

## **Skeletal muscle metastasis in non-small cell lung cancer: a case report and review of the literature**

Bhavini Tailor, MD\*; Seshan Subramanian MD, FACP

**\*Corresponding Author: Bhavini Tailor**

Department of Internal Medicine, Loyola University Medical Center, USA.

Email: Bhavini.Tailor@luhs.org

### **Abstract**

Lung cancer is the second most common type of cancer diagnosed worldwide and with the most associated deaths. Screening has allowed us to catch lung cancer in the earliest of stages, however not all patients will benefit from this. Patients may present with diffusely metastatic disease and in the case of lung cancer most commonly it is also found in the adrenal glands, liver, brain and bones. The disease may present with constitutional symptoms or overt ones due to the specific cancer. Here we present a unique case of a patient who presented with falls due to weakness found to have metastatic adenocarcinoma of the lungs with a lesion in the psoas muscle.

### **Keywords**

skeletal muscle metastasis; lung cancer; psoas abscess.

### **Abbreviations**

NSCLC: Non-small cell lung cancer; CT: Computed tomography; MRI: Magnetic resonance image; FDG-PET-CT: Fluorodeoxyglucose- positron emission tomography-CT.

### **Introduction**

In the year 2020, there were a total of 2,206,771 cases of lung cancer and 1,796,144 associated worldwide [1]. It is the second most commonly diagnosed cancer in both females and males, with breast and prostate cancers respectively being the most common for each. Out of all the cancer-related deaths, lung cancer resulted in the highest number of deaths [1]. Nowadays, at least in the United States (US), we have the ability to screen patients for lung cancer; particularly in patients that have a 20 or greater pack year smoking history and who have quit smoking within 15 years in patients aged 50-80 per the US Preventative Task Force. This has allowed physicians to find cancers earlier in patients who get screened; however

patients are still being diagnosed with metastatic disease on first presentation or later in the course of the disease despite adequate treatment.

The most common sites of metastasis for non-small cell lung cancer (NSCLC) have been found to be the adrenal glands, liver, brain, bones and spleen along with other areas of the lung [2]. Here we present a case of a patient with a rare presentation of her metastatic disease.

## Case Description

A 72 year-old woman with no known past medical history presented with multiple falls and lower extremity weakness. Over a one month period, she had 7 falls. The patient attributed her falls to worsening lower extremity weakness. Prior to the new onset weakness, she was able to complete all her activities of daily living along with being her daughter's primary caregiver. She also endorsed that when she had falls she would be on the floor for hours because she could not get herself back up. Other symptoms included decreased appetite, weight loss, dysuria, urinary frequency and right-sided flank pain. She had a 40 pack year smoking history and was an active smoker. On presentation, she was tachycardic and saturating at 93% on room air and the rest of her vitals were stable. Labs were remarkable for an anion gap of 17 and white blood cell count of 21.3. Computed tomography (CT) of the abdomen and pelvis demonstrated right pyelonephritis with moderate right hydro-ureteronephrosis with dense material in mid to distal portion of the ureter as well as a right psoas abscess (Figure 1 and Figure 2).



**Figure 1:** Transverse image of CT of the abdomen and pelvis demonstrating a large ring-enhancing lesion with central hypoattenuation within the right psoas musculature.



**Figure 2:** Sagittal image of CT of the abdomen and pelvis demonstrating a large ring-enhancing lesion with central hypoattenuation within the right psoas musculature.

Patient received pain control as well as antibiotics and had a ureteric stent placed. Post-procedure, she was found to be in rigors with an undetectable blood pressure (likely due to the rigors). She was febrile, tachycardic to the 150's and was hypoxic, requiring oxygen. A chest x-ray was obtained and a large right-sided apical mass was seen. Patient also had a CT angiogram of her chest, that demonstrated bilateral non-occlusive pulmonary embolisms and redemonstrated the mass (Figure 3).



**Figure 3:** Transverse image of chest CT demonstrating the large 78.7 mm by 62.7 mm lung mass which was found to be adenocarcinoma of the lung.

Patient subsequently underwent CT-guided drainage of the psoas abscess, however the fluid drained was sanguinous and not purulent concerning a malignant effusion and although cultured, did not grow any bacteria. Unfortunately, cytology was not done on this sample but it was assumed to be from the presumed cancer. Patient eventually underwent CT-guided biopsy of the apical mass which ended up being adenocarcinoma of the lungs. Patient's imaging also demonstrated diffuse metastatic disease in the lungs, adrenal glands, bones and many groups of lymph nodes in the chest and abdomen. A brain magnetic resonance image (MRI) demonstrated metastasis. Due to the diffuse nature of her disease and her functional status at the time, no treatment beyond palliative radiation could be offered to her. Unfortunately, the patient passed away from her disease within 16 days of her presentation to the hospital.

## Discussion

Skeletal muscle metastasis is a rare occurrence seen in patients with lung cancer. In a study by Bocchino et al, they looked at 1754 lung cancer patients over a 5 year period and found that only 2.6% were found to have skeletal muscle metastasis. 87% were found to be non-small cell lung cancer; with adenocarcinoma being 60% of the patients with NSCLC [3]. In a literature search with regards to skeletal muscle metastasis, there was a wide variety of muscles that have had reported metastasis from NSCLC in the past. These muscles include biceps brachii [4], the paraspinal muscles [5], psoas muscle [6], lower extremity [7,8], forearm [9], abdominal rectus [10], gluteal [11-13], pectoralis major [14] and rhomboideus major [15]. One case even demonstrated metastasis to the muscles of the forearm with eventual spread to the left and right major dorsal muscles and left deltoid despite radiation therapy to the original area and chemotherapy after 3 months, presenting as new-onset swelling in those respective areas. Patient also underwent further chemotherapy but still developed metastatic lesions in the neck and back muscles 8 months later [16]. This patient's total life span from her original surgery was 30 months [16]. demonstrating the possible poor prognosis that comes with skeletal muscle metastasis.

In a small scale study of 16 patients with diagnosed skeletal muscle metastasis from NSCLC demonstrated a total of 27 metastases between the patients with widely variable sites including the chest and abdominal walls as well as the upper and lower limbs. Despite having treated these patients, their

mean survival was only 5.6 years after diagnosis of the skeletal muscle metastasis. Additionally, a literature search was performed by Pop et al as well where they found 114 cases between the years 1946 and 2007. They reported that 84% of the patients presented with pain in the local area and in 78% of the cases, a mass was palpable as well. They found that median survival of the patients with recorded follow up was 6 months and the 1 year survival was 32.6% and 5 year survival only being 11.5%; demonstrating that skeletal muscle metastasis tends to be a poor prognostic sign. They also found that there was no specific muscle that NSCLC can metastasize to [17].

Many of the cases involved finding skeletal muscle metastasis on fluorodeoxyglucose- positron emission tomography-CT (FDG-PET-CT) scan [11]. Whereas many of the patients presented with pain and swelling in the local area; for which local palliative radiation therapy is commonly used to relieve the pain and swelling associated skeletal muscle metastasis [18].

Rarity of skeletal muscle metastasis has been theorized to have many mechanisms. These include lactic acidosis and its associated anoxic environment, destruction of tumour cells by contraction of the muscle fibers, changes in the pH, variations in blood flow as well as protease inhibitors which are present in the extracellular matrix of muscles; all of which prevent cancer cells to be able to seed [18,19].

Returning to our patient with the suspected metastatic lesion in the psoas muscle, she presented with falls from weakness she felt in her legs, however on reviewing the few case reports, pain was the most common presenting symptom [20]. Additionally, a portion of the patients were also asymptomatic in the area and the metastatic lesion was found on diagnostic imaging. A case series by Strauss et al demonstrated 3 different cases of psoas muscle metastasis, all with different types of lung cancer; adenocarcinoma, and two with squamous cell carcinoma. One of which presented with flank pain while the other two were asymptomatic. Despite treatment, all three of the patients developed progressive metastatic disease [21]. In another case report, a psoas metastatic lesion was thought to be a psoas abscess, much like in our patient's case, due to a sepsis-like picture requiring vasopressor-support in the intensive care unit. Upon biopsy of the lesion, it was found to be a metastatic lesion of large cell lung cancer [22].

In a small scale study by Pretorius et al, in a population of patients with a variety of cancers, including squamous cell carcinoma of the lung which revealed that many patients are found to have skeletal muscle metastasis incidentally unless overtly symptomatic which would warrant dedicated imaging of that particular area. They also found that 83% of the lesions showed up as rim-enhancing lesions within the musculature with central hypoattenuation [23]. This may also be confused with an intramuscular abscess which has a similar appearance, however these patients may present with other findings associated with infection such as bacteremia or intravenous drug use; in the case of our patient, her lesion was next to an active infection and she also had septicemia from it and at the time the CT scan was done, there was no sign overt signs of malignancy as her ongoing infection could explain her symptoms. It was not until the following day where her chest imaging, which was obtained due to hypoxia, revealed a large right upper lobe mass and upon drainage of her «abscess» where it revealed bloody fluid rather than purulent which would have been consistent with malignancy.

Due to the rare nature of skeletal muscle metastasis, there are no distinct treatment guidelines for

when they occur. From case reports and series, treatment was based primarily on palliation, usually starting with surgical excision, if feasible, followed by radiation therapy. Radiation therapy has also been used on its own for palliation and for relieving any pain or swelling from the metastatic lesion [18]. For patients with a good performance status, systemic therapy with chemotherapy with regimens such as etoposide and cisplatin [24], carboplatin and taxol [21], docetaxel and cisplatin [4], pembrolizumab, cisplatin, and pemetrexed [11], were used as well. Patients lived anywhere between 10 weeks and 3 years [16,21,24] in these case studies, with the majority of patients having very poor life expectancies of weeks and months rather than years.

## Conclusion

Overall, although skeletal muscle metastasis are rare, they may be found in cancer patients. They may present with pain, swelling or as an incidental finding on imaging. These symptoms, unfortunately, share in common features of intramuscular abscesses as well its appearance on imaging. Especially in a patient with known cancer or if an infection cannot explain the imaging finding or the symptoms, biopsy will be necessary. Unfortunately, upon diagnosis of a skeletal muscle metastasis, even with extensive treatment, prognosis appears to be poor.

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**Authors Information:** Bhavini Taylor, MD<sup>1\*</sup>; Seshan Subramanian, MD, FACP<sup>2,3</sup>

<sup>1</sup>Department of Internal Medicine, Loyola University Medical Center, USA.

<sup>2</sup>Department of Hematology/Oncology, Mercy Hospital and Medical Center, USA.

<sup>3</sup>Clinical professor of Oncology, University of Illinois Chicago, USA.

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