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CASE REPORT

Successful Total *En Bloc* Spondylectomy of T7 Vertebra for Hepatocellular Carcinoma Metastasis After Living Donor Liver Transplantation

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Study Design. Case report.

Objective. We report a patient who was successfully treated with total *en bloc* spondylectomy (TES) for T7 metastasis after living donor liver transplantation for hepatocellular carcinoma (HCC).

Summary of Background Data. Spinal metastasis from HCC has a poor prognosis. There are only a few studies on surgical outcomes of spinal metastasis from HCC. Because of the high surgical morbidity and short life expectancy in patients with HCC with spinal metastasis, TES is not considered in these patients, although several studies have reported satisfactory results for TES for some types of metastatic spinal tumors. Liver transplantation (LT) is the curative treatment option for early HCC. However, the recurrence of HCC is a possible problem after LT, although no reports on surgery for spinal metastasis following LT for HCC have been published. We report on the first case of a patient who was successfully treated with TES for T7 metastasis after living donor LT for HCC.

Methods. The patient was a 65-year-old man, who had undergone living donor LT for HCC 2 years before. His main symptom was progressive gait disturbance because of the spinal cord compression by the tumor at T7. Radiology and pathology examinations revealed a solitary metastasis at T7 with neither recurrence in the liver nor metastasis in the other organs. We performed TES using a pedicle screw system and a mesh cage filled with frozen autografts.

Results. After surgery, the patient showed clear improvement in neurological symptoms. At 3 months after surgery, a T4 metastasis was detected with magnetic resonance imaging, and the patient was treated with heavy ion radiotherapy. He could walk without a cane and there was no evidence of recurrence at 1.5 years after surgery.

Conclusions. Solitary spinal metastasis of HCC may become an indication for TES if liver function improves after LT.

Key words: hepatocellular carcinoma (HCC), total *en bloc* spondylectomy (TES), spondylectomy, spinal metastasis, liver, transplantation, thoracic, spine, instrumentation.

Level of Evidence: 5

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Hepatocellular carcinoma (HCC) can frequently metastasize to the lung (in 34%–70% of patients) and to the lymph nodes (in 16%–45%), whereas bone metastasis has been reported in 3% to 20% of patients with HCC. The spine is the most frequent site of bone metastasis, and spinal involvement is associated with a poor prognosis.[1,2] Therefore, it is thought that total *en bloc* spondylectomy (TES), a radical surgery for spinal metastasis, is not indicated for spinal involvement from HCC.

Liver transplantation (LT) is the curative treatment option for early HCC, although the recurrence rate is estimated as 15% to 20%.[3,4] There are no reports of spinal surgery for spinal metastasis following LT for HCC. We report on the first case of a patient who was successfully treated with TES for T7 metastasis after living donor LT for HCC.

CASE REPORT

A 65-year-old man, who had undergone living donor LT for HCC 3 years before, presented with a 2-month history of back pain. He had experienced rapid progression of paralysis of the lower extremities and was unable to walk. Muscle strength in the lower extremities was weak (grade 3/5 muscle strength), and he had a sensory loss bilaterally below the inguinal region. Magnetic resonance (MR) imaging showed a solitary tumor with homogeneous low-signal intensity on both T1- and T2-weighted images at the T7 vertebra and lamina that was

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severely compressing the spinal cord (Figure 1). Computed tomography (CT) images showed low-density areas at the T7 vertebra and lamina with pathological fractures. The patient displayed extremely high levels (13,300 mAU/mL) of protein induced by vitamin K absence or antagonist-II (PIVKA-II), a tumor marker for HCC (normal range: <40 mAU/mL). Positron emission tomography showed neither recurrence in the liver nor metastasis in the other organs. CT-guided needle biopsy of the T7 vertebra revealed a metastasis of HCC. He underwent radiation therapy, but the paralysis in the lower legs deteriorated further. The Tomita score and the modified Tokuhashi score to assess metastatic spine tumor prognosis were 5 and 10 points, respectively.[5,6]

The patient underwent TES through a single posterior approach. Briefly, after *en bloc* laminectomy of T7, pedicle screws were inserted into the T5, T6, T8, and T9 vertebrae bilaterally, and titanium alloy rods were placed. After *en bloc* corpectomy, anterior reconstruction was performed with a titanium mesh cage filled with frozen autografts (Figure 2A). The operation time was 5 hours and 10 minutes, and intraoperative blood loss was 250 mL. The PIVKA- II level decreased markedly to 26 mAU/mL 1 month after surgery. However, the PIVKA- II level increased to 469 mAU/mL 3 months after surgery, and MR imaging showed metastasis at T4 vertebra (Figure 2B). He underwent heavy ion radiotherapy as he desired. The PIVKA-II decreased to 34 mAU/mL. The intensity in T2-weighted MR images of the metastatic lesion in T4 vertebra changed to high intensity, and no other new lesions were detected (Figure 3). CT showed osteosclerotic changes around the metastatic lesion in T4. He could walk without a cane, and there was no evidence of recurrence 1.5 years after surgery.

DISCUSSION

The treatment options for spinal metastasis are radiotherapy and surgery, and surgery may be a better option in cases of neurological deterioration caused by spinal metastasis.[7] Wu *et al* reported that surgery greatly improved and maintained the quality of life (QOL) of patients with spinal metastasis during the 9 months after surgery.[8] However, there is controversy about whether surgery should be performed on a HCC patient with spinal metastasis. The prognosis of patients with HCC with spinal metastasis is poor, and the median survival time has been reported as 3 to 6 months.[9,10] Zheng *et al* reported that spinal surgery did not provide benefits for patients with HCC with spinal metastasis in terms of QOL or survival.[11] Because of the high surgical morbidity and limited life expectancy of patients with HCC with spinal metastases, the surgeon may be reluctant to perform surgery. There are only a few reports on surgery for patients with HCC with spinal metastases. Kim *et al* reported on the long-term surgical outcome of a case series of 33 patients with spinal HCC metastasis.[12] In that study, it was reported that patients survived for 203 ± 31 days after the operation and that hepatic function correlated significantly with survival time. Zhang *et al* analyzed the factors that affected the outcome of 36 patients with HCC spinal metastasis and found that a Tomita score no more than 7 was a favorable prognostic factor for HCC spinal metastasis.[13]

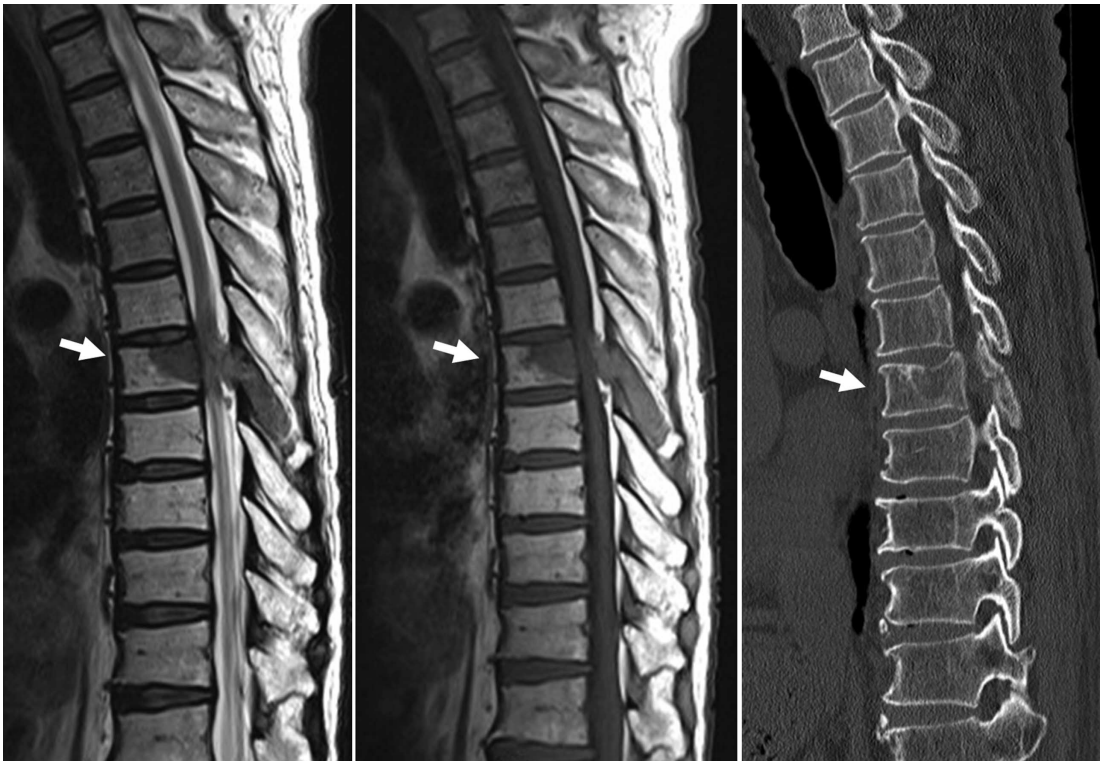

Figure 1. Preoperative radiographic images. Sagittal views of the T1-weighted (left) and T2-weighted (middle) magnetic resonance images and computed tomography image (right). Arrows indicate the T7 metastasis.

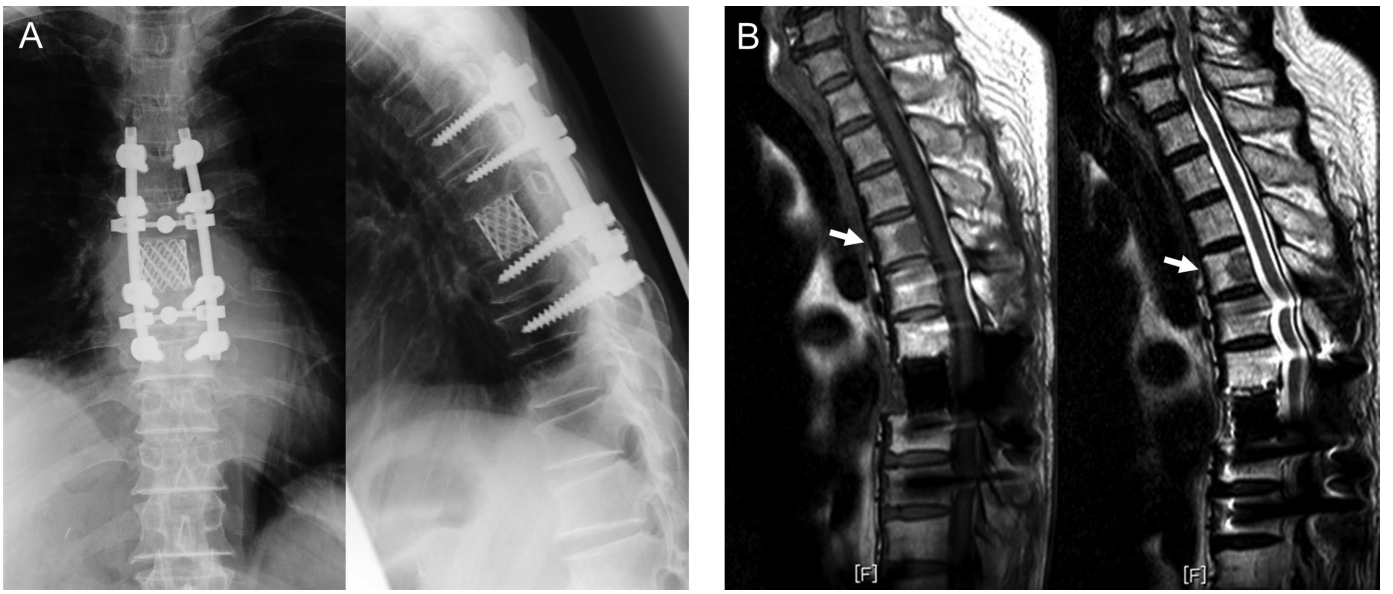

Figure 2. (A) Anteroposterior view (left) and lateral view (right) of radiographs 2 wk after total *en bloc* spondylectomy for T7 metastasis. **(B)** Sagittal views of the T1-weighted (left) and T2-weighted (right) magnetic resonance images at 3 mo after surgery. Arrows indicate the newly developed metastasis at T4.

Several studies have reported that TES for spinal metastasis has a survival benefit in selected patients.[14–17] We have performed TES in selected patients with a solitary spinal metastasis, based on the surgical strategy for spinal metastasis established by Tomita *et al*.[5] In patients with a Tomita score of 2, 3, or 4, TES is indicated for long-term control. In this case, the Tomita prognostic score was 5 points, indicating that the goal of surgery was mid-term to short-term palliation rather than cure.[5] In the modified Tokuhashi score, a total score of 10 points means that 73% of patients live more than 6 months and 30% of patients live more than 1 year.[6] However, this patient had good liver function without tumor recurrence in the liver after LT and no metastases except the solitary spinal metastasis. Therefore, we performed TES, and expected

Figure 3. Radiographic images after 1 yr and 3 mo after surgery. Sagittal views of the T1-weighted (left) and T2-weithted (middle) magnetic resonance images and computed tomography image (right).

long-term survival. The patient is now in a good condition with no evidence of recurrence and was satisfied with the treatment at the 1.5-year follow-up.

Several studies have reported that, after the lung, bone is the next most common site of extrahepatic tumor metastases (in 18%–33% of patients) in patients with HCC recurrence after LT.[18–20] To our knowledge, only one study has reported on the clinical features and prognostic factors of 30 patients with bone metastases from HCC after LT.[21] In that study, He *et al* reported that metastases frequently occurred in the thorax (43.4%) including the thoracic vertebrae (15.1%), pelvis (24.5%), and lumbar spine (9.4%). The median survival time after bone metastasis was 8.6 months, and the most common cause of death was liver failure due to hepatic decompensation or tumor progression.

No reports have been published on the treatment of spinal metastasis of HCC with TES after LT for HCC. We consider that a healthy liver after LT enables a successful treatment, as Kim *et al* described. The case study presented here suggests that solitary spinal metastasis of HCC without metastases in other organs may become an indication for TES if HCC is treated with LT and liver function improves.

➢ Key Points

- ❑ We reported on the first case of patient who was successfully treated with total *en bloc* spondylectomy for T7 metastasis after living donor liver transplantation for hepatocellular carcinoma.
- ❑ Considering that the prognosis of patients with HCC with spinal metastasis is poor, a healthy liver after liver transplantation may enable a successful treatment.
- ❑ Solitary spinal metastasis of hepatocellular carcinoma may become an indication for total *en bloc* spondylectomy if liver function is improved after liver transplantation.

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