A man in his 70s with a history of rheumatoid arthritis and a 50-pack-year smoking history presented with a worsening unproductive cough. Chest radiography identified a right lung nodule, with complete workup revealing a T2aN0M0 right upper lobe non–small-cell lung cancer (NSCLC) measuring 4.3 × 2.9 cm. A clinically significant cardiac history precluded the option of surgery. He was treated with a definitive accelerated hypofractionated course of radiotherapy to a total dose 60 Gy in 8 fractions. Acute toxic effects were not observed, with the exception of minor fatigue that resolved 1 month after treatment. A surveillance computed tomographic (CT) scan obtained at 3 months demonstrated that the right upper lobe tumor had decreased by 1 cm in all dimensions, and at this time the patient denied any new symptoms, including pain. Approximately 5 months after treatment, he awakened with abrupt onset of severe right shoulder pain. The pain was sharp, constant, and localized to his right scapula and ultimately progressed to the point of radiating down the extensor surface of his arm ending at his elbow. He denied paresthesias, weakness, or any inciting events that could have led to its onset. His primary care physician obtained a CT scan, followed 2 days later by a magnetic resonance image (MRI) of his right shoulder.

**WHAT IS YOUR DIAGNOSIS?**

A. Metastatic non–small-cell lung cancer

B. Rib fracture

C. Radiation-induced myositis

D. Polymyalgia rheumatica

**Figure 1.** Right shoulder diagnostic imaging 5 months after treatment. CT indicates computed tomography; MRI, magnetic resonance imaging.
Diagnosis
C. Radiation-induced myositis

Discussion
Hyofractionated radiotherapy (ie, stereotactic body radiotherapy [SBRT]) is the preferred modality of treatment for inoperable NSCLC, offering excellent local control.\(^1\)\(^2\) Chest wall pain is a known adverse effect of hyofractionated radiotherapy, with tumor location adjacent to the chest wall being the strongest predictor of toxic effects.\(^3\) In hopes of decreasing chest wall toxic effects, radiation oncologists frequently decrease the prescription dose or further fractionate the treatment (ie, smaller doses per day but more fractions).

The biologically effective dose (BED) is used in radiation oncology for isoeffective dose calculations, most commonly to compare the potency of different dose-fractionation schemes. Onishi et al\(^4\) demonstrated a local control rate of 92% for patients receiving SBRT with a BED greater than 100 Gy, compared with 74% with a BED less than 100 Gy. Instead of our usual prescription of 60 Gy in 5 fractions for peripheral lesions, we delivered 60 Gy in 8 daily fractions\(^5\) with a volumetric modulated arc technique with 10 MeV photons given that the lesion was abutting the chest wall. The BED for the delivered regimen was 105 Gy.

The T2-weighted MRI 5 months after radiation demonstrates a bandlike pattern of edema and inflammatory changes along the right posterolateral chest wall, with the 3500-cGy isodose line coinciding closely with the regions of T2 change (Figure 2). No rib fracture was identified on CT of the chest obtained 2 days prior to the MRI. The areas of inflammation include the subscapularis and serratus anterior muscles. It is possible the edema compressed the upper and lower subscapular nerves as well as the radial nerve—all arising from the posterior cord of the brachial plexus.

Radiation myositis is infrequently reported as skeletal muscle is relatively radio-resistant. Furthermore, a single report of functional imaging-detected radiation myositis mimicking a chest wall recurrence following lung SBRT has been published.\(^6\) Although the exact cellular response to acute muscle injury from ionizing radiation is unclear, animal and human studies implicate vascular injury leading to myofilament disruption and endothelial injury\(^7\) as well as release of amino acids, suggesting protein breakdown.\(^8\)

Because MRIs to evaluate soft tissue are rarely obtained following lung radiotherapy, our case highlights graphically and adds anecdotal evidence to the hypothesis that symptomatic chest wall toxic effects seen in a substantial percentage of patients undergoing lung radiotherapy may be attributable to acute muscle or nerve injury rather than to frank rib fracture.\(^9\) The patient was prescribed a 14-day tapering course of methylprednisolone to decrease the soft-tissue swelling, referred to physical therapy, and advised to continue pain and anti-inflammatory management. Eight months after therapy, shoulder pain was still present, albeit less severe.

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Figure 2. The patient’s radiotherapy isodose plan.