoarthritis

**Imaging**

In cases with clinical suspicion of HO, the first step is to obtain an X-ray. The typical radiologic appearance of HO consists of circumferential ossification with a lucent center, although it may take up to 4-6 weeks until calcified densities are detectable. The lesions are typically located lateral to the hip joint on pelvic radiographs and often occur in younger patients. The most sensitive imaging modality for the early detection of HO remains three-phase bone scintigraphy. Specifically, flow studies and blood-pool images can be used to detect HO roughly 2.5 weeks after injury. Most periodic bone scan findings return to normal at around 6-12 months; however, lesions can remain hyperactive even after the HO has become mature. Serial bone scans have been used successfully to monitor the metabolic activity of HO as well as determine the appropriate time for surgical resection (if necessary).

**Aneurysms/pseudoaneurysms**

**Epidemiology/etiology**

Most pelvic aneurysms are extensions of aortic atherosclerotic disease and involve the iliac arteries. Due to their deep location within the pelvis, many aneurysms are not detected until they become quite large, cause other symptoms (e.g., compression of adjacent structures) or rupture. Diagnosing aneurysms, both true and false, prior to rupture is important, as mortality rates during attempts at surgical repair are as high as 50%. Pelvic pseudoaneurysms have been reported in patients of all genders, races and ages, with causes including but not limited to penetrating or blunt trauma, infection, dissection and caesarian delivery in women (7).

**Imaging**

Much like our case, aneurysms are typically found incidentally, potentially on X-rays obtained to assess pain symptoms arising from the mass effect. If there is concern, noninvasive imaging techniques for identifying vascular abnormalities include ultrasound, CT and magnetic resonance imaging (MRI). Diagnostic ultrasound is frequently used as a screening modality for abdominal aortic aneurysms; however, its efficacy is limited by the presence of bowel gas, which can obscure visualization of the retroperitoneal and mesenteric vessels. For this reason, CT and MRI play a bigger role in confirming and characterizing abdominal and pelvic aneurysms and pseudoaneurysms. Multi-detector CT is likely the most frequently used modality for formally assessing the arterial flow in the abdomen and pelvis and is highly sensitive, especially when combined with an intravenous contrast agent, as illustrated in the case presented above. Similar to CT, MRI allows for depiction of the vascular system of the abdomen and pelvis and has the added benefit of not exposing the patient to radiation. MRI can also be applied using different techniques to depict the vascular flow, without the need for injection of contrast material, sparing the added burden on the patient’s kidneys. On ultrasound, visceral artery aneurysms usually appear as areas of circumscribed, anechoic or saccular vascular enlargement exhibiting a turbulent internal flow. On CT and MRI, assuming the aneurysm is patent, the lumen of the artery is depicted with the contrast agent through slices obtained at different levels, and the luminal diameter can be used to estimate the size of the aneurysm(s). Pseudoaneurysms may have an imaging appearance similar to that of aneurysms, although the margin of pseudoaneurysms is more irregular and pseudoaneurysms are typically surrounded by hematomas.

**Musculoskeletal tumors**

**Epidemiology/etiology**

Chondrosarcoma is the third most common malignant bone tumor after osteosarcoma and multiple myeloma. This lesion is a tumor of adulthood and old age, with the majority of patients falling between the ages of 50 and 70. Chondrosarcomas can be classified based on the histological subtype, origin or site (8).

A total of 80% of aneurysmal bone cysts occur within the first two decades of life, and the majority of patients present with pain and/or masses. Most aneurysmal bone cysts arise de novo and are referred to as primary cysts, whereas 30% arise from pre-existing bone lesions and are called secondary cysts (9).

**Imaging**

Chondrosarcomas are easily identified on plain film X-rays. With central chondrosarcomas being the most common type, lytic lesions usually appear well-defined in the epiphyseal region and may be associated with endosteal scalloping and cortical thickening or thinning. CT scans are also used to depict sites of bony erosion and small areas of calcification and determine the intra- and extra-ossseous extent of the tumor. MRI can also be used to precisely stage the degree of medullary involvement and assess soft tissue masses (8).

Similar to chondrosarcomas, aneurysmal bone cysts are diagnosed using multiple modalities, including plain film, CT and MRI. These lesions are typically located near the metaphysis of long bones or unfused growth plates, especially in the pelvis (femur). They are osteolytic and exophytic, although they may become sclerotic over time. Plain film and CT are used to define the bony extent of the lesion and rule out any fractures. MRI scans are obtained to evaluate the soft tissue and degree of intramedullary extension (9).

Other possibilities include enchondroma, synovial sarcoma and synovial chondromatosis. Although these entities...
are beyond the scope of this report, they appear similar to the above masses on plain radiographs. Characterization with MRI and biopsy is typically performed.

The detection of calcified pelvic masses on plain films presents a unique challenge to radiologists. The location of the lesion and the patient’s gender and history of trauma should be used to develop the differential diagnosis and prevent long-term complications due to misdiagnosis. Malignancy or post-traumatic aneurysms are special examples that must always be considered.

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