

## Oncology

# A Case of Delayed Radiation Myelopathy of the Thoracic Vertebrae Following Low Dose Radiation Therapy for Metastatic Renal Cell Carcinoma



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## ABSTRACT

Delayed radiation myelopathy (DRM) is a rare disorder that rapidly leads to disabilities, and the median incubation period was reported to be about 2 years (from 6 months to a few years). In this report, we describe a 61-year-old woman who presented with rapid progressive numbness and weakness in both legs 22 months after palliative radiation therapy with 39 Gy in 3 Gy fractions. She was diagnosed with DRM of the thoracic vertebrae and was treated sequentially with corticosteroids, heparin, and hyperbaric oxygen therapy. However, they were not effective, and complete paralysis of the legs occurred in 3 months.

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## Introduction

Radiation therapy (RT) is commonly used to treat bone metastasis of renal cell carcinoma (RCC) which induces severe symptoms such as pain or paralysis, since it often improves the quality of life. However, complications may occur after RT for metastasis to the vertebrae because the spinal cord is included within the radiation field. Delayed radiation myelopathy (DRM) is a rare complication of RT that typically develops within months to a few years following RT and manifests as progressive sensory and motor symptoms. The estimated median tolerance dose of the spinal cord is 69.4 Gy, and the probability of developing DRM at 50 Gy is only 0.2% with 2 Gy per fraction.<sup>1</sup> However, although rare, even low RT dose can cause DRM. Here, we describe a case of DRM of the thoracic vertebrae following low dose RT for metastatic RCC.

## Case presentation

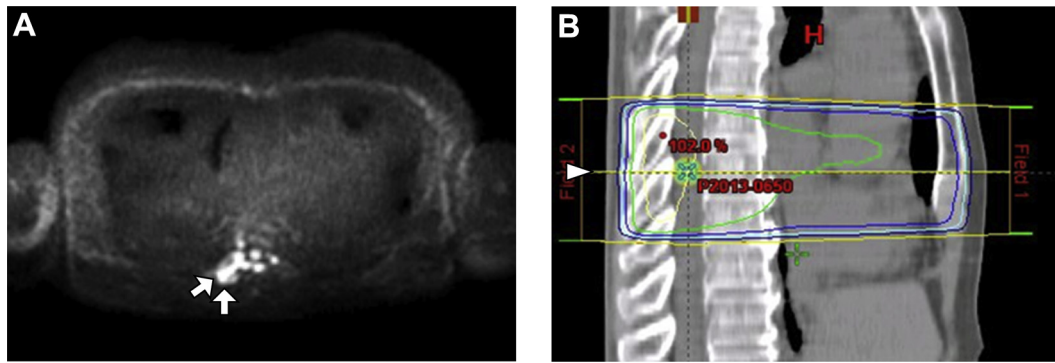
A 61-year-old woman presented with progressive neurologic disturbance. She had a history of T3bN0M1 right RCC and had

undergone laparoscopic nephrectomy at 59 years of age. After the surgery, she received RT with 39 Gy in 3 Gy fractions for metastasis to the transverse process of the eighth thoracic vertebra (Fig. 1), as well as molecular target therapy using tyrosine kinase inhibitors. Approximately 22 months after the RT, she experienced rapid progressive numbness and weakness in both legs. She was hospitalized immediately, and her muscular strength was evaluated by manual muscle tests (MMT). Her MMT score, which represented MMT results from bilateral iliopsoas, quadriceps femoris, gastrocnemius, and tibialis anterior muscles, was 37/40 upon admission. MRI showed an enhanced lesion in the spinal cord around Th8 level (Fig. 2). The differential diagnosis included primary or metastatic intramedullary neoplasm, demyelinating disease, and DRM. Examination of cerebrospinal fluid and blood exam showed no abnormalities, and she was finally diagnosed with DRM. Corticosteroid was administered for 7 days just after admission (500 mg methylprednisolone on the first day, 125 mg/day from the second to seventh day), which slightly relieved the numbness and paralysis (MMT score 39/40). But 3 weeks after initializing corticosteroid therapy, MRI turned worsted, so a second course of corticosteroid (methylprednisolone 125 mg/day) was administered for 7 days. However, this was not effective, and she experiences bladder and rectal disturbances. Six days after the second corticosteroid therapy, she received hyperbaric oxygen therapy (2 atm, 1 hour/day) for 10 days. In spite of those treatments, the neural disturbance worsened (MMT score 22/40). Nine days after the hyperbaric oxygen therapy, she received anticoagulant and corticosteroid for 7 days (heparin 8000 U/day and methylprednisolone 125 mg/day).

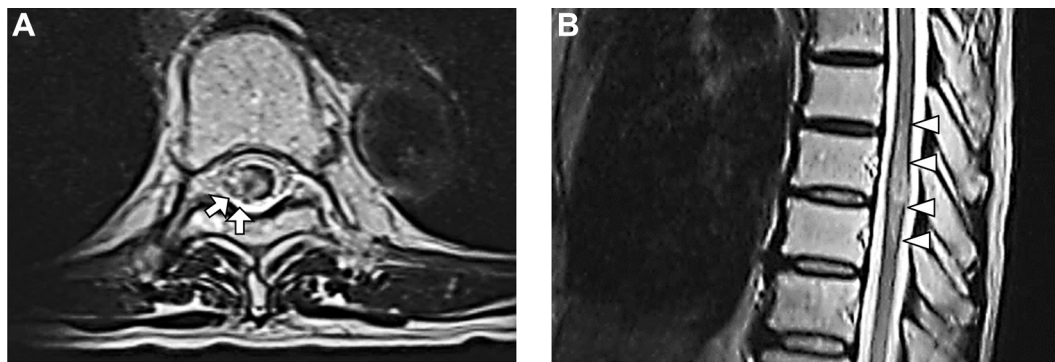
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**Figure 1.** Radiation therapy was performed for metastasis to the eighth thoracic vertebra. A: Diffusion weighted image of magnetic resonance imaging demonstrated metastasis to the eighth thoracic transverse process (arrow). B: The radiation was irradiated from around eighth thoracic vertebra (arrow head).



**Figure 2.** T2-weighted images of contrast-enhanced magnetic resonance imaging at symptom onset. A: Horizontal image reveals the enhancement in the right side of medulla in Th8 (arrow). B: Sagittal image reveals the enhancement in the region from Th7 to Th9 spinal cord (arrow heads) and the vertebral body.

**Table 1**  
Summary of articles as to delayed radiation myelopathy occurred in thoracic vertebra

Age/Sex	Tumor Type	Location	Total Dose (Gy)	Onset of Myelopathy (Months)	Treatments	Neurological Status After Treatments	Current Disability
59/F	Renal cell carcinoma	T6	50	9	Corticosteroids, antiplatelet, hyperbaric oxygen	Stable	Walker-dependent ambulation
55/F	Breast cancer	T5	40	6	Corticosteroids, antiplatelet, hyperbaric oxygen	Progressive	Progression to T4 paraplegia
71/F	Lung cancer	T8–12	36	16	Corticosteroids	Progressive	Paralysis of the lower part of the body
69/F	Breast cancer	T4–7	45	28	Corticosteroids, antiplatelet, heparin, warfarin	Stable	Walker-dependent ambulation
Current case	Renal cell carcinoma	T7–9	39	22	Corticosteroids, heparin, hyperbaric oxygen	Progressive	Paralysis of the lower part of the body

Despite these treatments, paralysis in both legs occurred (MMT score 0/40), and 10 months later, the paralysis was complete. However, she achieved stable disease of the cancer with tyrosine kinase inhibitor therapy.

## Discussion

For the diagnosis of DRM, comprehensive examination is essential. MRI is believed to be the most helpful since in T1-weighted images, vertebral bodies are enhanced, reflecting fatty degeneration of bone marrow in accordance with irradiation field. On the other hand, the spinal cord is enhanced in MRI T2-weighted images. These

findings are not particularly specific for DRM, but they are useful as an adjunct to the diagnosis. In addition, definitive diagnosis of DRM is based on exclusion criteria: history of malignancy treated with radiation; incorporation of the spinal cord in the radiation field; clinical level of the cord lesion coincident with the radiated segment of the cord; and exclusion of intramedullary neoplasm via diagnostic studies and clinical course.<sup>2</sup> In this case, we made a final diagnosis of DRM in accordance with the clinical course, imaging findings, and exclusion criteria.

Corticosteroids are administered commonly as treatment for DRM, although no definitive conclusions have been made with regard to their efficacy which is very limited. About half of

corticosteroid-treated DRM cases showed improvement, which may be due to reduction of edema and inflammation in the spinal cord. But in the other cases, paralysis often occurred about 2–6 months following treatment. Some reports showed that anticoagulant therapy such as warfarin or heparin was effective for DRM, but the efficacy was also partial. In this case, corticosteroid was given twice; the first treatment, improved neurological symptoms, but the second one did not elicit any response. Further, recent reports suggested that hyperbaric oxygen could be used as an adjunct treatment for suspected cases of DRM. Hyperbaric oxygen should begin shortly after the onset of neurologic disturbances in order to allow critical evaluation of its effectiveness.<sup>3</sup> In our case, despite treatments with corticosteroid, heparin, and hyperbaric oxygen, complete paralysis in both legs occurred in 3 months. Thus, hyperbaric oxygen should have been administered immediately after the diagnosis. Further investigation is needed.

DRM following RT for metastasis to the thoracic vertebrae is very rare. To our knowledge, only four cases have been reported (Table 1).<sup>4,5</sup> Radiation tolerance of the thoracic spinal cord is reported to be 50 Gy, and all four cases received lower dose, thus, attention should be paid even in low dose palliative RT. All cases including our own were administered various treatments (corticosteroids, antiplatelet agents, heparin, warfarin, hyperbaric oxygen), but none of them improved neurologic disturbance, and only two cases achieved stable diseases. DRM is an irreversible disease with a poor prognosis, therefore, prompt diagnosis and combination treatments are necessary to combat it.

## Conclusion

We experienced a case of DRM following palliative RT for metastatic RCC. RT is useful for metastasis to the spine vertebra, but severe complications such as DRM may occur even if the RT dose is low.

## Conflicts of interest

There are no potential conflicts of interest.

## Acknowledgments

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