

## ILIOPSOAS COMPARTMENT LESIONS: A RADIOLOGIC EVALUATION\*

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**Abstract** The iliopsoas compartment, a posterior boundary of the retroperitoneum, is comprised of the psoas major, psoas minor and iliac muscles. The symptoms picture in patients presenting with pathological involvement of this compartment may show a wide range of nonspecific clinical presentations that may lead to delayed diagnosis. However, in the search of an etiological diagnosis, it is already known that inflammation, tumors, and hemorrhages account for almost all the lesions affecting the iliopsoas compartment. By means of a retrospective analysis of radiological studies in patients with iliopsoas compartment lesions whose diagnosis was confirmed by anatomopathological evaluation or clinical follow-up, we have reviewed its anatomy as well as the main forms of involvement, with the purpose of identifying radiological signs that may help to narrow down the potential differential diagnoses. As each lesion is approached we will discuss the main radiological findings such as presence of gas in pyogenic abscesses, bone destruction and other bone changes of vertebral bodies in lesions secondary to tuberculosis, involvement of fascial planes in cases of neoplasms, and differences in signal density and intensity of hematomas secondary to hemoglobin degradation, among others. So, we have tried to present cases depicting the most frequent lesions involving the iliopsoas compartment, with emphasis on those signs that can lead us to a more specific etiological diagnosis.  
*Keywords:* Iliopsoas muscle; Psoas muscle; Computed tomography; Abscesses; Neoplasms.

**Resumo** *Patologias do compartimento iliopsoas: avaliação radiológica.*

Limite posterior do retroperitônio, o compartimento iliopsoas localiza-se externamente ao mesmo, sendo composto dos músculos psoas maior, psoas menor e íliaco. O quadro de sintomas dos pacientes com acometimento patológico deste compartimento é amplo e inespecífico, podendo haver importante atraso no diagnóstico. Entretanto, na busca do diagnóstico etiológico das alterações do compartimento iliopsoas, sabemos que as infecções, os tumores e as hemorragias respondem pela quase totalidade das lesões. Por meio da avaliação retrospectiva de exames radiológicos de pacientes com patologias do iliopsoas e que tiveram o diagnóstico confirmado por exame anatomopatológico ou acompanhamento clínico, revisamos a anatomia deste compartimento, assim como as suas principais formas de acometimento, identificando sinais que auxiliem na diferenciação dos potenciais diagnósticos diferenciais. Na abordagem de cada patologia discutiremos os principais sinais radiológicos, como a presença de gás em abscessos piogênicos, alterações ósseas em corpos vertebrais nas lesões secundárias a tuberculose, comprometimento dos planos fasciais nas lesões tumorais e diferenças na densidade e intensidade de sinal dos hematomas nas diferentes fases de degradação da hemoglobina, entre outros. Dessa forma, procuramos apresentar casos que exemplifiquem as doenças mais frequentes do compartimento iliopsoas, destacando a importância dos seus diferentes sinais, aproximando-nos de um diagnóstico etiológico específico.

*Unitermos:* Músculo iliopsoas; Músculo psoas; Tomografia computadorizada; Abscessos; Neoplasias.

## INTRODUCTION

In the present study, the iliopsoas compartment anatomy as well as main forms of its involvement will be reviewed to identify useful signs for potential differential diagnoses. The spectrum of symptoms in patients with involvement of the iliopsoas compartment is wide and non-specific, resulting in delayed diagnosis in a reasonable number of cases<sup>(1,2)</sup>. Historically, radiologists have been utilized planigraphy, excretory urography, nuclear medicine and ultra-

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sound for detection of diseases affecting the iliopsoas compartment; however, the arrival of computed tomography (CT) was a landmark in the differentiation of lesions in this site<sup>(3,4)</sup>. It is important to note that, despite several attempts to define specific signs for determining the etiology of lesions in the psoas muscle, the majority of authors have identified overlapping features, difficulting the diagnosis in a significant number of cases. However, the present study will try to validate the sensitivity and specificity of some radiological findings in an attempt to aid in the etiological differentiation of the lesions to be evaluated. In this context, this study presents typical findings of the most frequent diseases affecting the iliopsoas compartment, highlighting the signs that could lead to a more specific diagnosis.

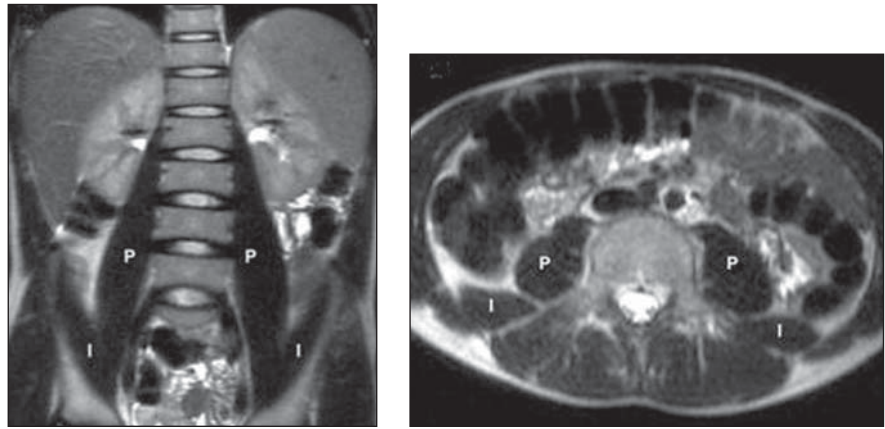
The present study includes retrospectively selected imaging studies performed at Hospital São Paulo at Universidade Federal de São Paulo-Escola Paulista de Medicina, in patients with iliopsoas compartment lesions, whose diagnoses were confirmed by means of anatomopathological study or clinical follow-up.

## DISCUSSION

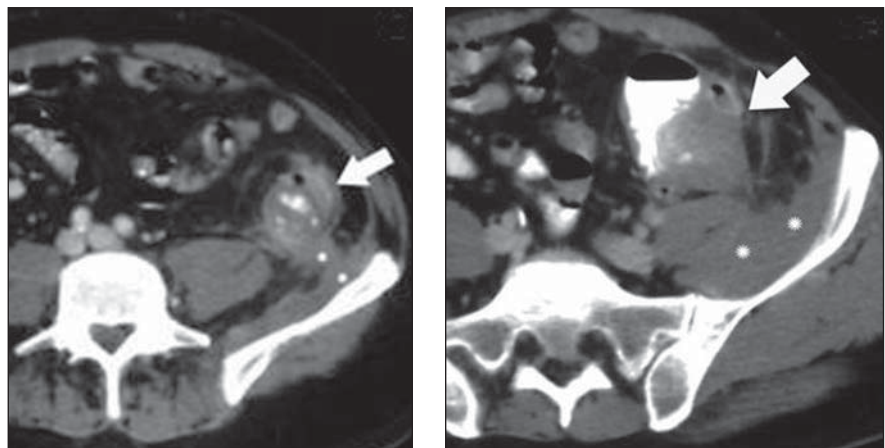
### Anatomy

The iliopsoas compartment may be affected by several diseases, including infections, tumors and hemorrhages. The spectrum of symptoms in these patients is wide and non-specific, resulting in delayed diagnosis in a significant number of cases<sup>(1)</sup>.

The iliopsoas compartment contains the greater psoas, the smaller psoas, and iliac muscles (Figure 1). The iliac muscle arises from the iliac wing. The greater psoas muscle originates from the transverse process of T12, merging with the iliac muscle at the L5-S2 level to form the iliopsoas muscle. The iliopsoas muscle inserts into the lesser trochanter of the femur. The smaller psoas muscle is located anteriorly to the greater psoas muscle, originating from the T12-L1 vertebral bodies, and inserting into the iliopectineal eminence. All of these muscles are involved by the iliopsoas fascia<sup>(1,2)</sup>. Anteriorly, the iliopsoas fascia is formed by the transversalis fascia, which represents the posterior limit of



**Figure 1.** Coronal, T2-weighted (A) and axial (B) MRI demonstrating the usual aspect of the iliac (I) and psoas (P) muscles.



**Figure 2.** Patient with acute diverticulitis (arrows) and signs of pericolonic inflammatory process extending to the iliopsoas muscle (asterisks).

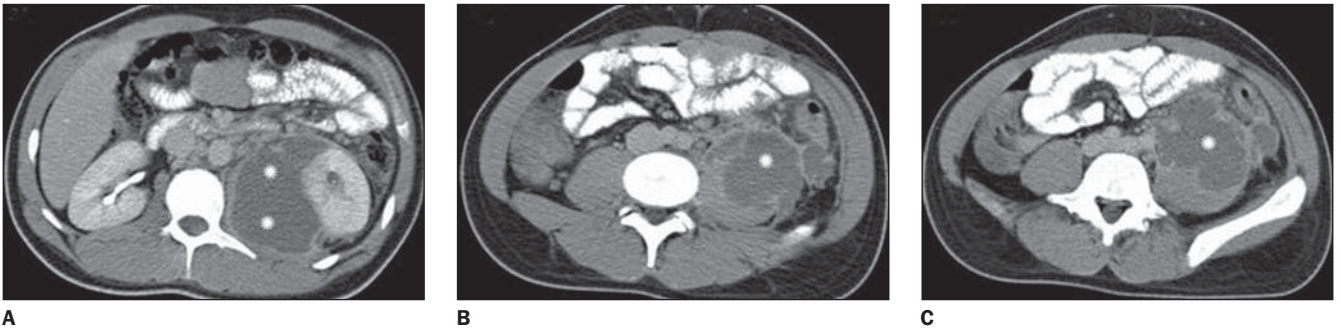
the retroperitoneum, so defining the iliopsoas compartment, externally and posteriorly located in relation to the retroperitoneum<sup>(3,4)</sup>.

### Infection

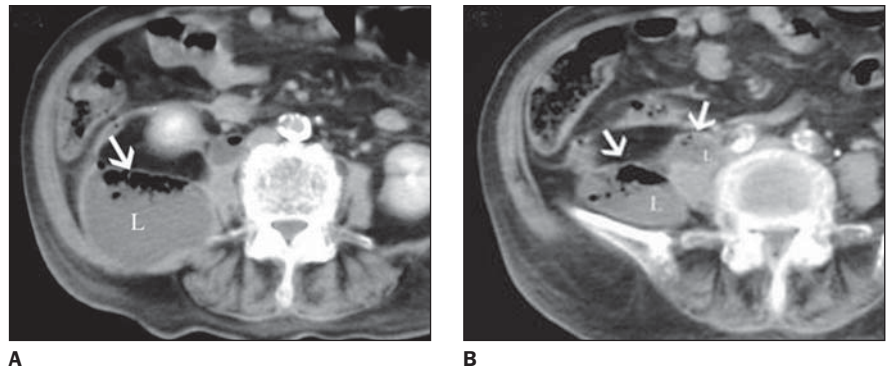
The iliopsoas compartment infectious involvement may be primary or secondary. Primary iliopsoas abscesses are rare and usually idiopathic. Most frequently, *Staphylococcus aureus* and Gram-negative microorganisms are involved. Immunocompromised patients, and particularly those under corticotherapy, chemotherapy, and those HIV-positive present higher predisposition to infection<sup>(1,3)</sup>. The secondary iliopsoas compartment involvement is even more frequent and usually results from the dissemination of infectious processes from

kidneys (perinephric abscesses), bones (osteomyelitis and tuberculosis), and from intestinal loops (appendicitis, diverticulitis, Crohn's disease, perforated colon carcinoma) (Figure 2)<sup>(1)</sup>.

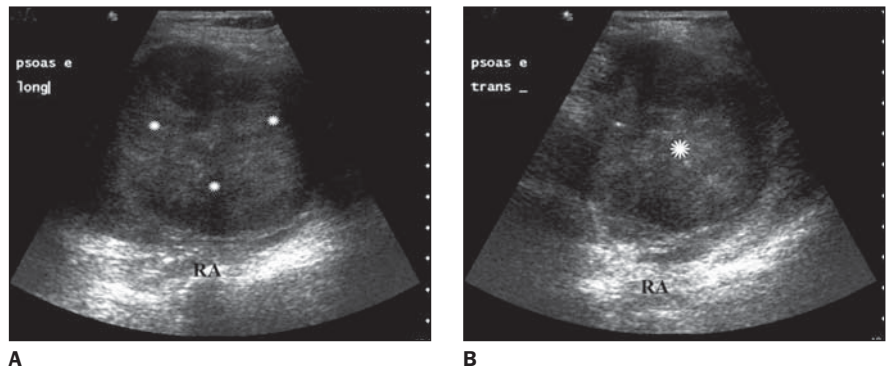
At CT, pyogenic abscesses manifest as lesions of low attenuation, this sign being the most frequent, although non-specific, since it also may be found in neoplasias with significant necrosis and chronic hematomas (Figures 3, 7 and 8)<sup>(1)</sup>. Although the finding of gas bubbles is quite specific of this type of lesion, it is present in only 50% of cases<sup>(1-3)</sup>. In these cases, CT is the most sensitive method for detecting the presence of gas inside the lesion (Figure 4)<sup>(1,2)</sup>. Pyogenic abscesses also present a typical, marginal enhancement after contrast agent injection, observed both on CT



**Figure 3.** Perinephric and psoas muscle abscess secondary to pyelonephritis. Extensive, encapsulated fluid collection (asterisks) causing psoas muscle volumetric increase and displacement of the left kidney.



**Figure 4.** Abscess of undetermined origin. Extensive abscess affecting psoas and iliac muscles at right, with presence of fluid (L) and gas (arrows) components.



**Figure 5.** Psoas muscle abscess. Extensive heterogeneous collection (asterisks) with posterior reinforcement and echoes in suspension.

and magnetic resonance imaging (MRI) (Figure 3). Obliteration of adjacent fat planes and varied degrees of bone destruction may be found in some cases<sup>(2)</sup>. At ultrasound, these lesions present a poorly specific aspect, as a mass with a heterogeneous contents and fluid/fluid level, highlighting echoes in suspension and debris (Figure 5)<sup>(2)</sup>.

Among infectious processes, tuberculosis was, in the past, the most frequent cause of abscesses involving the spine, paraspinal region and iliopsoas compartment. With the better control of the disease, the pyogenic etiology has become prevalent. However, with the HIV dissemination, there has

been a resurgence in tuberculous paraspinal infections, characterized by bone destruction, fluid collections and capsular calcifications (Figure 6)<sup>(2)</sup>.

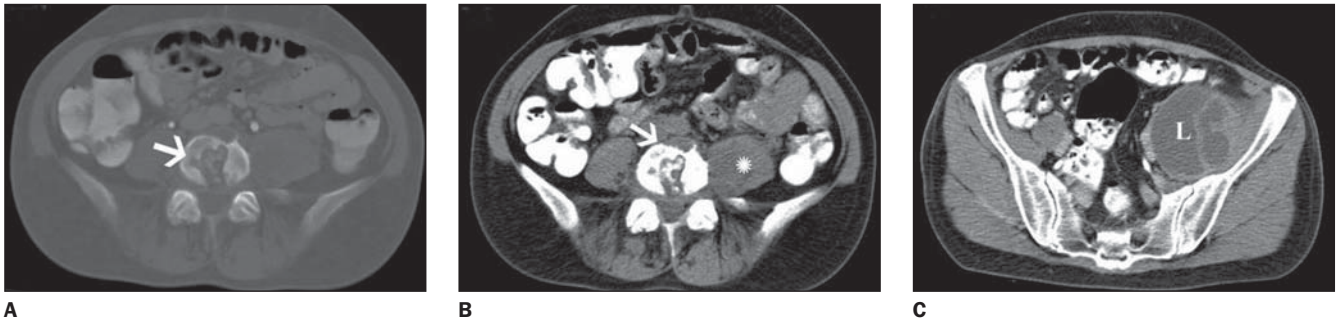
### Tumors

In most of cases, tumor-like involvement of the iliopsoas is secondary to the direct extension of primary retroperitoneal, abdominal, pelvic, neurogenic, bone tumors, and direct invasion from adjacent lymph nodes<sup>(1)</sup>. In contrast to the inflammatory/infectious involvement, the retroperitoneal fascial planes do not represent any barrier to tumor dissemination, with direct and random invasion<sup>(3)</sup>. On CT and MRI,

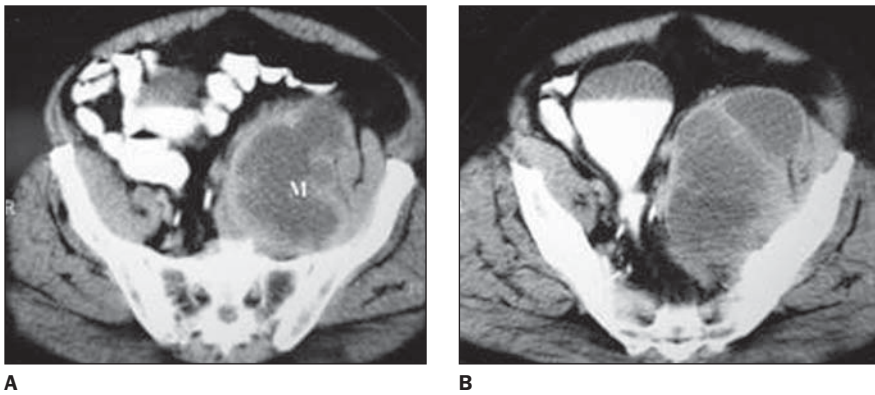
homogeneous or heterogeneous lesions are observed as a result of the presence of necrosis, hemorrhage and changes in the cellular structure (Figure 7)<sup>(3)</sup>. The most significant findings for differentiation of tumors, abscesses and hematomas, would be the presence of adenopathy, bone destruction and discontinuity of fascial planes<sup>(4)</sup>.

Primary iliopsoas tumors are rare, with liposarcoma, fibrosarcoma, leiomyosarcoma and hemangiopericytoma being the typical histological variants found (Figure 7)<sup>(1,2)</sup>. Metastasis to the iliopsoas compartment also is rare, and, most frequently result from hematogenous dissemination from lymphomas, melanomas and uterine cervix,





**Figure 6.** Paravertebral and iliopsoas muscle abscess at left, secondary to tuberculosis. Osteolytic lesion is observed (arrows) with bone sclerosis and cortical rupture at L5 level (A) associated with heterogeneous increase in volume of the psoas muscle at left (asterisk on B) and extensive, multiseptate fluid collection on left iliac fossa (L on C).



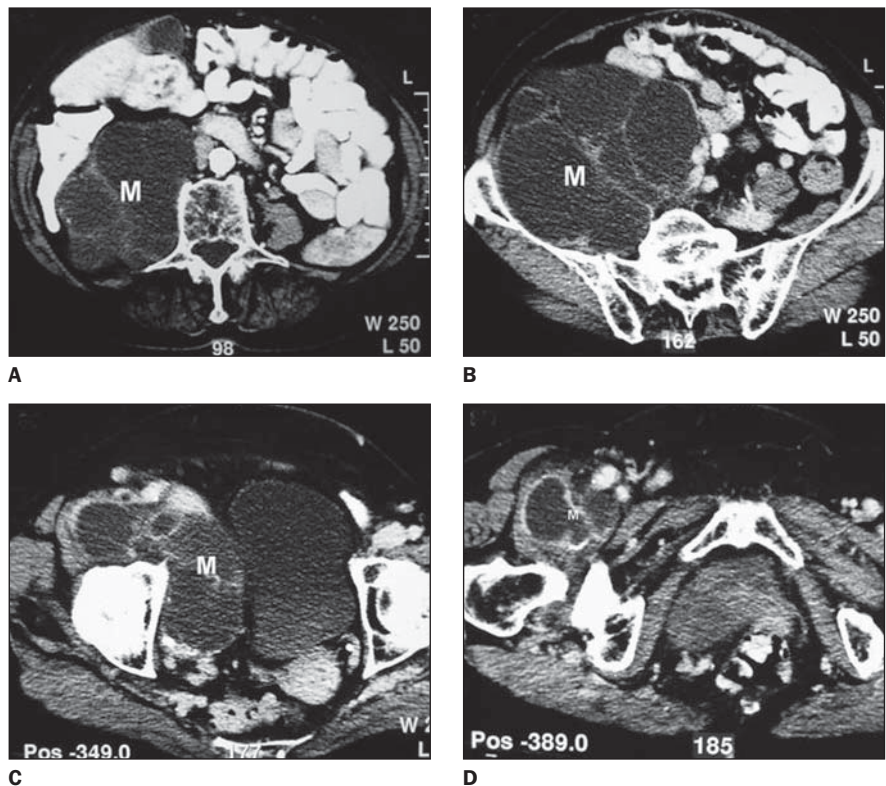
**Figure 7.** Undifferentiated retroperitoneal sarcoma involving the iliopsoas compartment. Presence of a bulging, heterogeneous, mass (M on A) with areas of central liquefaction corresponding to necrosis and mimicking an infectious process.

ovary, lung and breast carcinomas (Figure 8)<sup>(1,2)</sup>. The aspect of these lesions is quite overlapping, except for liposarcomas because of the presence of fat component detected at CT or MRI.

### Hematomas

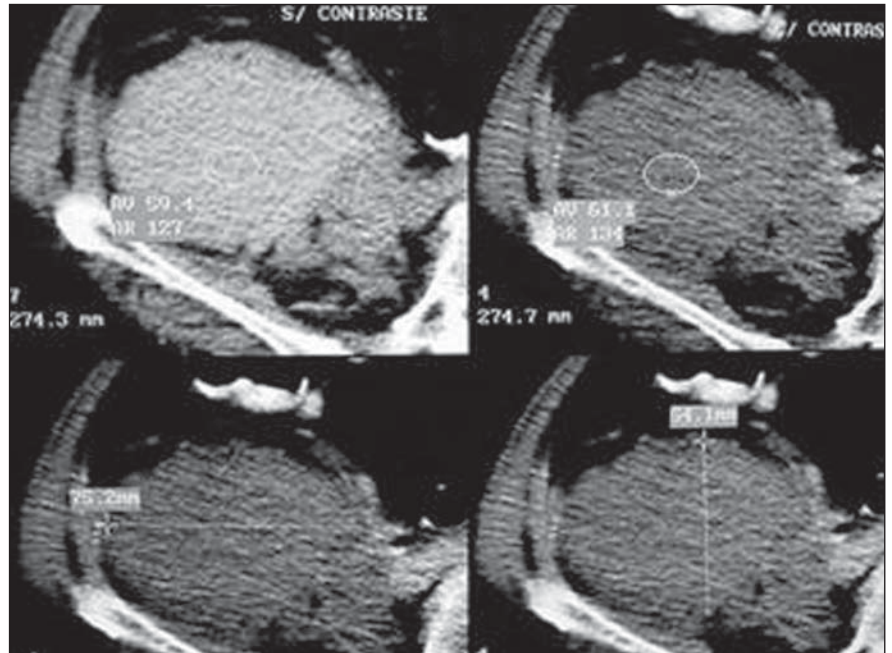
Iliopsoas compartment hematomas may be spontaneous or secondary to hemorrhagic diathesis, anticoagulant therapy, trauma, tumor, recent surgery or biopsy, or resulting from extension of bleeding in adjacent organs or vessels<sup>(1,2)</sup>. By correlation between causal factor and patient's age, it has been possible to observe a closer association with coagulopathies and trauma in a younger age range (fourth decade of life), and aortic aneurysm rupture and anticoagulant therapy for arteriosclerotic disease and thromboembolism in an older age range (seventh decade of life)<sup>(3)</sup>.

On CT, acute hemorrhage presents with muscular enlargement and hyperdense contents (usually > 40 UH), unenhanced after contrast agent injection (Figure 9), except in the presence of active bleeding<sup>(1,2)</sup>. In these cases, the involvement tends to be

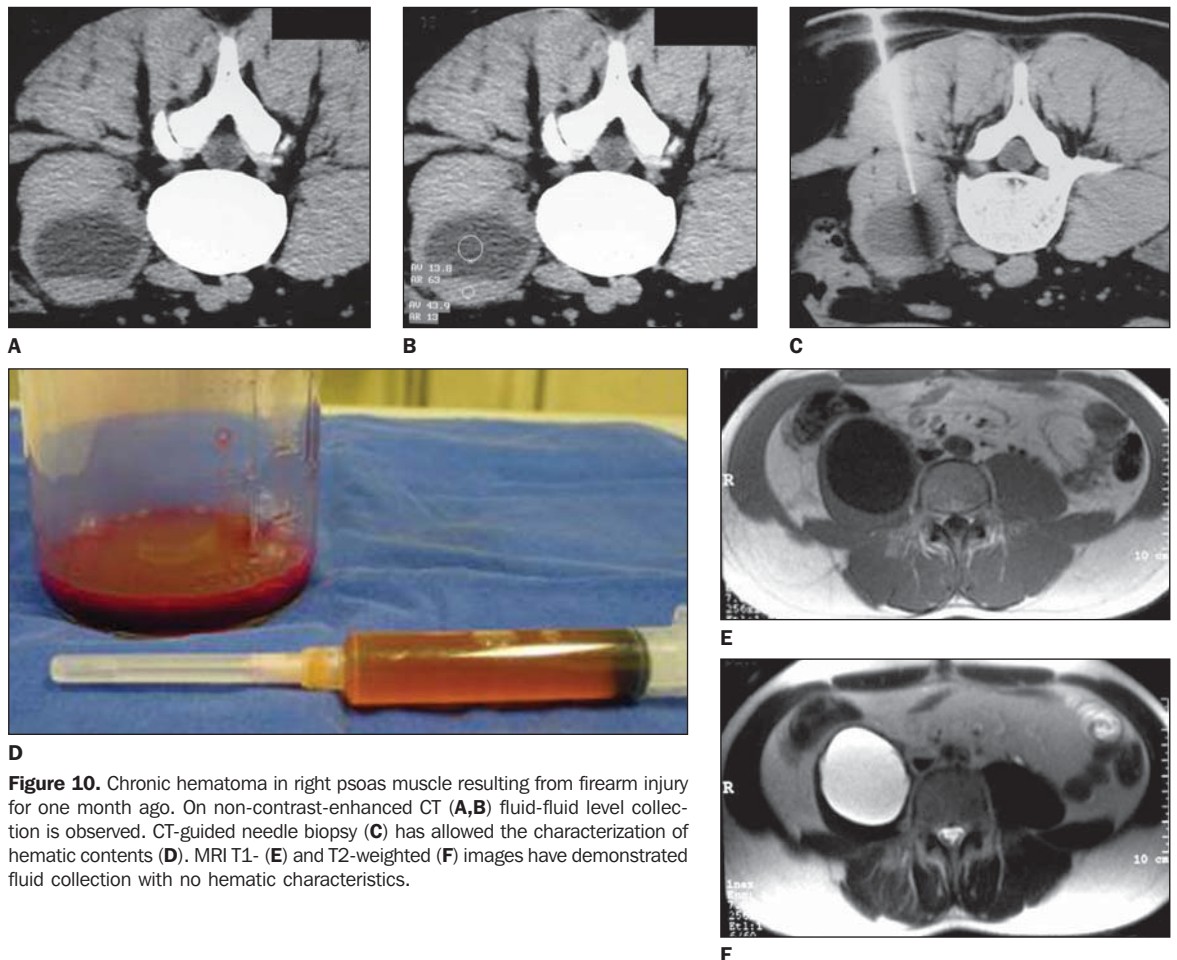


**Figure 8.** Retroperitoneal metastasis by ovarian mucinous adenocarcinoma. A large, cystic, multiseptate abdominopelvic mass is observed involving the iliopsoas compartment at right (M), and extending to the inguinal region (D).

diffuse, fulfilling the whole muscular compartment, this sign being significant for differentiation between processes of infectious and neoplastic origin<sup>(4)</sup>. Fluid/fluid level may be present in subacute and late phases of the disease (Figure 10). Chronic hematomas may be undistinguishable from abscesses and necrotic tumors; and percutaneous aspiration may be necessary for their differentiation (Figure 10)<sup>(1,2)</sup>. On MRI, the hemorrhage aspect depends on the evolutive phase of the disease. In the acute phase, T1-weighted images show a signal intensity similar or slightly lower than that of the muscle; on T2-weighted images, acute hematoma is slightly hyper or hypoattenuating. Subacute hematomas may present up to three different levels of signal intensity on T1-weighted sequences: a low-intensity capsular sign, high-intensity in the peripheral zone, and central isosignal. As the hematoma develops, the central and peripheral signal intensity tend

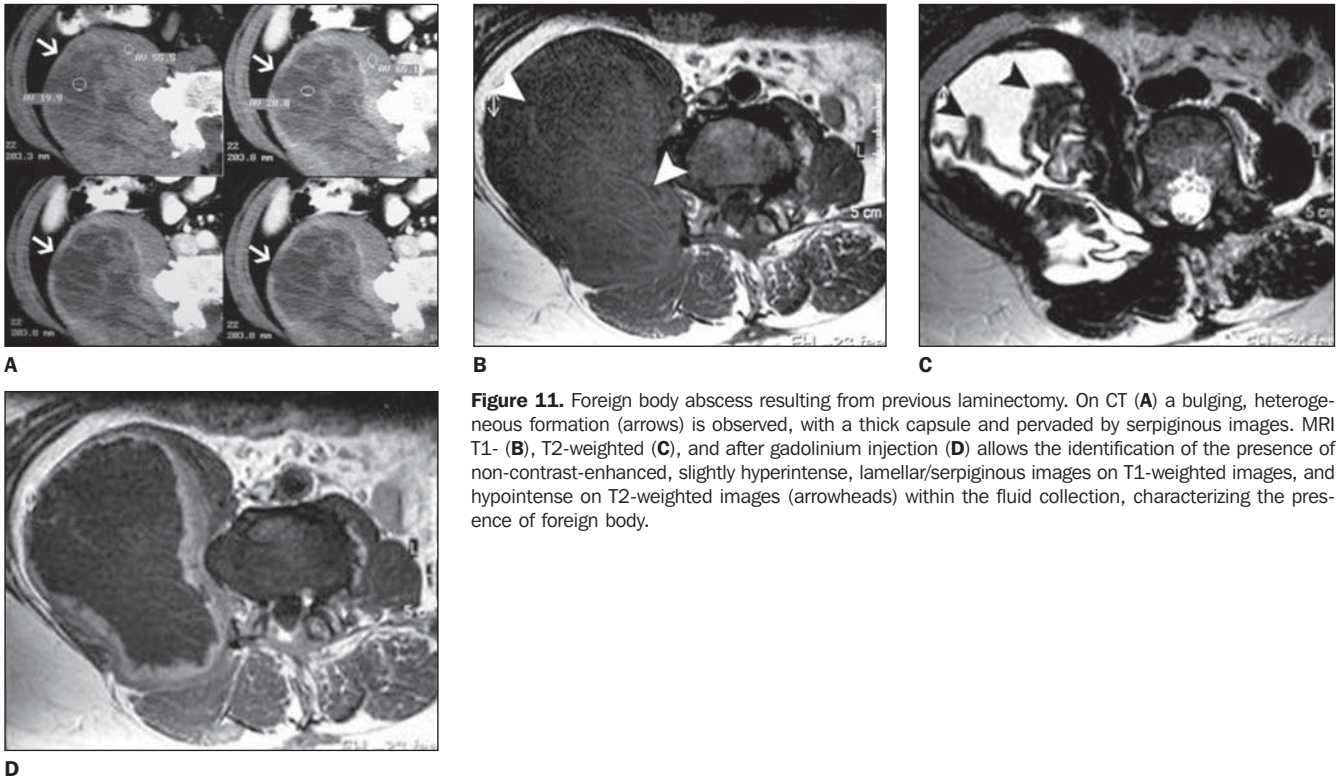


**Figure 9.** A bulging hematoma in iliopsoas compartment at right, resulting from firearm injury. Hyperintense formation with density similar to blood (UH = 59) is observed, with no significant enhancement after contrast agent injection (UH = 61).



**Figure 10.** Chronic hematoma in right psoas muscle resulting from firearm injury for one month ago. On non-contrast-enhanced CT (A,B) fluid-fluid level collection is observed. CT-guided needle biopsy (C) has allowed the characterization of hematic contents (D). MRI T1- (E) and T2-weighted (F) images have demonstrated fluid collection with no hematic characteristics.





**Figure 11.** Foreign body abscess resulting from previous laminectomy. On CT (A) a bulging, heterogeneous formation (arrows) is observed, with a thick capsule and pervaded by serpiginous images. MRI T1- (B), T2-weighted (C), and after gadolinium injection (D) allows the identification of the presence of non-contrast-enhanced, slightly hyperintense, lamellar/serpiginous images on T1-weighted images, and hypointense on T2-weighted images (arrowheads) within the fluid collection, characterizing the presence of foreign body.

to decrease, on both T1- and T2-weighted sequences<sup>(1,2)</sup>. Chronic hematomas may present with hypointense collections on T1-weighted images and hyperintense on T2-weighted images (Figure 10), simulating other types of collections.

### Miscellaneous

Retroperitoneal fibrosis, atrophy secondary to paralysis or muscle disease, calcifications secondary to trauma, rhabdomyolysis or foreign body (Figure 11) are other conditions that may involve the iliopsoas muscle<sup>(2)</sup>.

In a significant number of cases, radiological findings alone do not allow to define the etiology of iliopsoas compartment diseases. However, their diagnostic accuracy increases significantly when evaluated in association with clinical data. Imaging methods also are useful for guiding biopsies and drainage procedures.

The present study was aimed at illustrating imaging findings of different iliopsoas compartment lesions, to familiarize radiologists, improving their diagnostic effectiveness and level of confidence in the evaluation of this muscle compartment.

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