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Case Report

Thoracic dumbbell spinal metastasis secondary to neuroendocrine tumor of unknown origin: Case report and literature review

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ABSTRACT

Background: Dumbbell tumors are typically benign schwannomas, neurofibromas, and meningiomas and only rarely there are malignant variants of these lesions or other malignant histotypes. Here, a 34-year-old male presented with a thoracic spinal dumbbell metastatic neuroendocrine carcinoma of unknown primary origin.

Case Description: A 34-year-old male presented with 2 months of thoracic pain and progressive mid thoracic sensory loss. A post contrast thoracic MRI showed a dumbbell tumor localized between the T7 and T9 levels with extension laterally into the T7-T8 and T8-T9 foramina. The patient underwent a laminectomy for tumor resection following which his pain and gait improved. Histopathologically, the tumor demonstrated multiple rounded small cells with a Ki67 level around 30%, suggesting a malignant metastatic neuroendocrine tumor of unknown etiology.

Conclusion: We successfully treated a 34-year-old male with a T7-T9 malignant spinal dumbbell neuroendocrine tumor of unknown etiology utilizing a decompressive laminectomy.

Keywords: Dumbbell, Metastasis, Spine, Tumor

INTRODUCTION

Dumbbell tumors are typically benign schwannomas, neurofibromas, and meningiomas, with occasional malignant variants. Few dumbbell tumors are metastatic neuroendocrine lesions of unknown etiology.[1,3,5,9] Neuroendocrine tumors are epithelial neoplasms originating mainly from the gastrointestinal or bronchopulmonary tracts; they frequently metastasize to lymph nodes, liver, lungs, and bone.[2,5] Here, a 34-year-old male presented with a T7-T9 metastatic neuroendocrine spinal dumbbell tumor of unknown primary origin that was successfully decompressed utilizing a laminectomy.

CASE DESCRIPTION

Clinical and radiographic presentation

A 34-year-old male presented 2 months of mid thoracic pain, gait impairment/ataxia, and hypoesthesia from T11 downward. A post contrast thoracic MRI showed a dumbbell tumor between the T7 and T9 (i.e., maximal width T8) levels contributing to severe spinal cord compression [Figures 1a-d]. This lesion was hypointense on T1/T2-weighted images [Figure 1c], hyperintense on STIR sequences [Figure 1d], and intensely enhanced with contrast [Figures 1a and b]. The whole-body PET-CT-scan revealed multiple diffuse osteoblastic lesions, and the high level of a radioactive tracer involving the $8^{th}/9^{th}$ ribs bilaterally, sternum, pelvis, and C6-C7 and T3 pedicles.

Tumor markers

Blood tumor markers, that included beta-2-microglobulin, alpha-fetoprotein, carcinoembryonic antigen, and human chorionic gonadotropin-beta, were negative. Alternatively, serum neuron-specific enolase levels were high (48.4 µg/L; normal range: 0–16.3 µg/L) consistent with a neuroendocrine tumor origin.

Surgery

The patient underwent a T8 total/partial T7-T9 laminectomies to decompress the spinal cord. The tumor was hyper vascularized and there were significant adhesions between the tumor and the dura mater. Ultimately, a partial resection of the extradural lesion was accomplished. Postoperatively, the patient's gait disturbance and dorsal pain were improved. The 1-week postoperative thoracolumbar MRI documented complete removal of the extradural tumor [Figures 2a and b].

Histology

The histopathological examinations showed multiple round-small cells whose Ki67 level was about 30%, compatible with a neuroendocrine tumor of unknown etiology. Immunostaining showed a positive check for chromogranin and synaptophysin [Figures 3a and b] [Table 1]. The combination of studies allowed for documentation of a well-differentiated neuroendocrine neoplasm (i.e., NEN sec WHO 2019) [Figure 4].

Postoperative course

The patient has started a chemotherapy (i.e., etoposide and cisplatin). After 10 months, his gait ataxia and lower limbs hyposthenia improved. At that point, he underwent a 68 Gallium-DOTATOC positron emission tomography/computed tomography (PET/CT) that demonstrated stable disease.

DISCUSSION

Tumor presentation

According to the Dumbbell Scoring System, the neuroendocrine tumor presented in this case should be classified as a Grade 5 (size >5 cm, boundary indistinguishable, irregularly lobulated shape, and no osteolytic bone destruction) alternatively, it would belong to Grade 6 of the Eden classification (i.e. due to the multidirectional erosion of the bone).[4-6] The young age

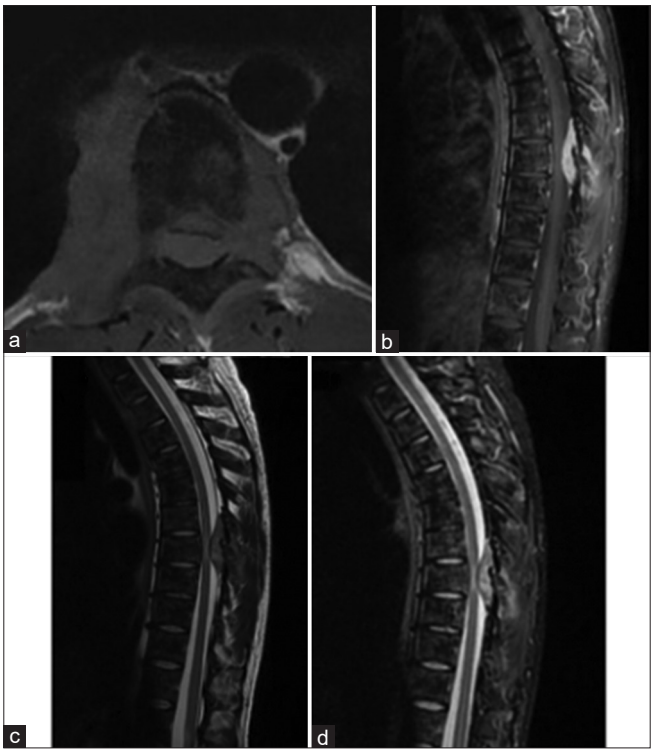

Figure 1: Preoperative axial (a) and sagittal (b) thoracic spine MRI sequences showed a T7-T9 intradural extramedullary dumbbell-shaped lesion with intense post contrastographic enhancement. Also, this lesion appears hypointense on T2-weighted images (c) and hyperintense on STIR sequences (d).

Table 1: Immunostaining showed a positive check for chromogranin, synaptophysin, CD56, and PanCK. TTF1, Calcitonin, CDX2, and PSA were found negative, excluding a metastatic tumor from a pulmonary, thyroid, colic, or prostatic primary site.

Immunostaining	
Chromogranin	+
CD56	+
Synaptophysin	+
PanCK	+
TTF1	−
Calcitonin	−
CDX2	−
PSA	−

of our patient, 34, led to the first diagnostic suspicion of a lymphoproliferative lesion (i.e., lymphoma), but this was ruled out when the whole-body PET CT scan documented multiple bone metastatic lesions.[6-8]

Cases of metastatic neuroendocrine dumbbell spine tumors

We found only two cases of comparable metastatic neuroendocrine dumbbell tumors of unknown origin in the literature.[4,8] Mori *et al*. reported a 51-year-old female with the sudden onset of paraplegia due to a dumbbell-shaped metastatic extradural lesion at the T10 and T11 levels accompanied by multiple vertebral metastases from a rectal NET.[4] After total tumor excision, the patient recovered and remained free from disease up to 18 months postoperatively. Saway *et al*. had a 75-year-old male with metastatic Stage 4 pNET, who presented with a cervical intradural-extramedullary metastasis at the C1-C2 level; it was effectively treated with a laminectomy and intradural tumor resection [Table 2].[8]

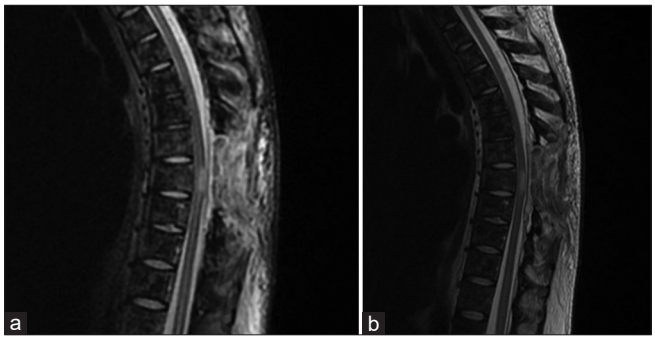

Figure 2: Postoperative sagittal thoracic spine MRI sequences showed a complete endospecal removal of the lesion images on STIR (a) and T2 sequences (b).

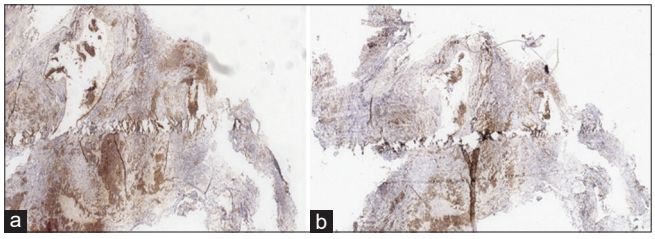

Figure 3: Immunostaining showed the two most specific and sensitive markers capable of defining the neuroendocrine nature of the neoplasm: Synaptophysin: diffuse and intense cytoplasmic positivity in about 90% of neoplastic cells. (a) Chromogranin-A: granular cytoplasmic positivity (dot-like) in about 90% of neoplastic cells (b).

Markers used to identify of the etiology of neuroendocrine tumors

Neuroendocrine tumors of unknown etiology compromise approximately 10% of all NETs. As they are predominantly undifferentiated, their biological behavior is very aggressive.[1] Urinary 5-hidroxy-indolic acetic can represent a valuable marker in establishing the NET diagnosis.[5] Certainly, the histopathological diagnosis is critical to further define and direct the treatment for Unknown Primary Cancer. Nevertheless, NET metastases carry a very poor prognoses, with 5-year survival rates ranging between 19% and 38%. In our case, the prognosis was supposed to be even

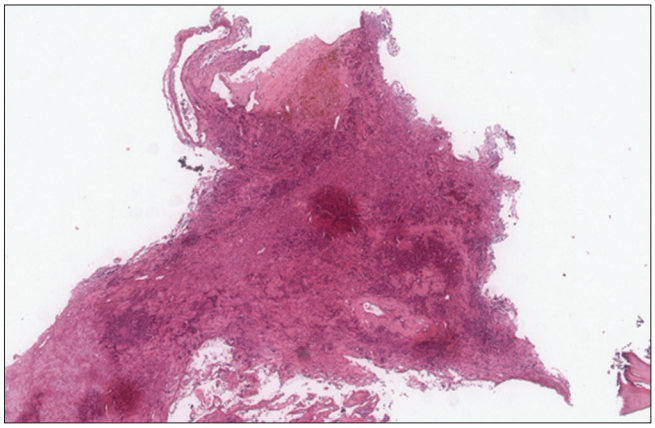

Figure 4: Hematoxylin and eosin stain image showed nuclear atypia, with diffuse "salt and pepper" chromatin.

Table 2: Literature review regarding dumbbell-shaped tumors.

Authors and year	Number of Patients	Age	Sex	Neurological Symptoms	Surgical Treatment	Tumor Location	Chemotherapy/ Radiotherapy	Outcome/ Follow-up
Mori *et al*., 2015	1	51	F	Paraplegia	T10-T11 laminectomy	T10-T11	Unknown	Remission at 1.5 years
Saway *et al*., 2020	1	75	M	None	Partial C1–C2 laminectomy with intradural resection	C1-C2	Unknown	Not specified
Our case, 2021	1	34	M	Sensory ataxia	T8 laminectomy, partial tumor resection	T7-T8-T9	Etoposide and cisplatin	Stable disease (under treatment)

poorer (about 11 months) due to the unknown primary.[9] In other rare cases, aggressive recurrences may respond to chemotherapy/radiotherapy protocols as well as surgical intervention.

CONCLUSION

Here, we diagnosed a thoracic T7-T9 malignant metastatic spinal dumbbell neuroendocrine metastatic tumor of unknown origin in a 34-year-old male that was successfully treated with a laminectomy followed by chemotherapy.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Alexandraki K, Angelousi A, Boutzios G, Kyriakopoulos G, Rontogianni D, Kaltsas G. Management of neuroendocrine tumors of unknown primary. Rev Endocr Metab Disord 2017;18:423-43.
2. Kaliya-Perumal AK, Tan M, Tee SW, Achudan S, Yap WM, Oh JY. Early post-surgical recurrence of metastatic vertebral neuro-endocrine tumour treated effectively with chemo-radiotherapy. Biomedicine (Taipei) 2019;9:5.
3. Matsumoto Y, Harimaya K, Kawaguchi K, Hayashida M, Okada S, Doi T, *et al*. Dumbbell scoring system: A new method for the differential diagnosis of malignant and benign spinal dumbbell tumors. Spine (Phila Pa 1976) 2016;41:E1230-6.
4. Mori K, Nishizawa K, Nakamura A, Ishida M, Imai S. Sudden paraplegia because of dumbbell-shaped metastatic neuroendocrine tumor (carcinoid tumor). Spine J 2015;15:e1-3.
5. Oronsky B, Ma PC, Morgensztern D, Carter CA. Nothing but NET: A review of neuroendocrine tumors and carcinomas. Neoplasia 2017;19:991-1002.
6. Ozawa H, Kokubun S, Aizawa T, Hoshikawa T, Kawahara C. Spinal dumbbell tumors: An analysis of a series of 118 cases. J Neurosurg Spine 2007;7:587-93.
7. Riihimäki M, Hemminki A, Sundquist K, Sundquist J, Hemminki K. The epidemiology of metastases in neuroendocrine tumors. Int J Cancer 2016;139:2679-86.
8. Saway BF, Fayed I, Dowlati E, Derakhshandeh R, Sandhu FA. Initial report of an intradural extramedullary metastasis of a pancreatic neuroendocrine tumor to the cervical spine: A case report and review of the literature. World Neurosurg 2020;139:355-60.
9. Scott S, Antwi-Yeboah Y, Bucur S. Metastatic carcinoid tumour with spinal cord compression. J Surg Case Rep 2012;2012:5.

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