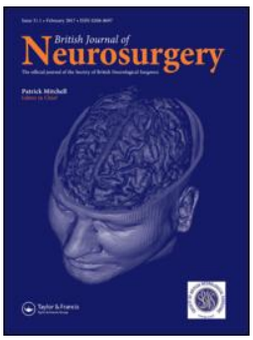

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SHORT REPORT

Giant intradural extramedullary spinal ependymoma, a rare arachnoiditis-mimicking condition: case report and literature review

Nicolò Marchesini[a], Christian Soda[b], Umberto Maria Ricci[b], Giampietro Pinna[b], Franco Alessandrini[c], Claudio Ghimenton[d], Riccardo Bernasconi[e], Gaetano Paolino[e] and Marco Teli[f]

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ABSTRACT

Background and importance: Ependymomas are tumours arising from the ependymal cells lining the ventricles and the central canal of the spinal cord. They represent the most common intramedullary spinal cord tumour in adults and are very rarely encountered in an extramedullary location. Only 40 cases of intradural extramedullary (IDEM) ependymomas have been reported, all of which were diagnosed pre-operatively as IDEM ependymomas on contrast-enhanced MRI.

Clinical presentation: We report a 23-year old male presenting with rapidly worsening signs and symptoms of spinal cord disease. A spinal MRI demonstrated a posterior multi-cystic dilatation extended between T1 and T12. Post-contrast sequences showed peri-medullar leptomeningeal enhancement and the diagnosis of spinal arachnoiditis was made. The patient underwent surgery and the spinal cord appeared circumferentially wrapped by an irregular soft tissue. The tissue was sub-totally removed and the pathological diagnosis was ependymoma WHO grade II. The patient experienced an excellent neurological recovery and no further treatments were administered. A small residue is now stable at 2.5 years follow-up.

Conclusions: Giant IDEM ependymomas are rare entities and pre-operative diagnosis can be challenging in some cases. Surgery represents the main treatment option being resolutive in most cases.

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Ependymoma; spinal ependymoma; extramedullary tumour; intradural tumour; spinal arachnoiditis; spinal tumour

Background and importance

Ependymomas are tumours arising from the ependymal cells lining the ventricles and the central canal of the spinal cord. They represent the most common intramedullary spinal cord tumour in adults and are classified as either WHO grade II or III.[1,2] Ependymomas are very rarely encountered in an extra-medullary location. To our knowledge, only 40 cases of IDEM ependymomas have been reported, all of which were identified on MRI as IDEM tumours before surgery. In our case, due to the peculiar radiological pattern, a diagnosis of spinal arachnoiditis was initially suggested. Surprisingly, a T1-T12 IDEM ependymoma was resected. To our knowledge, our case represents the largest IDEM ependymoma ever described.

Clinical presentation

In 2015, a 23-year-old male patient presented to our Department complaining of progressive paraparesis, lower limb numbness and urinary hesitancy for 1 week. His past medical history was unremarkable. Neurological examination revealed lower limb weakness (4/5 MRC) and a sensory level below the umbilical line. Pyramidal signs were present and he could not walk independently. Anal tone was lower than normal. All blood tests were within the normal ranges. A spinal MRI showed a peri-medullary, posterior multi-cystic dilatation extended between T1 and T12. Post-contrast sequences showed peri-medullary leptomeningeal enhancement and an initial diagnosis of spinal arachnoiditis was formulated (Figure 1). A brain MRI was negative. 2 weeks after the symptoms had begun, the patient underwent a T2-T12 laminotomy and longitudinal durotomy. The spinal cord appeared circumferentially wrapped by a greyish and irregular tissue. On manipulation, it appeared soft and a clear cleavage plan was seen throughout almost the whole extension of the affected the spinal cord. Most of the material was removed but some parts were left in place due to their anterior, inaccessible location (Figure 2). Resection was judged incomplete. Histology was in keeping with ependymoma WHO grade II (Figure 3). The patient was discharged 14 days after surgery. A few days later a wound infection occurred and an MRI revealed a fluid collection between T3 and T10. The patient underwent a successful revision surgery with subsequent eradication of the infection (Enterobacter aerogenes was isolated and Meropenem was administered). After intensive rehabilitation, he completely recovered his motor function, but a mild urinary urgency persisted. At the six months follow-up MRI a residue was seen at T2-T3 in association with post-operative arachnoid webs (Figure 4(A)). At the 2.5 years follow up MRI the residue at the level of T2-T3 was stable (Figure 4(B)) but the laminae were almost completely reabsorbed and kyphosis had increased compared to preoperatively

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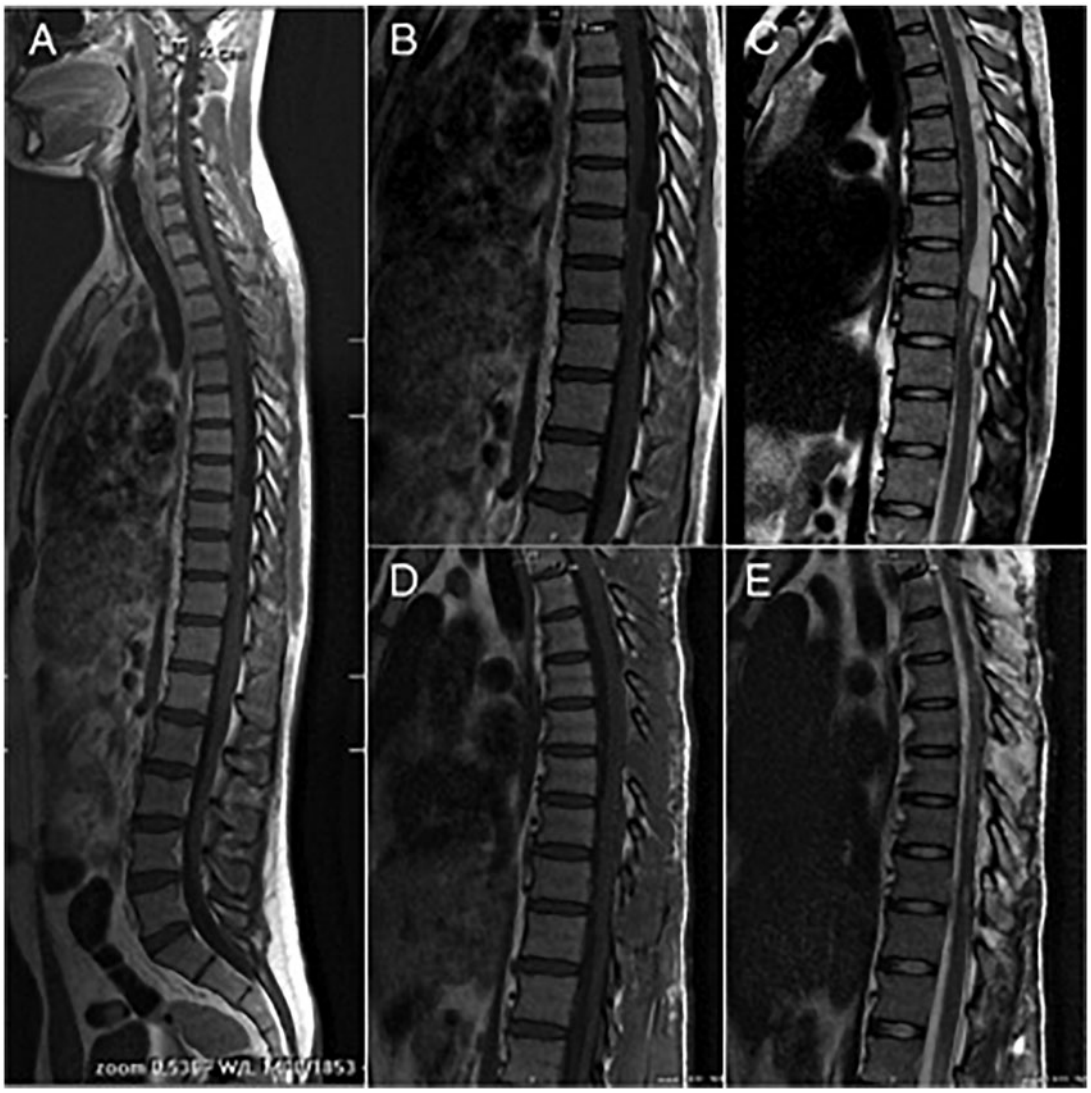

Figure 1. Pre-operative spinal T1 (A,B) and T2-sequences (C) showing CSF loculation and obliteration of the subarachnoid space, with angular defects of the spinal cord. Wound infection occurred a few days after discharge: T1 (D) and T2 (E) sequences show a fluid collection along the surgical site with some peripheral contrast enhancement.

(Figure 4(C–D)). The patient currently conducts a nearly normal life but complains of mild urinary urgency.

Discussion

Around 30% of spinal tumours are intradural extramedullary (IDEM). 80% of these are meningiomas and schwannomas, while 15% are filum terminale ependymomas.[2] IDEM ependymoma are usually wrapped by the cauda equina nerve roots and are characteristically **WHO grade II or III.**[3] IDEM ependymomas are thought to originate from ectopic ependymal cells trapped outside the neural tube during its closure.[4] This could be confirmed by their association with some congenital anomalies and the occurrence of ectopic ependymomas.[4–6] An hormonal influence is hypothesized due to their higher incidence in the female population.[7] IDEM ependymomas are most commonly encountered in adults, but pediatric cases exist.[8] IDEM ependymomas most frequently involve the thoracic spine and are usually described as single-mass tumors, but multifocal-cases are also described (Table 1).

Symptoms of IDEM ependymomas are usually non-specific with pain being the most common presenting one.[17] Pain can remain the only complain for several years before signs and symptoms of myelopathy appear.[10]

IDEM ependymomas most commonly appear as T2 hyperintense/T1 hypointense lesions, often heterogeneous; contrast enhancement is nearly always present.[44] The mass wraps and/or compresses the spinal cord. In all previous reports, a radiological preoperative diagnosis of IDEM tumor was made. The surgical finding of an IDEM ependymoma was surprising, but a tumor was expected. MR images of our patient showed a septated dilation of the posterior peri-medullary space from T1 to T12. Fluid collections were seen along the whole dilation. A syrinx at T9 was also present. Leptomeningeal enhancement was evidenced and the diagnosis of spinal arachnoiditis was formulated.

Spinal arachnoiditis constitutes an inflammation of the meninges, resulting in their thickening and scarring. The most common MR findings of arachnoiditis include central clumping of the nerve roots or their peripheral adhesion and tethering; subarachnoid space filled with soft tissue; pia and dura mater contrast enhancement. Syrinx and spinal cord hyperintensity can be

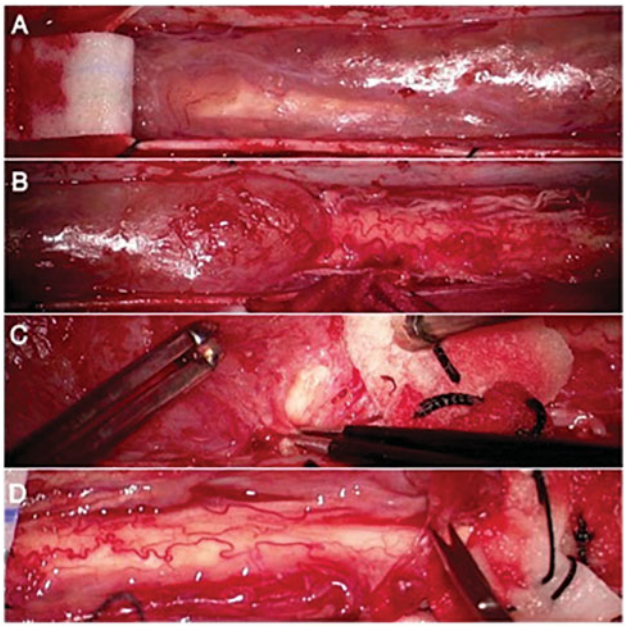

Figure 2. Intra-operative images. The spinal cord appears circumferentially wrapped by a greyish, soft and irregular tissue (A, B). On gentle manipulation, a cleavage plane is seen throughout almost the whole extension of the spinal cord but parts of the tissue are firmly adherent to the spinal cord (C). The resection was judged sub-total as some anterior parts of the tumor were left in place (D).

associated. In most severe cases spinal arachnoiditis can appear as loculated arachnoid cystic cavities exerting mass effect on the spinal cord.[45]

The clinical course of our patient was slightly different from most IDEM ependymomas previously reported. Pain was absent and the neurological deterioration was rapidly progressive. The radiological pattern was inconsistent with a well-defined space-occupying lesion. Liao *et al.* recently reported the case of a giant IDEM ependymoma extended between T2 and T12.[9] On MRI, it appeared as an intradural lesion compressing the spinal cord and the pre-operative diagnosis of IDEM tumour was formulated. Our case was slightly larger (T1-T12) but the radiological diagnosis was probably complicated by the mainly cystic aspect of the mass: the association of MRI and FDG PET/CT, as well as more recently introduced sequences (e.g. spinal DWI), could have been valuable in the differential diagnosis.[46]

Among the reported cases of IDEM ependymoma, twenty-three were grade II and three of these were multifocal. Eight cases were grade III, four were multifocal. In one case a multifocal tumor presented with two different histological grades.[12] One patient had a mixed histology.[13] Tripathy *et al.* described two cases of IDEM lumbo-sacral myxopapillary ependymoma where it was not possible to rule out the diagnosis of filum terminale ependymoma.[47] Vural *et al.* reported the case of an IDEM myxopapillary ependymoma too, but it appeared as a multifocal cervical and dorsal tumour.[28]

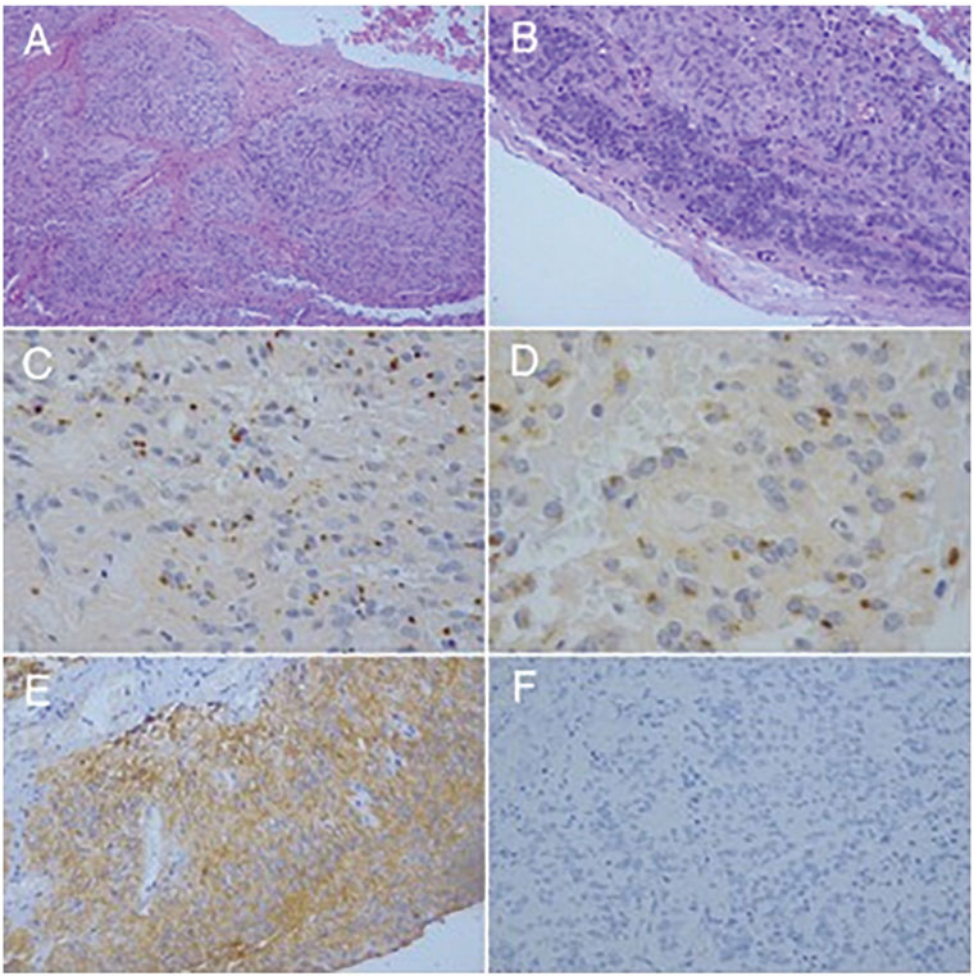

Figure 3. Photomicrographs of the resected neoplasm. The tumor is composed of monomorphic cells with round/oval nuclei and granular chromatin (H&E x100) (A), (H&E x200) (B). The cells show a typical dot-like pattern of cytoplasmic immunoreactivity for EMA (C x400, D x600) and a diffuse positivity for GFAP (E x200). OLIG2 is negative (F x200).

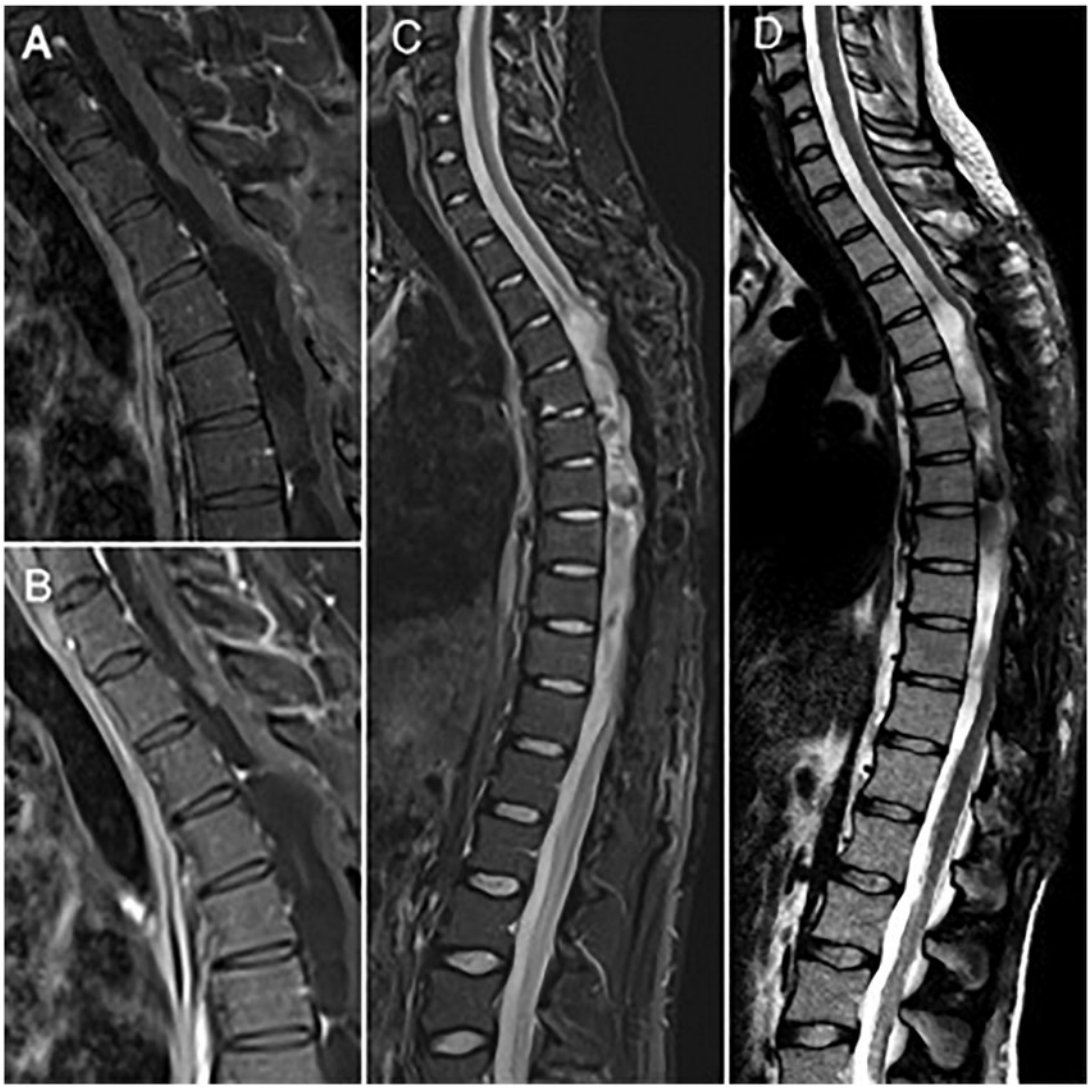

Figure 4. MR Imaging (6 months follow-up control) showed a residue at T2-T3 level on T1 weighted images after Gadolinium administration (A). The residue was stable at 2,5-year follow-up (B). Post-surgical arachnoid webs developed as shown by T1 sequences at 6 months and 2,5 years follow-up on. The laminae were progressively reabsorbed and a subsequent dorsal kyphotization occurred (C,D- T2 weighted images).

Table 1. Clinical and radiological features of previously described cases of IDEM ependymoma.

Author, year	Age, sex	Site (number of lesions)	Presentation	Operations	Removal	Adjuvant	WHO	F-U	Residual
Liao D *et al.* 2018[9]	23, F	T (1)	P, LL	1	GTR	N	II	52	DF
Oral S *et al.* 2018[10]	47, F	C (1)	P	1	GTR	N	II	52	DF
Chakravorty A *et al.* 2017[11]	47, F	CMJ, C, T, L, S (>10)	P, Se	2	GTR-S/GTR-D	N/RT	III/III + II	208	=
Honda A *et al.* 2017[12]	26, F	T (multiple)	W, P, Se	2	GTR/GTR	N/RT + CT	III/III + II	156	DF
Weinstein G *et al.* 2016[13]	56, F	L (1)	P, LL	1	GTR	N	II + as	52	DF
Funao H *et al.* 2016[14]	60, M	CM (1)	P, LL, U	1	GTR	N	II	4	DF
Pomeraniec J *et al.* 2015[15]	23, M	C, CA, CM multiple)	P, Se	1	GTR-C	RT	III	52	=
Severino M *et al.* 2015[8]	11, F	CMJ, C, brainstem (multiple)	P, UL, Se, W	1	STR	RT	II	104	N
Morselli C *et al.* 2015[5]	42, F	CCJ (1)	P	1	GTR	N	II	104	DF
Vats A *et al.* 2015[16]	59, F	CMJ, C, T (multiple)	P	1	GTR	RT	II	44	DF
Guarnieri G *et al.* 2014[17]	53, M	C, T (multiple)	Se	2	STR/STR	CT	II	6	n.r
Gardner L *et al.* 2013[18]	27, F	T (1)	Se, W, U	1	GTR	N	n.r.	32	DF
Moriwaki T *et al.* 2013[19]	23, F	T (1)	P, Se, W	2	GTR/GTR	N/RT	II/III	140	DF
Perez-Bovet J *et al.* 2013[20]	36, F	D, L, bones (multiple)	Se, encephalopathy	1	biopsy	CT	III	7	N
Ha SM. *et al.* 2012[21]	36, F	C-T (1)	P, LL	1	GTR	N	II	24	DF
Tripathy P *et al.* 2011[22]	24, F	DLS (1)	P, Se, W, U	1	GTR	N	my	12	DF
Tripathy P *et al.* 2011[22]	21, F	LS (1)	P	1	GTR	N	my	12	DF
Kinsman M *et al.* 2011[23]	53, M	C (1)	P, UL, LL	1	GTR	RT	III	n.r.	DF
Son DW *et al.* 2011[24]	57, F	C (1)	P, UL, LL	1	GTR	RT	II	260	DF
Bonfield C *et al.* 2011[25]	87, F	CM (1)	P	1	GTR	N	II	n.r.	DF
Guppy K. *et al.* 2011[26]	50, M	T (1)	LL, Se	1	GTR	RT	III	24	DF
Iunes EA *et al.* 2010[27]	32, M	C, T (multiple)	Se, W, U	2	STR/STR	CT/RT	II/II	105	∅
Vural M *et al.* 2010[28]	45, F	C, T (multiple)	P, W	2	GTR/GTR	N	my	28	Dx

(*continued*)

Table 1. Continued.

Author, year	Age, sex	Site (number of lesions)	Presentation	Operations	Removal	Adjuvant	WHO	F-U	Residual
De Bonis *et al.* 2009[29]	60, F	T (1)	LL, Se, U	1	GTR	N	II	n.r.	n.r.
Fasoli F *et al.* 2008[30]	32, F	T (1)	P	1	GTR	N	II	104	DF
Benzagmout M *et al.* 2008[7]	31, M	C (1)	P, LL, U	2	GTR/GTR	N/RT	II/III	52	R
Cerase A *et al.* 2006[31]	56, M	T (1)	W, P, Se	2	GTR/STR	N/RT	III/III	56	R + Dx, ∅
Schuurmans M el al. 2006[32]	29, F	C, LS (2)	P, UL, Se, U	4	N/GTR/GTR/GTR	N/N/ RT/N	III/III/III	104	DF
Graça J *et al.* 2006[33]	67, F	T (1)	Se	3	GTR/GTR/GTR	N	II/II/II	56	Dx
Robles S *et al.* 2005[34]	47, F	T (1)	Se, LL, U	2	GTR/GTR	N/RT	II/III	92	=
Fuentes R. *et al.* 2004[35]	47, F	L (1)	P	1	GTR	N	II	n.r.	DF
Duffau H *et al.* 2000[36]	43, F	T (1)	P, Se, LL	1	GTR	N	II	104	DF
Payer M *et al.* 1999[37]	62, F	T (1)	P	1	GTR	N	II	n.r.	DF
Wofla CE *et al.* 1997[38]	69, F	T (1)	LL	1	GTR	N	II	24	DF
Katoh *et al.* 1995[39]	24, F	C-T (1)	myelopathy	1	GTR	N	II	26	DF
Li *et al.* 1992[40]	63, M	L (1)	n.r.	1	GTR	N	n.r	n.r.	n.r.
Wagle *et al.* 1988[41]	41, F	T (1)	P, Se	1	GTR	N	n.r.	n.r.	n.r
Oliver B. *et al.* 1981[42]	34, F	T (1)	LL p	1	GTR	N	III	13	DF
Gonzalez FL *et al.* 1971[43]	42, F	T (1)	LL, P	1	GTR	RT	II	n.r.	DF
Cooper *et al.* 1951[4]	40, F	T (1)	LL, P, Se	1	GTR	N	I	106	DF

CMJ: cervico-medullary junction; CCJ: cranio-cervical junction; C: cervical; T: thoracic; L: lumbar; S: sacral; C-T: cervico-thoracic; L-S: lumbo-sacral; CA: cauda equina; CM: conus medullaris; P: pain; LL: lower-limbs weakness; UL: upper-limbs weakness; Se: sensory disturbances; W: walking disturbances; U: urinary disorders; GTR: gross total resection; STR: Sub-total resection; N: none; RT: radiotherapy; CT: chemotherapy; as: astrocytoma; my: myxopapillary; DF: disease free; =: stable; R: recurrence; ∅: died; Dx: dissemination; F-U: followup (weeks).

All of the reported IDEM ependymomas received surgery as first-line treatment. In single-mass tumors, adjunctive RT was used in only a few cases.[23,24,26,43] RT was added when recurrence occurred.[7,31,34] In patients with multiple lesions or with sub-total resection, an adjunctive RT and/or CT with carboplatin is suggested.[8,15–17,27] 3 authors reported the case of a single-mass grade II tumor that had a grade III recurrence. None of these had received adjunctive therapy after the first operation but received RT after the recurrence was resected.[7,19,34]

After surgery and adjuvant therapies most patients reported in the literature are disease-free or present stable residues and the neurological recovery is mostly satisfying. Nonetheless, aggressive cases are described.[20,31]

In our case when the laminae were removed and the dura was opened, it become clear that a proliferative mass was compressing the spinal cord and the tumour was resected. The histological diagnosis was consistent with a grade II ependymoma along its whole extension. As most cases of grade II IDEM ependymoma described, our patient did not receive adjuvant therapies, even if a small residue was noted on the post-operative MRI. This approach seems reasonable as the residue is stable 28 months after surgery and the neurological recovery has been excellent.

Conclusions

In our patient, an MRI morphological pattern compatible with spinal arachnoiditis was seen. The final diagnosis of IDEM ependymoma was made after surgery. We conclude that in patients with MRI features of spinal arachnoiditis without a history of infection, trauma or previous spinal surgery, a differential diagnosis of tumour should be raised.

Disclosure statement

Written, informed consent was obtained from the patient for his information to be included in our manuscript. His information has been deidentified to the best of our ability to protect his privacy.

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