longer than for patients with subtotal removal. In our experience, there was a 30% recurrence rate after incomplete removal, after a mean interval period of 8.1 years. The statistical analysis demonstrated an increasing time-dependent recurrence rate in patients with subtotal removal, up to 35% at 13 years. Our results are consistent with the literature on the timing and incidence of symptomatic recurrences (26, 58, 69). Zhou (71) reported only four recurrences in 68 patients during a period ranging from 5 to 20 years.

Altschuler et al. (3) emphasized the poor prognosis of patients suffering from fixed deficits, which persist through multiple operations, for recurrences. Extensive lesions, incomplete initial resection, and limited initial exposure were considered to be the primary causes of recurrences (3). However, some authors have reported excellent results in series of patients undergoing second or multiple operations (58, 66, 69). Notwithstanding these reported positive results, the higher the rate of subsequent operations, the less satisfactory is the outcome for reversal of neurological symptoms. Initial incomplete excision is unlikely to achieve definitive tumor cure.

The timing of subsequent surgery is controversial. Surgeons still debate whether second surgery should be performed at the first radiological evidence of recurrence, at the time the tumor presumably extends beyond the original operative field, or after the onset of symptoms. Because of radiological uncertainties, the general attitude is to wait either for clear radiological evidence of recurrence or for the renewal of symptoms (3, 9, 43, 70).

CONCLUSION

In contrast with other posterior fossa benign tumors, in which the cure is obtained by overcoming surgical technical difficulties, the main problems in the management of epidermoids remain misdiagnosis, incomplete removal at the first operation, and delayed detection of recurrences, which occur in nearly half of the patients. On MRI, PD-weighted images are superior to T1- and T2-weighted images in differentiating the cyst content from CSF. A classification system helps in patient assessment, in choosing the surgical strategies, and in determining prognosis. Among CPA epidermoids, a higher rate of preoperative neurological disturbances and a higher postoperative morbidity rate are demonstrated in mesencephalic extended tumors. Fourth-ventricle tumors carry higher risks of surgical complications, whereas few clinical signs and a good outcome are demonstrated in posterior fossa basal epidermoids. Because tumor extension plays a major role in limiting the extent of surgical removal, it should be considered in choosing the surgical approach and in following-up the patient. Our recommendation for the management of recurrent posterior fossa epidermoids is to conduct serial MRI studies, beginning 2 years after the initial operation and repeating at 2-year intervals. This strategy allows better assessment for subsequent surgery, before the tumor extends beyond the original location.

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Reprint requests: Andrea Talacchi, M.D., Department of Surgical Neurology, Verona University Hospital, Piazzale Stefani 1, 37126 Verona, Italy.

REFERENCES

1. Abramson RC, Morawetz RB, Schlitt M: Multiple complications from an intracranial epidermoid cyst: Case report and literature review. **Neurosurgery** 24:574–578, 1989.
2. Albanese V, Tommasello F, Picozzi P, Sampaolo S, Spadaro A: Paramedian hourglass epidermoid extending above and below the tentorium. **Surg Neurol** 18:356–363, 1982.
3. Altschuler EM, Jungreis CA, Sekhar LN, Jannetta PJ, Sheptak PE: Operative treatment of intracranial epidermoid cysts and cholesterol granulomas: Report of 21 cases. **Neurosurgery** 26:606–614, 1990.
4. Alvord EC Jr: Growth rates of epidermoid tumors. **Ann Neurol** 2:367–370, 1977.
5. Auger RG, Piepgras DG: Hemifacial spasm associated with epidermoid tumors of the cerebello-pontine angle. **Neurology** 39: 557–580, 1989.
6. Bartal A, Razon N, Avram J, Rochkind S, Doron A: Infratentorial epidermoids. **Acta Neurochir (Wien)** 42:142–146, 1988.
7. Bauman CHH, Bucy PC: Paratrigeminal epidermoid tumors. **J Neurosurg** 13:455–468, 1956.
8. Baxter JW, Netsky MG: Epidermoid and dermoid tumors: Pathology, in Wilkins RH, Rengachary SS (eds): *Neurosurgery*. New York, McGraw-Hill Book Co., 1985, vol 1, pp 655–661.
9. Berger MS, Wilson CB: Epidermoid cysts of the posterior fossa. **J Neurosurg** 62:214–219, 1985.
10. Brant-Zawadzki M, Badami JP, Mills CM, Norman D, Newton TH: Primary intracranial tumor imaging: A comparison of magnetic resonance and CT. **Radiology** 150:435–440, 1984.
11. Cantu RC, Ojemann RG: Glucosteroid treatment of keratin meningitis following removal of a fourth ventricle epidermoid tumor. **J Neurol Neurosurg Psychiatry** 31:73–75, 1968.
12. Conley FK: Epidermoid and dermoid tumors: Clinical features and surgical management, in Wilkins RH, Rengachary SS (eds): *Neurosurgery*. New York, McGraw-Hill Book Co., 1985, vol 1, pp 668–673.
13. Davidson HD, Ouchi T, Steiner RE: NMR imaging of congenital intracranial germinal layer neoplasms. **Neuroradiology** 27:301–303, 1985.
14. Davis KR, Roberson GH, Taveras JM, New PFJ, Trevor R: Diagnosis of epidermoid tumor by computed tomography: Analysis and evaluation of findings. **Radiology** 119:347–353 1976.
15. De Chadarévian J-P, Becker WJ: Mollaret's recurrent aseptic meningitis: Relationship to epidermoid cysts—Light microscopic and ultrastructural cytological studies of the cerebrospinal fluid. **J Neuropathol Exp Neurol** 39:661–669, 1980.
16. Dee RH, Kishore PRS, Young HF: Radiological evaluation of cerebellopontine angle epidermoid tumor. **Surg Neurol** 13:293–296, 1980.
17. de Souza CE, de Souza R, Da Costa S, Sperling N, Yoon TH, Abdelhamid MM, Sharma RR, Goel A: Cerebellopontine angle epidermoid cysts: A report on 30 cases. **J Neurol Neurosurg Psychiatry** 52:986–990, 1989.
18. Eekhof JLA, Thomeer RTWM, Bots GTAM: Epidermoid tumor in the lateral ventricle. **Surg Neurol** 23:189–192, 1985.
19. Fawcitt RA, Isherwood I: Radiodiagnosis of intracranial pearly tumours with particular reference to the value of computer tomography. **Neuroradiology** 11:235–242, 1976.
20. Fein JM, Lipow K, Taati F, Lansem T: Epidermoid tumor of the cerebellopontine angle diagnostic value of computed tomographic metrizamide cisternography. **Neurosurgery** 9:179–182, 1981.