Interdisciplinary Neurosurgery: Advanced Techniques and Case Management 24 (2021) 101059

Contents lists available at ScienceDirect

Interdisciplinary Neurosurgery: Advanced Techniques and Case Management

journal homepage: www.elsevier.com/locate/inat

Case Reports & Case Series

# Metastatic osteosarcoma of craniovertebral junction with cervicalgia and torticollis an a pediatric patient

Valentina Baro [a,*], Elisa Garbin [a], Luca Sartori [a], Samuel L Caliri [a], Giulia M Furlanis [a], Luisa Santoro [c], Sandro Dal Pos [b], Andrea Landi [a], Luca Denaro [a]

[a] Academic Neurosurgery, Department of Neurosciences, University of Padova, via Giustiniani 5, 35100 Padova, Italy
[b] Neuroradiology Unit, Department of Neurosciences, University of Padova, Via Giustiniani 5, 35128, Padova, Italy
[c] Institute of Pathology, University Hospital of Padova, Padova, Italy

ARTICLE INFO

*Keywords*
Craniovertebral junction
Primary osteosarcoma
Pediatric
Torticollis

ABSTRACT

*Background:* Primary osteosarcoma of craniovertebral junction is extremely rare and reports in paediatric patients are limited. The symptoms are subtle and mostly underestimated.
Case presentation.
We present an unusual case of a 11-years old girl affected by an extensive and metastatic osteosarcoma of the atlas presented with cervicalgia and right torticollis refractory to medical treatment. The patient underwent open biopsy confirming the malignant histology.
*Conclusions:* Cervicalgia with or without a torticollis refractory to medical treatment, in absence of history of fell or trauma, is highly suspicious and should be considered as a warning sign for a severe pathology and it should not be neglected.

## 1. Introduction

Osteosarcoma is a malignant bone tumor that usually arises in the metaphyseal regions of the long bones, representing about 1% of all primary bony neoplasms. The involvement of the spine is uncommon, ranging between 0.85 and 4% of the reviewed cases in literature, carrying a worse prognosis. Moreover, cases of osteosarcoma affecting the craniovertebral junction (CVJ) are more infrequently reported (Table 1). In the first two decades of life, primary spine tumors are mostly benign (i.e. chordomas, fibrous dysplasia, aneurysmal bone cysts, eosinophilic granuloma, osteoblastoma, neurenteric cysts, meningioma and schwannoma) and the incidence of malignant lesions (i.e. osteosarcoma and Ewing's sarcoma) increases with age [1–4]. Due to the large subarachnoid space of the cervicomedullary junction, neurological findings may occur very late, when a significant size has been achieved. In fact, the most common symptom reported is neck pain usually associated with torticollis and refractory to medical treatment (70%) followed by upper extremities paresthesia and dysesthesia (40%); cranial nerves palsy was reported in 33% of patients with one-third complaining of dysphagia or dysarthria [1,2]. Since early diagnosis is very difficult, the treatment often is delayed and the patient's outcome can be improved with an aggressive multidisciplinary approach with advanced spinal surgery, chemotherapy and radiotherapy [2,5–10], especially in cases without metastasis. Reports of osteosarcoma in pediatric age are anecdotal in recent literature, accounting only 2 cases, one involving the corpus of C2 [5] and the other affecting the right lateral mass of the atlas [9] (Table 1). Herein we describe a case of a 11-years old girl affected by an extensive and metastatic osteosarcoma of the atlas presenting with cervicalgia and right torticollis refractory to medical treatment.

## 2. Case illustration

A 11 years-old girl was addressed to our Pediatric Emergency Department for a persistent cervicalgia and right torticollis refractory to physical and medical treatment (started 3-months prior admission). There was no history of fall or trauma. Ten days prior admission she noticed the onset of a right lateral mass, investigated with ultrasound revealing a latero-cervical adenomegaly. This finding was considered as a parotitis and she underwent antibiotic treatment. At clinical evaluation the girl presented a right-hand paresthesia, right C-1 nerve root neuralgia and a palpable hard mass on the right latero-cervical region. A CT scan revealed a 7x5x5 cm sized dense mass involving the right lateral

* Corresponding author at: Academic Neurosurgery, Department of Neurosciences, University of Padova Medical School, Via Giustiniani 2, 35128, Padova, Italy.
*E-mail address:* valentina.baro@unipd.it (V. Baro).

https://doi.org/10.1016/j.inat.2020.101059
Received 10 September 2020; Received in revised form 23 November 2020; Accepted 14 December 2020
Available online 20 December 2020

mass and both the anterior and posterior homolateral hemiarch of C-1, disrupting the bony architecture and extending to the posterolateral neck soft tissue with a stenosis of the foramen transversarium (Fig. 1A, B). The MRI showed that the lesion violated the spinal canal lightly deviating the spinal cord and encasing the vertebral artery. After contrast medium administration, it displayed a mild enhancement highlighting also a focal involvement of the contralateral anterior hemiarch (Fig. 1 C, D). Whole-body CT scan disclosed bilateral, multiple small lung metastasis. After multidisciplinary discussion, considering the probable malignant histology of the lesion, the extensive involvement of C1 (anterior and posterior right arch with also a focal alteration in the left anterior arch) and the lung metastasis, we decided to perform an open biopsy for histological and molecular analysis. Pathology confirmed the suspicion of osteoblastoma (Figs. 2, 3). Two weeks after surgery she started chemotherapy according to ISG/OS-2 protocol. She received 2 cycles of high dose of methotrexate (12 g/m$^2$), one cycle of Cisplatin (120 mg/m$^2$) and doxorubicin (60 mg/m$^2$), one cycle of cisplatin and ifosfamide (15 g/m$^2$/w) for 7 weeks of treatment. Due to clinical conditions and tumor progression, the planned radiotherapy was abandoned. The patient died 9 months after diagnosis.

## 3. Discussion

Management of patients with osteosarcoma of the cervical spine is challenging. There is no consensus about the optimal treatment because of the lack of clinical randomized prospective trials on this condition. This tumor is usually a malignant aggressive lesion that requires a multidisciplinary approach with surgery, chemotherapy and radiotherapy. However, the need for preoperative spinal immobilization and the role of adjuvant therapy are often clinical perplexities. The therapeutic goals in these patients are to totally remove the tumor, achieve spinal stability and preserve neurological function. Extent of resection of the mass is the most important prognostic factor because chemotherapy has only a limited function in the treatment [2,4]. The role of surgery in

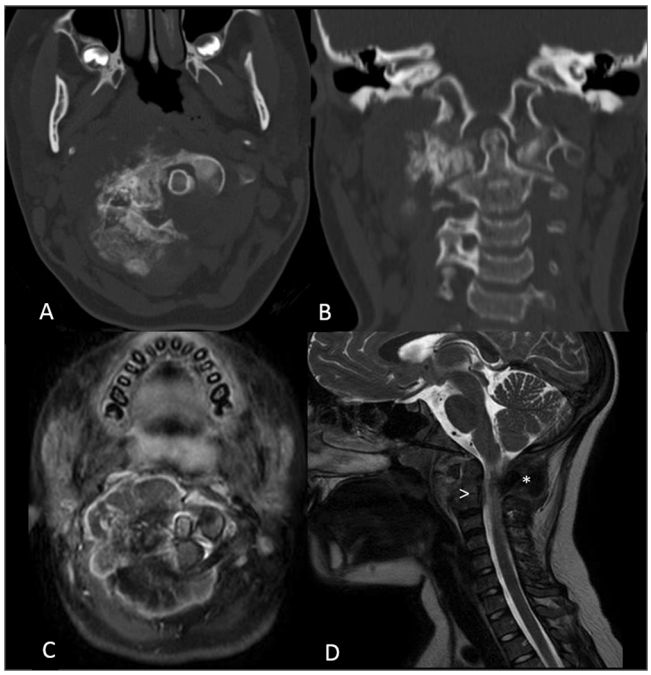


**Fig. 1.** Axial (A) and coronal (B) CT scan images disclose a dense, solid mass which subverts the bony architecture of the right C-1 hemiarch and extending to the homolateral posterolateral neck soft tissue. The mass determined a stenosis of the foramen transversarium. C) Axial MRI T1-weigthed image after contrast medium administration shows a mild enhancement of the lesion which invades the spinal canal, slightly deviating the spinal cord. D) A sagittal MRI T2 weighted image display the anterior (>) and posterior (*) extension of the lesion.

**Table 1**
Review of the literature.

| Author, year | N. pts | Age (y) | Sex | Location | Clinical presentation | Duration of symptoms | Treatment | Outcome | Length of FU |
|---|---|---|---|---|---|---|---|---|---|
| Sar et al, 2001 | 1 | 15 | M | Corpus of C2 | Neck pain, torticollis | 6 months | Transoral resection, cage placement and C1-C3 fusion; removal of lamina and pedicles by a posterior approach, C0-C4 fusion; postoperative CHTP and RTP | No neurologic deficits | 40 months |
| Denaro et al, 2005 | 1 | 39 | M | Right condyle and right C1 lateral mass. Lungs metastasis | Neck pain and progressive palsy of the lower right cranial nerves | 6 months | STR, C0-C2 posterior fusion; RTP + CHTP | Poor outcome follows by death | 2 months |
| Braccini et al, 2010 | 1 | 19 | F | Left C1 lateral mass with anterior arch disruption | Neck pain irradiating to the left shoulder, weight loss, fatigue | NR | STR, C0-C3 posterior fusion, postoperative CHTP, Cyberknife | No neurologic deficits | 29 months |
| Mavrogenis et al, 2012 | 3 | NR | NR | C1 in two cases, C2 in one case | Neck pain, palpable mass | NR | Biopsy; postoperative CHTP | NR | NR |
| Chung et al, 2012 | 1 | 48 | M | Right C1 lateral mass with anterior and posterior homolateral arches involvement | Palpable painful mass on the right posterior neck | 10 months | Preoperative CHTP; V3 and distal V2 segment of the VA coil embolisation. GTR + reconstruction with C0-C2 lateral cage on the right side and C0-C3 posterior fusion; postoperative CHTP. | Return to normal life in 6 months after surgery | 48 months |
| Feng et al, 2013 | 1 | 22 | F | Left C1 lateral mass | NR | NR | Preoperative CHTP, STR (fusion NR), postoperative CHT | No neurologic deficits | 44 months |
| Clarke et al, 2016 | 1 | 8 | F | Right C1 lateral mass and pathological fracture | Neck pain appeared after a fall | NR | Preoperative CHRP; GTR (posterior and transoral approach) + C0-C4 fusion; postoperative CHTP | No neurologic deficits | 14 months |
| Our case | 1 | 11 | F | Right anterior and posterior right-sided C1 arches. Lungs metastasis | Neck pain and torticollis. Right-hand paresthesia and right C-1 nerve root neuralgia. Palpable mass | 3 months | Biopsy; postoperative CHTP | Poor outcome follows by death | 9 months |

CHTP: chemotherapy; GRS: gross total resection; NR: not reported; RTP: radiotherapy; STR: subtotal resection; VA: vertebral artery.

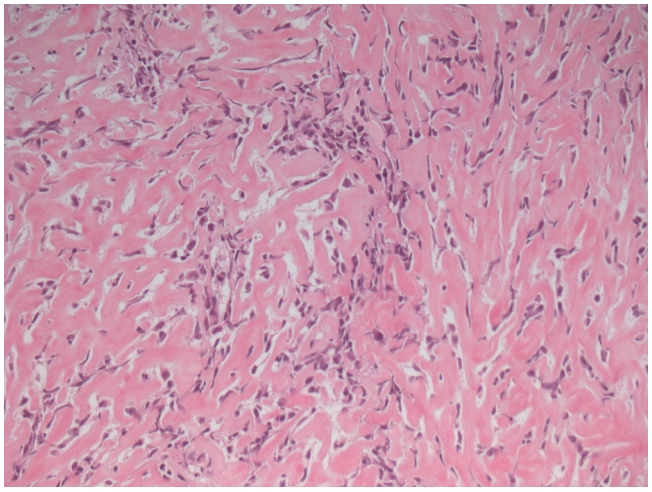

**Fig. 2.** H & E–stained photomicrograph: The neoplasm is characterized by a proliferation of malignant cells with high nuclear to cytoplasmic ratio in a background of abundant deposition of osteoid.

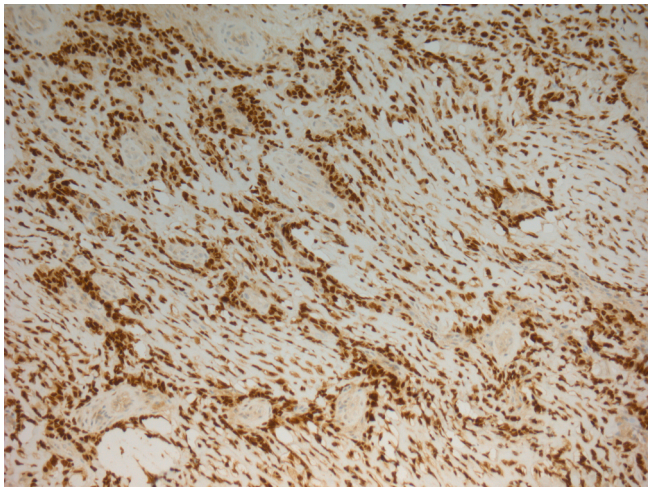

**Fig. 3.** The neoplastic cells show diffuse and intense nuclear SATB2 immunohistochemistry staining.

spinal malignant tumor has evolved and improved in last decades, achieving total resection by advanced multi-staged procedures even in CVJ region [5,7–9]. Indeed, cervical spine and above all the CVJ, is an exceptional location leading to a higher complexity of surgery required for a total resection of the tumor, and a higher risk of morbidity. In pediatric population, almost anecdotally reported, complex multi-staged en bloc resection of a the lesion have been reported so far, achieving an excellent outcome [5,9]. Unfortunately, our patient was already metastatic at time of diagnosis, limiting surgical treatment to biopsy. A cervicalgia with or without a torticollis, refractory to medical treatment in absence of history of fall or trauma, is indeed highly suspicious. It should be considered as a warning sign for a severe pathology and not be banalized and deemed to psychosomatic manifestations. Undeniably, psychosomatic symptoms are frequently reported in children and adolescent, involving up to 50% of them. The most common complains in children are pain, fatigue, headache and gastrointestinal whereas other neurologic symptoms tend to emerge later, in adolescence, following a developmental sequence. Nonetheless, the diagnosis of such disorders requires an extensive medical work-up to rule out an underlying physical illness, often with heavy utilization of resources burdening on the health care system [11]. Moreover, torticollis is seen in 1.3% of children, sustained by a wide range of pathologies, from benign muscular problems to malignant tumors [12]. As mentioned above, the most frequent symptoms reported at diagnosis for CVJ neoplasm is neck pain and torticollis [1,2,12], highlighting the importance of an early clinical evaluation to investigate the presence of a life-threating underlying disorder, avoiding delaying of treatment and/or inappropriate therapy.

Conclusions: The occurrence of neck pain and/or torticollis in youngers should be broadly investigated to rule out an organic pathology. Moreover, it is mandatory to raise awareness on pediatricians, physiotherapist and physiatrist in this very complex field.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

[1] A.H. Menezes, Craniovertebral junction neoplasms in the pediatric population, Child's Nerv. Syst. 24 (10) (2008) 1173–1186, https://doi.org/10.1007/s00381-008-0598-4.
[2] T. Ozaki, S. Flege, U. Liljenqvist, A. Hillmann, G. Delling, M. Salzer-Kuntschik, H. Jürgens, R. Kotz, W. Winkelmann, S.S. Bielack, Osteosarcoma of the spine: experience of the cooperative osteosarcoma study group, Cancer. 94 (4) (2002) 1069–1077.
[3] H. Ilaslan, M. Sundaram, K.K. Unni, T.C. Shives, Primary vertebral osteosarcoma: imaging findings, Radiology 230 (3) (2004) 697–702, https://doi.org/10.1148/radiol.2303030226.
[4] A.F. Mavrogenis, G. Guerra, M. Romantini, C. Romagnoli, R. Casadei, P. Ruggieri, Tumori dell'atlante e dell'epistrofeo: 37 anni di esperienza nella diagnosi e trattamento, Radiol. Med. 117 (4) (2012) 616–635, https://doi.org/10.1007/s11547-011-0753-y.
[5] C. Sar, L. Eralp, Transoral resection and reconstruction for primary osteogenic sarcoma of the second cervical vertebra, Spine (Phila Pa 1976) 26 (17) (2001) 1936–1941, https://doi.org/10.1097/00007632-200109010-00025.
[6] A.L. Braccini, P.Y. Bondiau, S. Litrico, F. Burel-Vandenbos, A. Thyss, Long term survival of an atlas osteosarcoma treated by surgery, chemotherapy and robotic stereotactic radiotherapy: A case report, Radiother. Oncol. 97 (3) (2010) 608–609, https://doi.org/10.1016/j.radonc.2010.10.018.
[7] J.Y. Chung, Kim J. Do, G.H. Park, S.T. Jung, K.B. Lee, Occipitocervical reconstruction through direct lateral and posterior approach for the treatment of primary osteosarcoma in the atlas: A case report, Spine (Phila Pa 1976) 37 (2) (2012) E126–32, https://doi.org/10.1097/BRS.0b013e31822172b1.
[8] D. Feng, X. Yang, T. Liu, J. Xiao, Z. Wu, Q. Huang, J. Ma, W. Huang, W. Zheng, Z. Cui, H. Xu, Y. Teng, Osteosarcoma of the spine: Surgical treatment and outcomes, World J. Surg. Oncol. 11 (1) (2013) 89.
[9] M.J. Clarke, D.L. Price, H.J. Cloft, L.G. Segura, C.A. Hill, M.B. Browning, J. M. Brandt, S.M. Lew, A.B. Foy, En bloc resection of a C-1 lateral mass osteosarcoma: Technical note, J. Neurosurg. Pediatr. 18 (1) (2016) 46–52.
[10] L. Denaro, R. Pallini, L. Lauriola, L. Di Muro, G. Maira, Osteosarcoma of craniovertebral junction, Lancet Oncol. 6 (12) (2005) 1000, https://doi.org/10.1016/S1470-2045(05)70469-1.
[11] P. Ibeziaki, S. Bujorenau, Approach to psychosomatic illness in adolescents, Curr. Opin. Pediatr. 23 (4) (2011) 384–389, https://doi.org/10.1097/MOP.0b013e3283483f1c.
[12] H. Per, M. Canpolat, A. Tümtürk, H. Gumuş, A. Gokoglu, A. Yikilmaz, S. Özmen, A. Kaçar Bayram, H.G. Poyrazoğlu, S. Kumandas, A. Kurtsoy, Different etiologies of acquired torticollis in childhood, Childs Nerv. Syst. 30 (3) (2014) 431–440.