Muscular metastasis from visceral organ neoplasms detected at abdominal CT/MRI/US imaging

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Learning objectives

To familiarize the reader with usual appearance of metastases affecting the abdominal wall muscles seen during body examination. A short review of current literature considering the topic has also been done.
Background

Skeletal muscle metastases are rare. Despite of the fact that skeletal muscles account for nearly 50% of the total body weight and have a rich blood supply, the incidence is reported to be in general less than 1-2% (0.03-5.6 %), although some studies refer significantly mayor prevalence if considered microscopic level (until 17 %). It is to expect that plenty of these micrometastases can not be detected on radiological images. In one of the most recent papers considering the topic (Surov and all) the skeletal metastases was detected in 1.2 % of 5170 oncological patients during radiological exams, quite low considering the prevalence of metastasing to other organs.

There are several protective mechanisms: the presence of different inhibitors secreted by myocytes (low molecular weight factor, leukemia inhibitory factor, IL 6, agonist of adenosine receptor), acidic condition within the muscle as a consequence of its metabolism, muscular contractions that dislodge and possibly mechanically damage the tumor cells and variable blood flow in skeletal muscle. From other side, the skeletal muscle metastases occur as a late event in the progression of disease and probably only a part of these patients survive long enough for metastasis mass to be detectable. It should be also considered an effect of chemotherapy induced tumor growth suppression. Further more, the muscles of the abdominal wall is often less-watched area during the analysis of the body CT exams.

A wide spectrum of primary visceral malignancy metastasing to skeletal muscle has been described: pulmonary, ovarian, renal, colonic, gastric, pancreatic, hepatocellular, colangiocarcinoma, uterine, urinary bladder, esophageal, thyroid, melanoma. The most frequent origin of the primary tumors differs among various studies; in general it includes lung, gastrointestinal and renal cell carcinoma. In our experience the most frequent origin was in the lung (although different pathologic types have been seen). The prevalence of detected skeletal muscle metastases differ from tumor to tumor, being, according to the work of Surov, the highest for carcinoma of cervix uteri (4.9%), melanoma (3.6%) and ovarian carcinoma (3.5%). From other side, there are also differences about the most frequently affected muscle. Iliopsoas, paravertebral and gluteal muscles are in general the most frequently involved sites although several investigators refer the appendicular muscle (especially the lower limb muscle) to be the most affected group. It is to consider that only the proximal portions of appendicular musculature are seen on chest and abdominal CT, leaving most of the body’s musculature outside the scanning volume. It is referred an association of ileopsoas metastases with gluteal muscle and subcutaneous tissue metastases.

There are some differences in the literature about the common clinical presentation. Meanwhile several authors refer that the most of the detected lesions were palpable or
painful, other investigators state that the most of the lesions are silent. Improvements in diagnostic techniques in recent years, namely the detection of small metastatic lesions by high-resolution MRI, MCTC and other investigative methods, and better follow-up protocols may explain each time more probable detection of silent lesions as an incidental finding.

Although the superior intrinsic soft-tissue contrast afforded by MR imaging makes it the gold standard ad for imaging of muscle disease, many lesions will first be discovered on helical CT because of its routine use in oncologic imaging of the chest, abdomen and pelvis. Several articles considering favorable results of PET-CT have been published recently.

The clinical outcome of patients with skeletal muscle metastases is generally poor, mostly because of the fact that great majority of the patient has additional systemic metastatic disease at the time of detection. Muscular metastasis as the initial manifestation of malignancy or as a unique site of tumor recurrence has been reported in the literature and is not unusual initial presentation of a neoplasm.

Treatment of these patients may depend on the clinical setting and the condition of the patient. Excision of the painful mass may be helpful in carefully selected patients. Since the metastases of carcinomas appear to be a late event in the progression of the disease, the treatment of these patients should be specific. In general wide excision, chemotherapy, radiotherapy and a combination of the three are the possible option.

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disease, the treatment of these patients should be specific. In general wide excision, chemotherapy, radiotherapy and a combination of the three are the possible option.
Imaging findings OR Procedure details

As stated above many lesions will first be discovered on helical CT because of its routine use in oncologic imaging of the chest, abdomen and pelvis. In majority of cases the tumor density is quite similar to the muscle density what makes it less conspicuous and sometimes practically undetectable at unenhanced CT. Sometimes only indirect sign as slight asymmetry in disposal of intramuscular fat can suggest possible lesion. Contrast administration significantly improves tumor detection. It has been described different patterns of muscular metastatic lesions that are nicely summarized in the work of Surov and all. They recognize 5 different patterns of metastases:

1. homogeneous contrast enhancement
2. abscess-like central low attenuation with rim enhancement
3. diffuse muscle infiltration with swelling and inhomogeneous enhancement
4. associated with intramuscular calcification
5. associated with intramuscular bleeding

Although there is no general consensus about the most common pattern of metastatic presentation (whether is homogenous or peripheral rim enhancement) it is evident that these two patterns (together with the diffuse muscle infiltration) are what we expect to see in almost all of the cases (over 95 % of the lesions). There is no primary tumor related specific pattern and it is not uncommon that lesions with different enhancing pattern appear in the same patient.

On ultrasound the skeletal muscle metastasis in general presents as hypoecogenic lesions, well defined, with detectable internal Collor and Doppler signal. Sometimes it presents as completely anechogenic lesion without any sign of blood flow, simulating cystic lesion. In the case of calcification it is to expect hyperechogenic lesion with acoustic shadow and in case of bleeding the appearance is nonspecific, typical of hematoma and directly depending on the time passed since the initial hemorrhage. Ultrasound is especially useful in guiding the biopsy or FNA when necessary.

MRI has better tissular resolution and is the gold standard for imaging muscle disease. However, in few cases will be really necessary to use this technique for further study of abdominal wall lesions, mostly because the diagnosis is evident in the context of primary disease or because of its accessibility and low-risk of percutaneous tissue sampling. On T1-wighted images, the skeletal muscle metastasis presents as low to isointense mass in the majority of the cases. The T2-weighted images show an iso to hyperintense intramuscular mass with well-defined margin. Extensive tumoral enhancement associated with the central necrosis is one of the characteristic features
of the skeletal muscle metastasis although in general the MRI appearance of the metastases can be correlated pretty well with those described on CT.

We present in continuation some of the most typical cases from our daily practice.
Images for this section:

**Fig. 0:** Unenhanced CT shows slight hyperdense metastasis in patient with renal cell carcinoma (left gluteal muscle)

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**Fig. 0:** The same patient from fig.1. Note isodense metastatic nodule in left paravertebral muscle.

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**Fig. 0:** The same patient. Peripheral rim enhancement is evident after contrast administration.

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Fig. 0: Same patiente. Isodense metastasis in anterior abdominal wall; nonenhanced CT

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Fig. 0: Same patient. Ultrasound appearance of anterior abdominal wall metastasis. Note hypoecogenic mass with positive color doppler sign.

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**Fig. 0:** Left gluteal homogenously enhancing metastasis from esophageal carcinoma

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**Fig. 0:** Same patient. Note the peripheric rim enhancement in the right paravertebral metastasis. It is not uncommon the presence of different metastatic enhancement patterns in the same patient.

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Fig. 0: Metastatic involvement of left gluteal muscle (peripheral rim enhancement) and of left iliac muscle (diffuse muscle infiltration with swelling) in patient with squamous lung cancer. One patient-two patterns

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**Fig. 0:** Tiny metastasis in the muscle of anterior abdominal wall in patient with ovarian cancer. It is sometimes hard to distinguish between diffuse and peripheric rim enhancement.

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**Fig. 0:** Slightly hyperenhancing left paravertebral metastasis in patient with large-cell lung carcinoma

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Fig. 0: Different patient with large cell pulmonary cancer with left paravertebral metastasis, this time presenting as rim enhancing pattern.

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**Fig. 0:** Rim enhancing metastasis in the right abductor muscles in patient with uterine cervical carcinoma.

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**Fig. 0:** Same patient. Small hyperenhancing metastases in left paravertebral (with slight circumferencial edema) and oblique left posterior muscles. Note periaortic retroperitoneal metastatic fibrosis with the left ureter involvement.

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Fig. 0: Left abdominal rectus muscle enhancing metastasis in patient with rectal carcinoma. Apparently it is of the similar density as the nearby small intestine loops.

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Fig. 0: Slighty enhancing psoas muscle metastasis from occult ringlet cell carcinoma. Note accompanying circumferencial fat atrophy and retroperitoneal lymph nodes involvement.

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Fig. 0: Same patient. T1 weighted sequence shows isointense right psoas muscle metastasis. Note surrounding hyperintense ring of fatty transformation within the muscle.

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Fig. 0: Multiple bilateral psoas metastases in patient with ovarian carcinoma. Note the rim enhancing pattern of metastases and pretroperitoneal lymphnode dissemination.

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Fig. 0: Same patient. In complete remission 4 moths later.

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Fig. 0: Note asymmetry of iliac muscle (the right one slightly more prominent) as a sign of metastasis in patient with pulmonary sinovial sarcoma

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Fig. 0: Same patient, six months later.

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**Fig. 0:** Same patient. Note asymmetry with slight mass effect in the paravertebral muscle on the left side, just next to spinous process.

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Fig. 0: Same patient. Six month later. The metastasis is more prominent.

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Fig. 0: Same patient. Ultrasound appearance of the paravertebral metastasis. Hypoecogenic cystlike metastasis. Note acoustic shadow from spinous process (yellow arrow).

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**Fig. 0:** Same patient. Sagital plane STIR. The paravertebral metastasis appears as bright lesion with discrete perilesional edema. Note vertebral bone metastasis with extension to spinal canal.

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Fig. 0: Same patient. Note hyperenhancing left paravertebral metastasis.

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**Fig. 0:** Same patient. It is hard to identify the lesion at this T1 weighted image. It presents as isointense to paravertebral muscle

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Fig. 0: Same patient. Left muscular metastasis is hyperintens on this T2 weighted image.

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Fig. 0: Same patient. Diffuse enhancement at this postcontrast T1 weighted image.

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Fig. 0: Rim enhancing left paravertebral metastasis in patient with uterine leiomiosarcoma.

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Fig. 0: Same patiente. Dynamic gadolinium enhanced SGE. Rim enhancing left paravertebral muscle metastasis.

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Fig. 0: Same patient. Cyst-like hypoecogenic lesion.

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Conclusion

Muscular metastases are quite rare but can be detected during abdominal imaging and can change prognosis and therapeutic attitude as well as offer an alternative for less invasive biopsy when needed.
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