Radiation-Induced Intraspinal Chondrosarcoma: A Case Report

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Abstract

Study Design Case report and review of the literature.

Objective To report a unique case of an intraspinal chondrosarcoma that was diagnosed 18 years after radiotherapy for a cervical carcinoma and its remarkably unusual clinical presentation.

Methods A retrospective case description of an intraspinal mass lesion that occurred 6 weeks after previous spinal surgery.

Results Within ~9 weeks, the tumor had infiltrated the peritoneal cavity and reached the lumbar subcutaneous tissue.

Conclusion Radiation-induced sarcomas are rare, are highly aggressive, and may be difficult to diagnose. Furthermore, the only means of achieving long-term survival is through early and extensive surgery.

Keywords
- intraspinal tumor
- radiation-induced sarcoma
- chondrosarcoma
- secondary malignancy
- radiotherapy

Introduction

Radiotherapy is a well-established treatment modality for various cancers. Although radiotherapy can significantly reduce cancer-related mortality, it is associated with several side effects and long-term complications. The development of a secondary malignancy is an especially serious late effect. Exposure to ionizing radiation is a risk factor for the occurrence of mesenchymal tumors of the bone.[1] It has long been recognized that exposure to medical radiation increases the incidence of undifferentiated sarcomas.[2,3] The interval between irradiation and the development of a secondary malignancy (the latency period) varies widely, ranging from as few as 5 years to as many as 50 years.[4] However, the risk of developing a secondary sarcoma after irradiation is relatively low. Chondrosarcomas account for only 3.7% of all radiation-induced sarcomas (RISs).[4,5] This report concerns a 57-year-old woman who developed an intraspinal radiation-induced chondrosarcoma 18 years after radiochemotherapy for a cervical carcinoma.

Case Report

A 39-year-old woman underwent surgery and radiochemotherapy for a cervical carcinoma in 1995. Following this therapy, she was in good health, and her regular follow-up evaluations did not reveal any notable pathologic findings. However, 18 years later (at the age of 57 years), she presented with left lumbosciatic pain in the absence of any trauma, which was resistant to conservative treatment. The initial computed tomography (CT) and magnetic resonance imaging (MRI) scans (►**Figs. 1** and **2**) showed an ankylosing spondylolisthesis (Meyerding degree II) at the L5–S1 level with a central defect, which was interpreted as old spondylodiskitis. We performed a dorsal instrumented L4–S1 spondylodesis with decompression of the nerve roots and an L5–S1 interbody fusion with autologous bone through a transforaminal approach. The biopsy sample obtained from the ankylotic disk zone and the vertebral body of L5 showed no evidence of malignancy or infection. The patient's sciatic pain reduced significantly after surgery, and she was discharged from the hospital. No complications occurred during her stay at the hospital.

Six weeks later, she returned to the hospital. The left sciatic pain had reappeared and she had additional distal paraparesis. A radiogram showed no evidence of implant failure, and an MRI scan (►**Fig. 3**) showed an intraspinal mass lesion. Although the dynamics of clinical symptoms were unusual, we thought that the lesion was most likely a hematoma.

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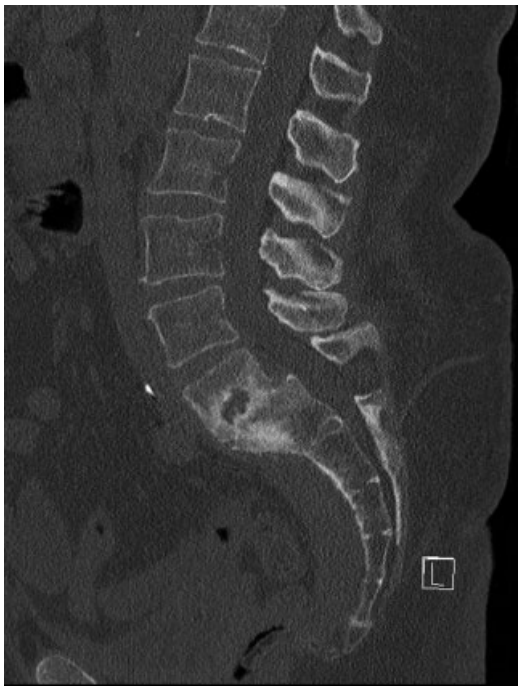

Fig. 1 Initial computed tomography scan.

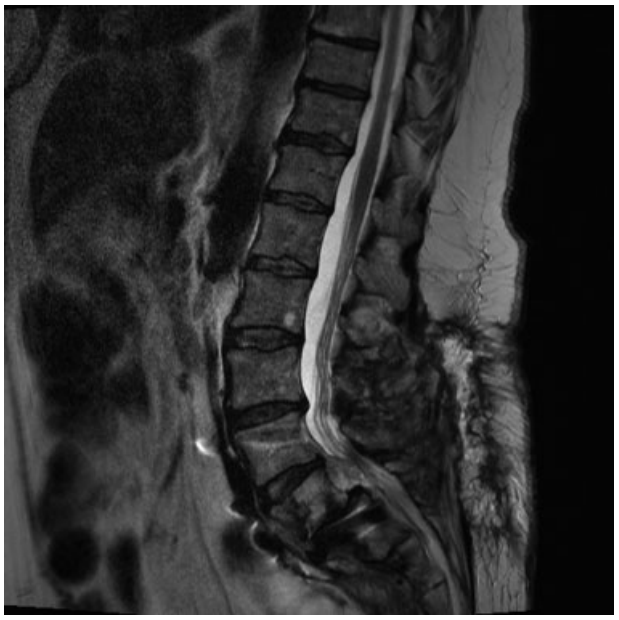

Fig. 3 Magnetic resonance imaging scan 6 weeks after the first operation showing the intraspinal mass lesion.

Intraoperatively, we only found necrotic tissue compressing the dura and the nerve roots. We performed circular tumor debulking and decompression. The pathologic examination revealed no signs of the lesion being a metastasis from the cervical carcinoma. After surgery, the patient developed a wound-healing disorder that necessitated further surgery. Intraoperatively, we observed that the tumor had regrown significantly. In the same session, another debulking procedure was performed. At this point (14 days after the second operation), the pathologic examination of the first debulking indicated dedifferentiated chondrosarcoma. Our institution's tumor board decided to initiate chemotherapy. Unfortunately, the patient developed ileus postoperatively, and chemotherapy was therefore not performed as scheduled. To re-evaluate the tumor region, another MRI scan (►**Fig. 4**) was performed. Within ~9 weeks, the tumor had infiltrated the peritoneal cavity and reached the lumbar subcutaneous tissue. By that time, the patient had developed complete paraplegia below L5. Unfortunately, the patient could not be mobilized again. Using a palliative therapy regimen, we were able to achieve a fairly stable level of pain. The patient died 6 months after her first visit to the hospital.

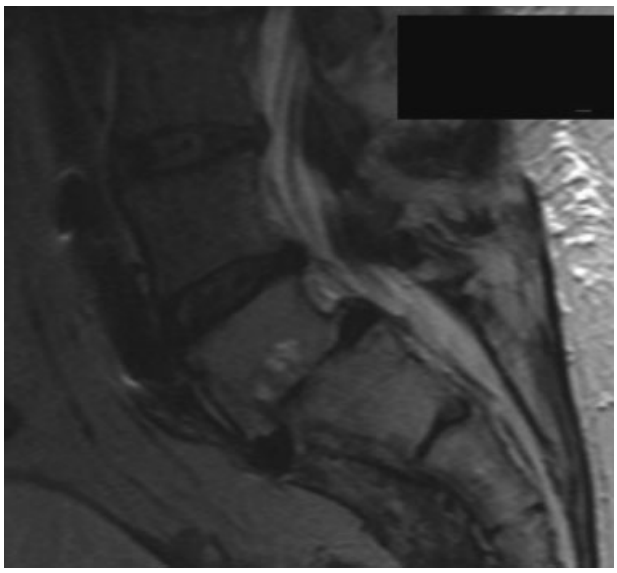

Fig. 2 Initial magnetic resonance imaging scan.

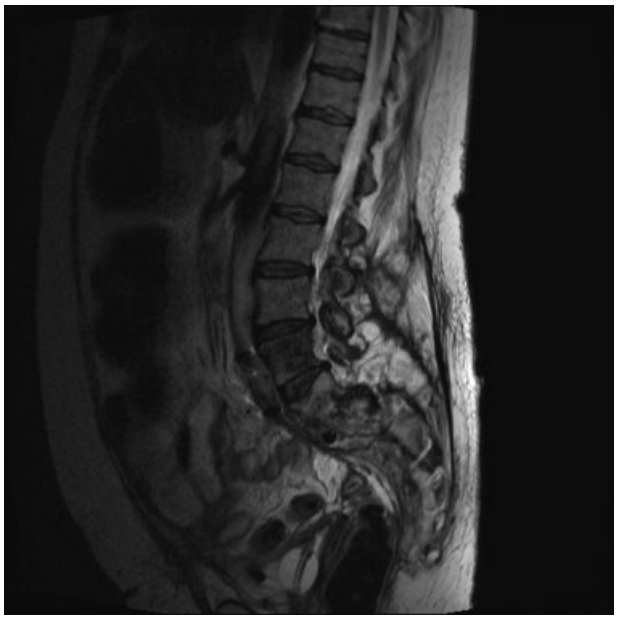

Fig. 4 Magnetic resonance imaging scan 9 weeks after the first operation showing infiltration of the peritoneal cavity and lumbar subcutaneous tissue.

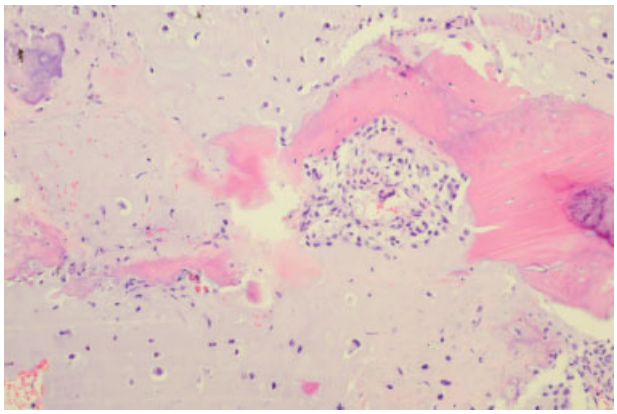

Fig. 5 Differentiated chondrosarcoma (hematoxylin and eosin, original magnification ×100).

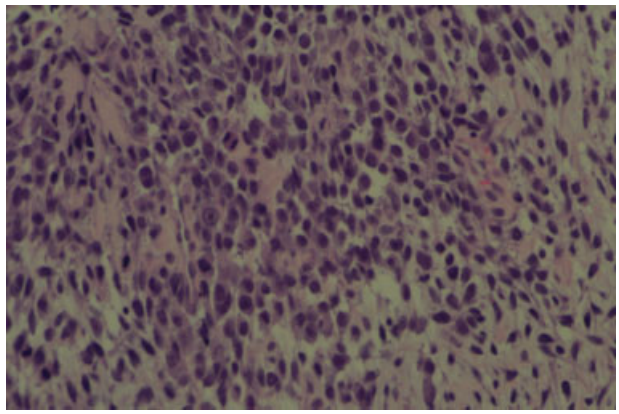

Fig. 7 Dedifferentiated chondrosarcoma (hematoxylin and eosin, original magnification ×200).

A postmortem examination confirmed the diagnosis of a chondrosarcoma. ►**Figs. 5–7** show the histopathologic findings of the chondrosarcoma and illustrate the pleomorphism of the tumor with its differentiated and undifferentiated regions, which made diagnosis difficult.

Discussion

Incidence of Radiation-Induced Sarcoma

Because RIS is quite rare, its exact incidence is difficult to quantify. Accordingly, the literature includes a wide variety of estimates. Phillips and Sheline estimated a 0.23% frequency of sarcomas after irradiation for breast cancer.[6] Mark et al estimated the absolute risk of developing RIS to be 0.03 to 0.8% after radiation therapy for gynecologic malignancies.[7] Amendola et al noted an estimated incidence of sarcomas of 0.09 to 0.11% after radiotherapy for any purpose.[8] Furthermore, Huvos et al and Souba et al estimated that 5% of sarcomas developed after therapeutic or accidental irradiation.[9–11]

The Present Case and Previous Studies of Radiation-Induced Sarcoma

Our case meets the criteria of Murray et al for RIS.[12] They specify that radiotherapy must have been administered previously and that the sarcoma must have developed from an area within the 5% isodose line. To the best of our knowledge, radiation-induced intraspinal chondrosarcoma has not been described previously. The rarity of radiation-induced chondrosarcoma is reflected by the very few case series that have included such cases. Indeed, in a multi-institutional series of 80 histologically confirmed cases that were diagnosed as RIS between 1975 and 1995, only one patient had chondrosarcoma.

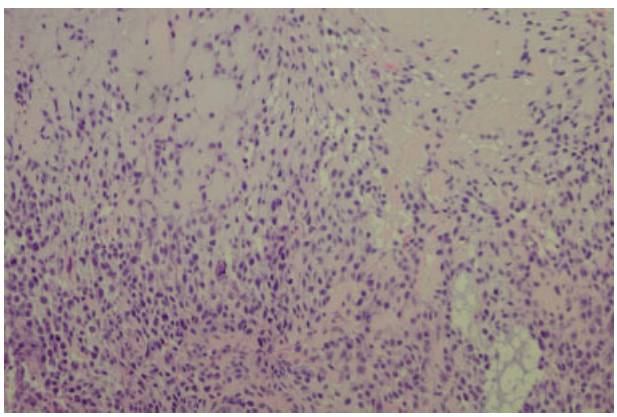

Fig. 6 Shift from differentiated to dedifferentiated chondrosarcoma (hematoxylin and eosin, original magnification ×200).

Prognosis of Radiation-Induced Sarcoma and Therapeutic Options

The prognosis for patients diagnosed with RIS is generally very poor. In a case series of RIS, Lagrange et al reported a median survival of 23 months.[13] These tumors are generally aggressive and have a high potential for local recurrence. Sarcomas also have a high potential for metastasis.[14,15] Buis and Spiro found that the size of the RIS is predictive of the overall survival and recurrence-free survival, independent of the other variables that they studied, including the tumor margin.[15]

Surgery appears to be the only therapy that is capable of providing long-term survival for patients with RIS. The important role of surgery has been highlighted in the literature.[16–18] According to Bobin et al, a cure is only possible for patients who develop RIS at the extremities and therefore can undergo amputation.[19] Lagrange et al reported a 5-year overall survival rate of 0% among patients who received chemotherapy alone, compared with 39% among patients who underwent surgery. The addition of chemotherapy to surgery had no statistically evident effect on the survival rate.[13]

Recommendations

In 2006, the National Cancer Institute of the United States reported that cancer survivors constitute 3.5% of the United States population, but that second malignancies in high-risk groups accounted for 16% of all cancer incidence.[4] Because advancements in cancer therapy have substantially improved long-term survival, the incidence of secondary malignancies will grow. Accordingly, clinicians should be conscious of the possibility of secondary malignancies.

In this case, we had thought that the mass lesion was most likely to be a hematoma—which was not consistent with the dynamics of the clinical symptoms—or a metastasis from the cervical carcinoma. Although we performed a biopsy during the first operation, an accurate diagnosis could only be made after the third operation. By this time, postoperative complications had already occurred and the tumor had already attained significant local growth. There was no possibility of curative or extensive surgery at that point.

One might hold surgery itself accountable for the rapid progression of the tumor. Although there are reports of rapid tumor expansion after surgery,[20] there is no real proof to support this thesis. Demicheli et al support the thesis of tumor alteration through surgery. The primary tumor may influence distant metastases. They also state that a few advanced in vitro models highlight the crucial role that tumor stroma plays both in carcinogenesis and in tumor development and clinical behavior.[21] Overall, one cannot rule out the thesis that surgery has triggered the rapid expansion of this previously clinically quiescent tumor.

Conclusion

This case highlights the importance of both being conscious about the possibility of a secondary malignancy when managing cases that include a history of radiotherapy and reaching a diagnosis at the earliest possible time. The possibility of a radiation-induced secondary malignancy should be considered in any case that involves a new mass lesion after radiotherapy. In summary, RISs are rare, are highly aggressive, and may be difficult to diagnose. Furthermore, the only means of achieving long-term survival is through early and extensive surgery.

Disclosures
Peter Obid, none
Mathias Vierbuchen, none
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Acquisition of data: M. Vierbuchen, E. Wolf, and M. Reichl
Critical revision: T. Niemeyer and H. Übeyli
Supervision: A. Richter

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