A Malignant Transformation of a Spinal Epidural Mass from Ganglioneuroblastoma to Neuroblastoma

Mehmet Osman Akcakaya, M.D.,¹ Bilge Bilgic, M.D.,² Yavuz Aras, M.D.,¹ Nail İzgi, M.D.¹
Departments of Neurosurgery,¹ Pathology,² School of Medicine, Istanbul University, Istanbul, Turkey

Ganglioneuromas are benign tumors. Surgical excision is the treatment of choice with very good prognosis. However, neuroblastomatous malignant transformation of ganglioneuromas was previously reported. We report a patient with spinal neuroblastoma recurrent from a ganglioneuroblastoma after disease free survival of 13 years. This is one of the rare examples of spinal neuroblastoma and to our knowledge the second case report with malignant transformation from a ganglioneuroblastoma or a ganglioneuroma. The present case is the only report in the literature with further genetic investigations.

Key Words: Ganglioneuroblastoma · Neuroblastoma · Malignant transformation · Spinal tumor.

INTRODUCTION

Neuroblastic tumors present a wide spectrum of tumors, including the benign ganglioneuroma, intermediate ganglioneuroblastoma and undifferentiated neuroblastoma (NB). Ganglioneuromas are benign tumors, which usually arise from the thoracic cavity as mediastinal tumors or abdominal cavity as retroperitoneal mass lesions. Ganglioneuroblastomas are tumors with decreased differentiation, which consist of a ganglioneuromatous stroma and a neuroblastomatous component. NB is a common malignant tumor in pediatric age group, on contrary to that it is a rare entity in adults. NB represents 8–10% of all childhood cancers. Spinal involvement is rare and spinal NB in adulthood is extremely rare. We report a case of spinal NB recurrent from a ganglioneuroblastoma after disease free survival of 13 years. To our knowledge, it is the second spinal case in the literature indicating such a malignant transformation and the only case with further genetic investigations.

CASE REPORT

A 22-year-old male patient admitted with abdominal pain to the general surgery department. His physical examination was normal. An abdominal computed tomography scan was obtained and a retroperitoneal mass lesion with spinal involvement was observed. The patient was then referred to neurosurgery department. His neurological examination revealed no abnormalities. Magnetic resonance imaging (MRI) of the thoracolumbar spine showed a retroperitoneal mass lesion at T12–L3 level, extending from the left paraspinous region into the spinal canal. Using a combined lateral and posterior approach, T12–L3 laminectomy

Fig. 1. On T2-weighted, axial MR image of the mass lesion with heterogeneous signal intensity is detected in the left D11–12 neural foramen (arrow). There is also some enlargement and remodeling of the foramen.
and left L1-2 facetectomy was performed. The tumor was near
totally removed with only a small retroperitoneal remnant,
which could not be reached with the current approach. Patho-
logical diagnosis was ganglioneuroma. Postoperative course
was uneventful. The patient was discharged from the hospital
with no neurological deficits.

After four years with stable disease, the patient presented
with the same complaints. His neurological examination was
normal. MRI revealed a T11–L3 left paraspinal mass growing
towards T11–12 neural foramen and spinal canal (Fig. 1). With
the same approach tumor was subtotally removed (except the
retroperitoneal extension) and spinal cord was decompressed.
Macroscopic examination revealed a grey coloured, lobulated,
soft tumor with a capsule and 8×7.5×5 cm in size. The cut sur-
face was yellow-white coloured and included hemorrhagic ar-
eas. Histopathological diagnosis was ganglioneuroblastoma.
While there was a inconsistency between the previous and cur-
rent biopsies, the patient's former biopsy material was reevalu-
atated. Histopathologically, most of the tumor consists of spindle
schwannian component and mature ganglion cells. In one sec-
tion of the first specimen, a cellular area of 1.5 mm diameter
has been observed. The cells in this section are round blastic in
appearance. In between these cells scattered mature ganglion
cells were also seen. To exclude a lymphocytic infiltration, im-
munohistochemical staining was performed. These small cells
were positive for CD56 and negative for LCA. The diagnosis of
the first tumor was changed and accepted as a ganglioneuro-
blastoma (Fig. 2). The patient was discharged from the hospital
with no neurological deficits. An anterior approach was planned
for the resection of the retroperitoneal rest tumor and oncologi-
cal treatment afterwards. However, the patient refused to have
further treatment and lost to follow-up.

Nine years after the second operation, the patient admitted
with progressive paraparesis, urinary retention and hypoesthesia.
MRI revealed a right foraminal T10 extradural mass (Fig. 3).
With posterior approach and T10 right hemilaminectomy the
extradural part of soft, white-brown coloured tumor tissue with
in the spinal canal was removed. Neuropathological analysis
showed a round cell malignant tumor without mature compo-
nent. The tumor cells showed positive immunoreactivity for
CD56, synaptophysin and negative immunoreactivity for desmin
(Fig. 4). The histopathological diagnosis was NB. A genetic anal-
ysis was obtained. Interphase fluorescent in situ hybridisation
(FISH) analysis was used for the evaluation of n-myc (2p24) sta-
tus in the tumor cells with the use of “Cytocell n-myc amplifica-
tion FISH probe”. 1p and 11q deletions were assessed again with
the interphase FISH analysis. “Vysis 1p36/1q25 and 19q13/
19p13 FISH probe” and “Vysis 11q23 FISH probe” was used and
it was shown that the n-myc oncogene was not amplified
and there were no deletions of chromosome 1p and 11q for all of
the pathological samples.
DISCUSSION

Ganglioneuroma is a slow growing, benign tumor, which can be rarely associated with neurofibromatosis type I and multiple tumor syndromes like multiple endocrine neoplasia type II (MEN II). These tumors are fully differentiated tumors with mature ganglion cells and schwann cells. Spinal ganglioneuromas represent less than 10% of all ganglioneuromas, usually with the involvement of paraespinal region. Ganglioneuromas can remain asymptomatic for a long period and can be diagnosed incidentally. Surgical excision is the treatment of choice in the management of symptomatic ganglioneuromas with very good prognosis. Ganglioneuroblastoma is one of the neuroblastic tumors and like ganglioneuroma or NB, it is also derived from the primordial neural crest cells. It contains both spindle schwannian stroma with mature ganglion cells and undifferentiated neuroblastic cells.

NB is a tumor that primarily effects children. 89% of patients diagnosed with NB are under the age of 10 years. Spinal involvement of NB constitutes 20–30% of all pediatric primary extradural spinal tumors. Familial genetic predisposition and environmental causes are thought to be responsible for the etiology of NB, although mechanisms leading to the disease are not fully understood. NB is an unexpected pathological diagnosis in adults and spinal involvement of this tumor is extremely rare. There are limited number of cases with spinal NB in adults. NB has a relatively poor prognosis in adults.

The differentiation of NB into ganglioneuroblastoma or ganglieneuroma was first described by Cushing and Wolbach in 1927. Also the transformation from ganglioneuroma into malignant nerve sheath tumors was previously described. However, the malignant transformation of a ganglioneuroma or a ganglioneuroblastoma into NB was only described by Kulkarni et al. in 1998. In this particular report malignant transformation from a ganglioneuroma to a NB was occurred 11 years after the initial surgery. To our knowledge, it is the only report in the literature indicating such a condition.

The mechanism of the malignant transformation into NB is debatable. Kulkarni et al. proposed whether a malignant transformation of the remnant tumor or a neuroblastomatous component, which remained undiagnosed after the first operation. Considering the long survival period in both patients by Kulkarni et al. and the present report, namely 11 and 13 years, it is not possible to claim the latter proposal is realistic. However, with careful reevaluation of the former biopsy material, an undiagnosed cellular area with ganglioneuroblastomatous characteristics was found in our case. Four years after the first operation, it was observed that the whole tumor shared the pathological characteristics of this small ganglioblastomatous nodule. Although the biopsy of the first tumor in our case was in consistency with a ganglioneuroma, except this small nodule, it should be accepted as a ganglioneuroblastoma. After the second operation our patient was lost to follow-up, neither underwent surgery for the resection of the retroperitoneal rest tumor nor get any further oncological treatment. The total nine year survey after the second operation (a total of 13-year disease free survival until the neuroblastic transformation) despite a rest tumor and without any additional therapy is considerably long. Our case demonstrates that the biological behaviour of these tumors varies greatly and it might be more likely related to genetic factors rather than the histopathological characteristics.

Genetic inheritance of NB is also not fully understood. A polygenic inheritance is most probable. The limited number of familial cases limits the pursuit of genetic factors or familial inheritance in NB. Well known genetic abnormalities in NB are chromosome deletion of 1p, 11q, gain of 17q and amplification of the n-myc oncogene. Prior to the current report, there were no cytogenetic work-up has been done for the spinal NB. The specimens were tested for the amplification of the n-myc oncogene for the deletions of chromosome 1p and 11q. All these neurogenetic investigations were negative.

NB is known with its wide spectrum of clinical behavior. The prognosis might change in each particular case with regression, maturation, or progression of the tumors. The variety in clinical behavior was found to be associated with specific cytogenetic malformations. Histologic grade, age, tumor differentiation, the status of n-myc oncogene, 11q and DNA ploidy are associated with clinical outcome. Previously reports cases of adult spinal NB is related with a shorter survival, less than 2 years. However the present case and the case presented by Kulkarni et al. had similar survival of more than 10 years. This prolonged survival with stable disease may be related to better prognosis of spinal NB. For pediatric age group it is known that, spinal-paraspinal NB has a more favorable outcome with less frequent metastases. Two genetic abnormalities, which were known to be oncogenic factors in NB, namely n-myc amplification and 1p, 11q deletions, were not found in this case. The relation between prolonged survival of our case and lack of this genetic abnormalities is debatable, however our patient is still doing well with no neurological deficits or complaints two years after the third operation with no recurrence.

CONCLUSION

This report demonstrates that ganglioneuroblastomas or even ganglioneuromas can rarely dedifferentiate into NB with a quite long transformation process.

References
1. Abdou AG, Asaad NY, Elbasset A, Said H, Dawoud M : Adult pancreatic neuroblastoma, an unusual site and fatal outcome. Pathol Oncol Res 18 : 239-243, 2012
2. Allan SG, Cornbleet MA, Carmichael J, Arnott SJ, Smyth JF : Adult neuroblastoma. Report of three cases and review of the literature. Cancer 57 : 2419-2421, 1986
3. Banks E, Yum M, Brodhecker C, Goheen M : A malignant peripheral nerve sheath tumor in association with a paratesticular ganglioneuro-
rence of malignancy in a ganglioneuroma 19 years following radiation therapy to a neuroblastoma. J Surg Oncol 25 : 227-231, 1984
21. King D, Goodman J, Hawk T, Boles ET Jr, Sayers MP : Dumbbell neuroblastomas in children. Arch Surg 110 : 888-891, 1975
22. Kulkarni AV, Bilbao JM, Cusimano MD, Muller PJ : Malignant transformation of ganglioneuromas into spinal neuroblastoma in an adult. Case report. J Neurosurg 88 : 324-327, 1998
23. Kyoshima K, Sakai K, Kanaji M, Oikawa S, Kobayashi S, Sato A, et al. : Symmetric dumbbell ganglioneuromas of bilateral C2 and C3 roots with intradural extension associated with von Recklinghausen's disease : case report. Surg Neurol 61 : 468-473; discussion 473, 2004
24. Manor E, Kapelushnik J, Joshua BZ, Bodner L : Metastatic neuroblastoma of the mandible : a cytogenetic and molecular genetic study. Eur Arch Otorhinolaryngol 269 : 1967-1971, 2012
25. Marchevsky AM : Mediastinal tumors of peripheral nervous system origin. Semin Diagn Pathol 16 : 65-78, 1999
26. Maris JM, Hogarty MD, Bagatell R, Cohn SL : Neuroblastoma. Lancet 369 : 2106-2120, 2007
27. Mueller S, Matthay KK : Neuroblastoma : biology and staging. Curr Oncol Rep 11 : 431-438, 2009
28. Pang BC, Tchoysson Lim CC, Tan KK : Giant spinal ganglioneuroma. J Clin Neurosci 12 : 967-972, 2005
29. Punt J, Pritchard J, Pincott JR, Till K : Neuroblastoma : a review of 21 cases presenting with spinal cord compression. Cancer 45 : 3095-3101, 1980
30. Radin R, David CL, Goldfarb H, Francis IR : Adrenal and extra-adrenal retroperitoneal ganglioneuroma : imaging findings in 13 adults. Radiology 202 : 703-707, 1997
31. Ricci A Jr, Parham DM, Woodruff JM, Callihan T, Green A, Erlandson RA : Malignant peripheral nerve sheath tumors arising from ganglioneuromas. Am J Surg Pathol 8 : 19-29, 1984
32. Schwab M, Westermann F, Hero B, Berthold F : Neuroblastoma : biology and molecular and chromosomal pathology. Lancet Oncol 4 : 472-480, 2003
33. Shektita KM, Sobin LH : Ganglioneuromas of the gastrointestinal tract. Relation to Von Recklinghausen disease and other multiple tumor syndromes. Am J Surg Pathol 18 : 250-257, 1994
34. Tachdjian MO, Matson DD : Orthopaedic aspects of intraspinal tumors in infants and children. J Bone Joint Surg Am 47 : 223-248, 1965
35. Traggis DG, Filler RM, Druckman H, Jaffe N, Cassady JR : Prognosis for children with neuroblastoma presenting with paralysis. J Pediatr Surg 12 : 419-425, 1977
36. Ugarriza LF, Cabezudo JM, Ramirez JM, Lorenzana LM, Porras LF : Bilateral symmetric C1-C2 dumbbell ganglioneuromas producing severe spinal cord compression. Surg Neurol 55 : 228-231, 2001
37. Urios JI, Garcia-Larran LR, Rosell TV : Neuroblastoma in an adult causing spinal cord compression : report of a case and review of the literature. Paraplegia 27 : 394-401, 1989
38. Weiss SW, Goldblum JR : Ewing's sarcoma/PNET tumor family and related lesions in Weiss SW, Goldblum JR (eds) : Enzinger and Weiss's Soft Tissue Tumors, ed 5. Philadelphia : Mosby Elsevier, 2008, pp945-987