Review Article

Recurrent liponeurocytoma: A case report and systematic review of the literature

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ABSTRACT

Background: Liponeurocytomas are rare neurocytic neoplasms that most often arise in the posterior fossa and affect individuals in the third and fifth decades of life. Most reported cases of this unique tumor in the literature have described a favorable clinical prognosis without recurrence. However, increasing reports of recurrent cases prompted the World Health Organization, in 2016, to recategorize the tumor from Grade I to the less favorable Grade II classification. We conducted a systematic review to identify recurrent cases of this unique tumor and to summarize differences between the primary and recurrent cases of liponeurocytoma.

Methods: A systematic review exploring recurrent liponeurocytoma cases was conducted by searching the PubMed, Google Scholar, and Scopus databases for articles in English. Abstracts from articles were read and selected for full-text review according to a priori criteria. Relevant full-text articles were analyzed for symptoms, imaging, location, histological, pathological, treatment, and recurrence-free time between the primary and recurrent cases.

Results: Of 4392 articles, 15 articles accounting for 18 patients were included (level of evidence: IV) in the study. Recurrence-free time decreased from an average of 82 months between the primary tumor resection to first recurrence to 31.3 months between the first and second recurrence. Recurrent tumors demonstrated increased pleomorphic neural cells, necrosis, vascular proliferation, and MIB-1 index when compared to the primary tumor. Several cases also demonstrated decreased lipidizing components when compared to the primary tumor, further indicating increased dedifferentiation. The primary treatment for this tumor was surgical resection with occasional adjunctive radiotherapy.

Conclusion: Recurrent cases of liponeurocytoma have features of increased malignant proliferation compared to the primary cases. The standard treatment for these primary and recurrent tumors is gross total resection. The role of adjunctive radiotherapy remains a matter of debate.

Keywords: Liponeurocytoma, Neurocytic neoplasm, Recurrent, Systematic review

INTRODUCTION

Liponeurocytomas are rare and slow-growing tumors of neuroectodermal origin first described by Bechtel et al. in 1978 who, on histological examination, reported mixed mesenchymal and neuroectodermal differentiation. Given this juxtaposition of features, this tumor has...
often been mistaken for several other CNS tumors, most prominently, medulloblastoma. Prior reports have described liponeurocytomas as “lipomatous or lipidized medulloblastoma,” “medullocytoma,” and “lipomatous glioneurocytoma.”

In response to increasing reports of this unique pathology, in 2000, the World Health Organization (WHO) described liponeurocytoma as a separate mixed neuronal and glial tumor and categorized it as WHO Grade I, reflecting its favorable prognosis. However, as reports of recurrence after resection mounted, in 2016, the tumor was recategorized as the WHO Grade II.

Over 80 cases of liponeurocytomas have been reported in the literature. Of those, 18 cases demonstrate recurrence following resection of the primary tumor. Only seven cases thus far have reported a second tumor recurrence.

Here, we report a case of liponeurocytoma which recurred following two gross total resections (GTRs), along with a review of the 18 previously reported cases of recurrent liponeurocytoma with the hope of improving understanding of histopathological changes that occur with recurrence as well as guiding treatment and surgical decision-making in the treatment of this rare but intransigent entity.

**MATERIALS AND METHODS**

**Case description**

A 55-year-old man with a history of a left cerebellar liponeurocytoma resected at an outside facility 9 years prior was subsequently lost to follow-up. He presented to our institution's emergency center with 2 months of severe bifrontal and occipital headaches as well as loss of balance with a predilection to falling toward his left. The patient's physical examination was notable for mild dysmetria on finger-to-nose test (L>R) as well as mild ataxia with heel to shin (L>R).

Magnetic resonance imaging (MRI) revealed a mixed solid and cystic mass in the left cerebellum measuring 4.4 × 2.6 × 3.2 cm with surrounding vasogenic edema and associated mass effect with partial effacement of the fourth ventricle. The mass was T1 iso-to-hypointense and heterogeneously hyperintense on T2. Given the patient's neurologic decline, severe headaches, and radiographic findings of partial effacement of the fourth ventricle, the patient was offered surgical resection. A left retrosigmoid craniotomy was performed and extended to the sigmoid and transverse sinuses. The tumor was identified at the pial surface of the cerebellum and subsequently debulked internally. GTR was

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**Figure 1:** Magnetic resonance imaging demonstrates (a-d) presumptive recurrent liponeurocytoma (white arrow) as a heterogeneous solid and cystic mass in the left cerebellum abutting the left sigmoid sinus. (a-c) On axial, coronal, and sagittal T1-weighted imaging the lesion was isointense to the cortex with areas of hypointensity (not shown) with heterogeneous enhancement. The tumor was well marginated with minimal edema and without obstructive hydrocephalus. (d) Axial T2-weighted imaging shows heterogeneous hyperintensity of the tumor. Postoperative T1 axial, coronal, and sagittal (e-g); and T2 axial (h) images show complete resection of the mass.
achieved. The patient tolerated the procedure well and had an unremarkable postoperative course. At a 2-week follow-up, the patient had recovered well with normalization of finger-to-nose and heel-to-shin tests, though he did have a Romberg test notable for mild left-sided sway.

Pathologic analysis revealed monotonous neurocyte-like cell proliferation, vague rosetting, and focal vascular proliferation. Multifocal fat droplets with adipocyte formation were also seen. No necrosis or mitotic activity was identified [Figure 2]. The tumor stained positive for S100, CD56, and synaptophysin. Immunoperoxidase stains for p53, EMA, GFAP, and IDH-1, on the other hand, were negative in the tumor. MIB-1 proliferation index was 2.8%.

Three years postoperatively, routine surveillance MRI revealed a recurrent tumor measuring 2.1 × 2.0 × 2.9 cm in the left cerebellar hemisphere accompanied with mass effect on the left inferior sigmoid sinus, with associated loss of flow void in the distal left transverse sinus, proximal sigmoid sinus, and left jugular bulb. The mass was hyperintense on T1 and isointense on T2 [Figure 3]. On further questioning, the patient reported severe headaches, intermittent diplopia, neck pain, and difficulty maintaining balance. Physical examination revealed no focal neurologic deficits, however.

Given that the patient was symptomatic, the patient was once again offered surgical resection. He underwent a redo left retrosigmoid craniotomy for resection of his tumor. At surgery, we found a largely well-encapsulated tumor. The tumor was initially internally debulked and then removed in piecemeal fashion. The patient had an unremarkable postoperative period. Postoperative MRI showed no evidence of residual tumor.

Pathologic analysis of the recurrent tumor demonstrated reduced lipomatous components compared to the prior pathology. Moreover, focal necrosis of the tumor, increased vascular proliferation, and increased cellularity were all noted on these tissue specimens, and the MIB-1 proliferation index had increased to 7.4%. Immunohistochemical marker phenotype remained unchanged [Figure 4]. On a 2-week

Figure 2: Histopathologic slides of the first recurrent liponeurocytoma. (a) Low magnification of the specimen shows large multifocal fat droplets intermixed with neurocytic cells and focal vascular proliferation. (b) High magnification shows detail of the monotonous nature of the neurocytic cells.

Figure 3: Magnetic resonance imaging (MRI) demonstrates (a-d) recurrence of the liponeurocytoma (white arrow) occupying the left cerebellum. (a-c) On axial, coronal, and sagittal T1-weighted imaging, the lesion was hyperintense compared with the cortex. The tumor was well marginated without edema or obstructive hydrocephalus. (d) Axial T2-weighted imaging of the tumor is isointense to the cortex (not shown), with increased heterogeneous enhancement as compared to the initial recurrence. Postoperative T1 axial, coronal, and sagittal (e-g); and T2 axial (h) MRI images demonstrate no radiographic evidence of residual disease.
follow-up, the patient has continued to do well with no focal deficits noted on the physical examination.

**Literature search**

We performed a systematic review of recurrent liponeurocytoma following the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines [Figure 5]. On November 3, 2021, the PubMed MEDLINE (National Library of Medicine), Scopus (Elsevier), and Google Scholar (Google) databases were queried for relevant articles by key words “liponeurocytoma,” “neurolipocytoma,” “lipomatous medulloblastoma,” “lipidized medulloblastoma,” “medullocytoma,” and “lipomatous glioneurocytoma.” These key words were combined with “recurrent,” “cerebellar,” and “central” using the “AND” operator. We did not restrict our search based on date of publication, article type, or language.

Duplicated records were excluded once the search was completed. Studies were subsequently screened based on title and abstract. The remaining articles were screened by a full-text review for final inclusion. Studies were selected for final review based on the following inclusion criteria: case report or peer-reviewed original research detailing a cohort of patients who underwent treatment for liponeurocytoma more than once (demonstrating recurrence), English language, and full-text availability. Studies other than full-length articles such as abstracts, posters, and editorials were excluded from the study. Two reviewers (D.S. and P.P) independently screened all articles and disagreements were reconciled by discussion.

**RESULTS**

Our literature search identified 18 previously reported cases of recurrent liponeurocytoma [Table 1]. There was a slight male predominance (55.5%). Age at which the primary tumor was diagnosed ranged from 4 to 74 years with an average age of 46 years. The most common location for the primary tumor was the cerebellum (13 cases or 72.2%) followed by the lateral and fourth ventricles (two cases or 11.1% each). One case was reported in the frontal lobe. Given the predominance of the cerebellum as the site for tumor localization, the most reported presenting symptoms of the primary and recurrent tumors included headaches, gait disturbance, vertigo, and difficulty with ambulation. GTR of the primary tumor was performed in 15 cases (83.3%) and STR was performed in 3 cases (16.7%). Two patients with the primary tumors underwent postoperative radiation therapy.

The time between the primary tumor removal and detection of recurrence ranged from 8 months to 15 years with an average time for recurrence of 82 months. GTR of the recurrent tumor was performed in 13 cases (72.2%) and STR was performed in 5 cases (27.8%). Radiotherapy was employed in three cases for the treatment of the recurrent tumor. Seven of the previously reported patients, like our patient, experienced a second recurrence of their liponeurocytoma. Four of these patients had undergone complete resection of the first recurrence; three had undergone STR of the first recurrence. A second recurrence was not seen in patients who had been treated with radiotherapy.

The time between the first and second recurrence ranged from 3 months to 5 years with an average time for recurrence of 31.3 months. Five patients (71.4%) with a second recurrence were treated with a GTR of the tumor, 1 patient (14.3%) was treated with a STR supplemented with a standard medulloblastoma chemotherapy regimen, and 1 (14.3%) patient was treated with Gamma-Knife surgery. No more than 2 recurrences of the tumor have been reported in the literature.

Histological examination of the tumor was, for the most part, consistent between the primary tumor and the recurrent tumors. In six recurrent tumors (three from the first recurrence and three from the second recurrence),

![Figure 4: Histopathologic slides of the second recurrent liponeurocytoma (a) show small, microscopic collections of fat with increased vascularity and cellularity compared to the first recurrent tumor. (b) Small tumor cells with mixed lipomatous differentiated neoplastic cells express synaptophysin. (c) Axons of the surrounding central nervous system tissue express neurofilament. (d) The Ki-67 proliferation index (as determined by MIB-1 staining) is 7.4%.]
histological examination showed increased pleomorphic neural cells and decreased lipidized areas when compared to the primary tumor. In three recurrent tumors (one from the first recurrence and two from the second recurrence), histological examination showed increased lipidized areas when compared to the primary tumor. No necrosis or vascular proliferation was seen in the primary tumor. Necrosis and vascular proliferation were increased in six recurrent tumors (five from the first recurrence and one from the second recurrence). Increased mitosis from the primary tumor was described in five recurrent tumors (three from the first recurrence and two from the second recurrence). The Ki-67/MIB-1 proliferation index was described in 12 primary tumor cases with a mean of 5.08%. The Ki-67/MIB-1 proliferation index was reported after the first tumor recurrence in 10 cases with a mean of 9.08%. The Ki-67/MIB-1 proliferation index was reported after the second tumor recurrence in four cases with a mean of 8.25%.

DISCUSSION

Liponeurocytomas are rare neurocytic neoplasms that most frequently arise in the posterior fossa and affect individuals in the third and fifth decades of life, and mostly demonstrate favorable clinical prognosis. However, due to increased evidence of recurrent cases, the WHO, in 2016, updated the tumor from a Grade I classification to a Grade II classification. In 2018, Gembruch et al. completed a systematic review of all liponeurocytomas, including recurrent cases, reported in the literature. We report an additional case and provide a more focused look at the radiological and histological differences between the primary and recurrent tumors. We also seek to highlight key differences between singly and multiply recurrent cases to provide guidance in the identification of and treatment approach for more aggressive variants of liponeurocytoma.
| Authors          | Year | Patients | Sex | Age (years) | Location | Sx | Rx | Surgery | Imaging | Size | Histology | Pathology | IHC | Tx | Reference |
|------------------|------|----------|-----|-------------|----------|----|----|---------|---------|------|-----------|-----------|-----|----|-----------|
| Shah et al       | 1999 | 1        | M   | 37          | Left CPA  | Headache and gait disturbance, left-sided hearing loss, nystagmus, dysarthria, and Romberg's sign | GTR | NA | NA      | Hyperintense lesion on T1 MRI | 6 cm | Small, poorly differentiated cells with hyperchromatic nuclei, numerous oligodendrocyte-like perinuclear halo, lipid-filled cells scattered in clusters throughout the tumor, mitosis present (3 per 10 HPF), increased lipomatous proliferation, and necrosis. MIB-1 = 15% | Synaptophysin+, MAP2C+, S100+, GFAP+ | GTR | STR | 11 |
| Giangaspero et al| 2001 | 1        | M   | 36          | Left frontal lobe | Headaches, vertex, gait disturbance, and left-sided hearing loss | STR | GTR | NA      | Hyperintense lesion on T1 MRI | 3 cm | Small poorly differentiated closely packed cells with hyperchromatic nuclei, numerous oligodendrocyte-like perinuclear halo, lipid-filled cells intermingled with tumor cells, occasional mitosis, absent vascular proliferation and necrosis. MIB-1 < 1% | Synaptophysin+, MAP−2+, GFAP+, vimentin+, S-100+ | GTR | STR | 1 |
| Soylemezoglu et al | 2001 | 1        | F   | 51          | Right cerebellar | Headaches, vomiting, difficulty walking, decreased memory, and cold sensation in the right arm and leg | GTR | NA | NA      | Enhancing lesion on CT scan | 12 cm | Enhancing lesion on CT scan | Similar histological examination increased | MIB-1 < 3% | Same IHC | 46 |
| Scheithauer et al | 2003 | 1        | M   | 53          | Left-sided hearing loss, nystagmus, and vertigo, left-sided hearing loss, nystagmus, and Romberg's sign | GTR | NA | NA      | Enhancing lesion on CT scan | 12 cm | Enhancing lesion on CT scan | Increased lipomatous proliferation and necrosis. MIB-1 < 3% Same IHC | NSE+, GFAP+, S-100−, S-100+, GFAP− | GTR | STR+Radiation | 54 |
| Jenkinson et al  | 2005 | 1        | M   | 61          | Right cerebellar | Headaches, vertigo, gait disturbance, left-sided hearing loss and facial paralysis, and+ | GTR | NA | NA      | Hyperintense lesion on T1 MRI | 2 cm | Same proportion of small poorly differentiated closely packed cells with hyperchromatic nuclei, occasional mitosis, and intermixed lipid-filled cells, perinuclear halo, diffuse homer-wright rosettes and scattered pseudo rosettes, rare necrosis and microhemorrhage, moderate vascular hyperplasia, focal areas of high mitosis MIB-1=20% NSE+, NF+, GFAP+, SY+, S100− | MIB-1=15% | Same proportion of small poorly differentiated closely packed cells with hyperchromatic nuclei, occasional mitosis, and intermixed lipid-filled cells, perinuclear halo, diffuse homer-wright rosettes and scattered pseudo rosettes, rare necrosis and microhemorrhage, moderate vascular hyperplasia, focal areas of high mitosis MIB-1=20% NSE+, NF+, GFAP+, SY+, S100− | GTR | STR+Chemotherapy | 15.4 |

*Note: GTR = Gross Total Resection; STR = Subtotal Resection; STR+ = Subtotal Resection with adjuvant therapy; CT = Computed Tomography; MRI = Magnetic Resonance Imaging; S100+ = Positive for S100 protein; GFAP+ = Positive for glial fibrillary acidic protein; MIB-1 = Mitotic index; NSE+ = Positive for neuron specific enolase; NF+ = Positive for neurofilament; SY+ = Positive for synaptophysin; EMA− = Negative for epithelial membrane antigen; Lu-5− = Negative for Lu-5; MAP−2+ = Positive for microtubule-associated protein-2; desmin− = Negative for desmin; p53− = Negative for p53; NA = Not available; Contd... (continued)
| Reference | Sex | Age | Location | Image | Symptom(s) | Treatment | Time (months) | Lesion Size | Pathology | IHC | Treatment | IHC | References |
|-----------|-----|-----|----------|-------|------------|-----------|--------------|-------------|-----------|-----|------------|-----|-------------|
| Jantet et al., 2007 (1) | 4/F | 24 | Fourth ventricle | Headache, postural imbalance, nystagmus | Hypodense lesion on T1 and hyperintense on T2 | GTR | 14 | Headache | Hypodense lesion on T1 MRI, hyperintense on T2 | GTR | 4/F | Jantet et al., 2007 (1) |
| Limatou et al., 2009 (2) | 42/M | 112 | Fourth ventricle | Headache and ataxia | Hypodense lesion with discrete hyperintensity on T1, hyperintense on T2 | GTR | NA | NA | NA | NA | GTR | Limatou et al., 2009 (2) |
| Chalidou et al., 2011 (3) | 56/M | 96 | Fourth ventricle | Headache and blurred vision | Mixed density on CT scan | NA | 96 | Headache, ataxia | NA | NA | NA | Chalidou et al., 2011 (3) |
| Chalidou et al., 2019 (4) | 74/M | 24 | Fourth ventricle | Headache, postural imbalance | Hypointense and hyperintense components on T1 MRI, hyperintense on T2 | GTR | 24 | Headache, postural imbalance | Hypodense lesion with internal hyperintense | GTR | 74/M | Chalidou et al., 2019 (4) |
| Reis et al., 2019 (5) | 49/M | 40 | Vermis and right paravermian region | Headache and back pain | Hypodense on CT | NA | 40 | Headache, back pain, neck pain, and walking impairment | Hypodense on CT | NA | NA | Reis et al., 2019 (5) |
| Reis et al., 2019 (6) | 59/F | 24 | Fourth ventricle | Headache and neck pain | Hypodense on CT | NA | 24 | Headache | Hypodense lesion with internal hyperintense | GTR | 59/F | Reis et al., 2019 (6) |
| Reis et al., 2019 (7) | 59/F | 108 | Fourth ventricle | Headache, postural imbalance, nystagmus | Hypodense lesion on T1 and hyperintense on T2 | GTR | 108 | Headache | Hypodense lesion on T1 and hyperintense on T2 | GTR | 59/F | Reis et al., 2019 (7) |
| Khansari et al., 2019 (8) | 40/F | 8 | Fourth ventricle | Headache and postural imbalance | Hypodense lesion with internal hyperintense | GTR | 8 | Headache | Hypodense lesion on T1 MRI | GTR | 40/F | Khansari et al., 2019 (8) |
| Shen et al., 2022 (9) | 29/F | 12 | Fourth ventricle | Headache and blurred vision | Hypodense lesion with internal hyperintense | GTR | 12 | Headache | Hypodense lesion on T1 MRI | GTR | 29/F | Shen et al., 2022 (9) |

Sx: Symptoms; Tx: Treatment; IHC: Immunohistochemistry; RFS: Recurrence-free survival; GTR: Gross total resection; STR: Subtotal resection.
Radiologically, liponeurocytoma share features seen in other cystic and neurocytic neoplasms of the central nervous system. They are usually described, like our first recurrence, as iso-to-hypointense on T1-weighting imaging and hyperintense on T2-weighted imaging.[24] Lesions that are hyperintense on T1 and isointense on T2, like the second recurrent tumor in our patient, have been described in the literature less frequently.[14] This unique imaging finding is associated with lesions with an abundance of lipidized tissue.[12] To the best of our knowledge, this represents the first recorded case of liponeurocytoma where an inversion of T1 and T2 sequence intensity occurred between recurrent lesions. Moreover, histological evaluation of the second recurrent tumor found a decreased lipomatous component compared to the first recurrent tumor, highlighting a different mechanism for the imaging changes in the second recurrence. Possible causes of increased intensity on T1 and decreased intensity on T2 between the recurrent tumors include increased intratumor areas of hemorrhage or protein concentration.[5]

Histologically, liponeurocytommas are characterized by small and poorly differentiated neurocytic cells with focal areas of intermixed neuroepithelial cells with lipid accumulation. The tumor cells are usually described as round to oval.[13] However, spindle-shaped and more multinuclear bizarre-shaped cells have also been reported in the literature. Other common histological features of this tumor include sharp demarcation from the surrounding brain tissue, cell-free fibrillary neutrophils, vessel hyalinization, calcification, and neural rosettes and pseudorosettes.[27] While the primary tumors, for the most part, showcase these benign features, the recurrent tumors have been shown to demonstrate more atypical features. In our patient, for example, the second recurrent tumor showed necrosis, vascular proliferation, and increased mitosis and atypia, features not present in the first recurrent tumor. Similarly, in six of the 25 (including the first and second recurrence) recurrent tumors found in the literature, increased necrosis and vascular proliferation were seen when compared to the primary tumor or prior recurrent tumor. Moreover, in our patient, the MIB-1 proliferation index increased by 5.4% between the first and second recurrent lesions. As shown earlier, this trend of increasing MIB-1-positive cells between the primary and recurrent lesions and between recurrences has been well documented in the literature and seems to indicate malignant progression and different grade of neuronal differentiation between the primary lesions as compared to the recurrent lesions. The reduced lipomatous components seen with recurrence in our case and others documented in the literature can be interpreted further as a sign of progression and dedifferentiation with recurrence.

Recurrence in liponeurocytoma is rare. In a systematic review of 73 patients with liponeurocytoma, Gembruch et al. found that 14 or 28.6% had a primary tumor recurrence. Moreover, they found that six or 8.2% of patients experienced a second tumor recurrence.[9] In our patient, recurrence-free survival (RFS) time decreased with each recurrence. This pattern follows the trends seen in other cases with multiple recurrences. Our review found the RFS decreased from an average of 82 months between the primary tumor resection and first recurrence to an average of 31.3 months between the first and second recurrence. Increasing cellularity and dedifferentiation along with increased malignant progression and proliferation may also explain this phenomenon. Moreover, several studies have proposed a possible genetic cause of liponeurocytoma formation and recurrence. Particularly, transcription factors NEUROG1 and fatty acid-binding protein-4 are enhanced in liponeurocytoma. It is possible that the interactions between these genes and others explain the molecular mechanisms that decrease RFS time between recurrences.[2,26]

Complete surgical resection has been described as the preferred treatment for patients with liponeurocytoma. Despite this, Gembruch et al. found that of the 49 patients in their cohort that received complete surgical resection of the tumor, six experienced tumor recurrence. Radiotherapy has been discussed as a viable adjunctive therapy in patients with liponeurocytoma. Gembruch et al. found no recurrence in eight patients who received adjunctive radiotherapy paired with complete resection and only found one case of recurrence in six patients who received adjunctive radiotherapy paired with incomplete resection.[9] However, given the extensive side effect profile of cranial radiation, the debate remains whether there is enough evidence for this to become the standard of care for all primary liponeurocytommas.[4] In a limited sample size, our systematic review showed effective management of recurrent tumor without a second recurrence in the three patients who received adjunctive radiotherapy for treatment of a recurrent tumor. This may indicate adjunctive radiotherapy as an appropriate treatment option for patients with recurrent disease and tumors with aggressive histological features including reduced lipomatous components, increased necrosis and vascular proliferation, and increased MIB-1 proliferation index.

Limitations

There are several limitations to this study. Although our research relied on three main databases, PubMed, Google Scholar, and Scopus, yielding over 4365 articles, there is a chance that the literature search is not entirely complete. This is especially true for this topic as liponeurocytoma was not established as a separate glioneuronal tumor until 2000. Thus, while our search accounted for other names used to describe this pathology, it is still likely that the results were not comprehensive. Moreover, only studies in English were
included in the study, potentially excluding other regions where this pathology may be more common. In addition, because of the nature of this review, any errors in diagnosis, radiological examination, or pathological examination related to the included cases would bias our conclusions. Furthermore, the quality of evidence was moderate to low, as all the studies used in the review were case reports with a level of evidence of V and no randomized trials or cohort and case–control studies were identified. Another limitation of this study is the heterogeneity of the data collected in the case reports and case series. For instance, many cases did not have specific information on tumor imaging, size, pathology, or immunohistochemistry in the primary and recurrent tumors.

CONCLUSION

The present case is the 19th reported case of recurrent liponeurocytoma and only the eighth case with more than 1 recurrence following treatment. This paper highlights the noted radiological and histological differences between the primary and recurrent tumors and points to a trend of increased malignant proliferation between primary and recurrent tumors. The standard treatment for these tumors is complete resection. The role of adjunctive radiotherapy remains an area of investigation, but the data thus far indicate that at least in the case of histologically aggressive appearing tumors, adjunctive radiation treatment is likely warranted.

Declaration of patient consent

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

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Conflicts of interest

There are no conflicts of interest.

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