Incidence of Postoperative Neurological Deficit and Recovery of Neurological Outcome and Ambulation Status After Total en Bloc Spondylectomy for Spinal Tumors

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INTRODUCTION:
Total en bloc spondylectomy (TES) is indicated in patients with spinal tumors. Reportedly, the surgery achieved favorable local control if the metastases are solitary and localized with longer life expectancy. However, TES is an extensive surgical procedure, therefore perioperative systemic complications may result in additional symptoms and deterioration in activities of daily living. Furthermore, the detailed recovery has not been investigated after TES. This study aimed to examine the incidence of postoperative neurological dysfunction and evaluate the recovery of neurological outcomes and walking ability after TES.
METHODS:
We analyzed data of 140 patients who underwent TES for primary and metastatic spine tumor between 2010 and 2017, and identified 71 patients whom neurological symptoms could be followed up to 6 months postoperatively. The study population included 45 men and 26 women (mean age 55 years at the time of surgery). Of the 71 patients, 13 had primary malignant tumors, 14 patients with aggressive benign tumors and 42 had metastatic tumors. TES was performed on the thoracic and lumbar spine in 49 and 22 patients, respectively. Ambulation status was recorded and neurological functions was evaluated using the modified Frankel grade (Figure) preoperatively, and 1 week, 1 month, 3 months, and 6 months postoperatively. We recorded the rate of postoperative neurological changes in at least one modified Frankel grade. Ambulatory status was defined as the ability to walk with a cane or walker. The Mann-Whitney U and chi-square tests were used for intergroup comparisons.

RESULTS:
Preoperatively, 40 patients showed neurologically normal modified Frankel grade E. Preoperative neurological deficits were observed in 31 patients (modified Frankel grade A in 1, B in 2, C in 9, D1 in 2, D2 in 4, and D3 in 13). The ambulatory rate was 100% and 55% in patients without and with preoperative neurological deficits, respectively ($p<0.01$). Postoperative neurological deficits were observed in 26 patients (37%) (modified Frankel grade A in 3, B in 1, C in 10, D1 in 17, D2 in 7, D3 in 7, and E in 27). The incidence of neurological deficits was significantly higher in patients who underwent lumbar TES (18/22 patients, 82%) than those who underwent thoracic TES (9/49 patients, 21%) ($p<0.01$).Among patients with preoperative neurological deficits, improvement in the modified Frankel grade was observed in 6 patients (19%) at 1 week, in 14 patients (45%) at 1 month, in 11 patients (36%) at 3 months, and in 8 patients (26%) at 6 months postoperatively. The ambulatory rate was 10 patients (32%) at 1 week, 19 patients (61%) at 1 months, 21 patients (68%) at 3 months, and 24 patients (77%) at 6 months after TES. Among 13 patients with preoperative modified Frankel E, who developed neurological deficits postoperatively, improvement in the modified Frankel grade was observed in 11 patients (79%) at 1 month, in 6 patients (43%) at 3 months, and in no patients (0%) at 6 months postoperatively. The ambulatory rate was 4 patients (29%) at 1 week, 13 patients (93%) at 1 months, 14 patients (100%) at 3 months, and 14 patients (100%) at 6 months postoperatively.
DISCUSSION AND CONCLUSION:
Post-TES neurological deficits were observed in 37% of the patients included in this study. The incidence of neurological dysfunctions was higher in patients who underwent lumbar TES than in those who underwent thoracic TES. Lumbar spine TES usually necessitates extensive nerve root dissection with frequent retraction and is therefore shown to be associated with high complication rates. Notably, 90% of patients with postoperative neurological deficits were able to walk one month postoperatively. Furthermore, patients with preoperative neurological deficits showed improvement in neurological function and walking ability until 6 months postoperatively. These results suggest that neurological function and walking ability continued to improve over a prolonged period after TES. Although TES is associated with a potential risk of neurological complications, the results of this study indicated that surgery is an appropriate approach and indicated patients with a favorable prognosis.

Modified Frankel grading scale

Grade	Neurological status
A	Complete motor and sensory loss
B	Preserved sensation only, voluntary motor function absent
C	Preserved motor loss than fair grade (nonfunctional for any useful purpose)
D1	Preserved motor at lowest functional grade (3+/5+) and/or with bowel or bladder dysfunction
D2	Preserved motor at mid functional grade (3+ to 4+/5+) and/or neurologic bowel or bladder function
D3	Preserved motor at high-function grade (4+ to 5+) and normal voluntary bowel or bladder function
E	Complete motor and sensory function normal (may still have abnormal reflexes)