Research Article • DOI: 10.1515/tnsci-2017-0028 • Translational Neuroscience • 8 • 2017 • 207-210

Translational Neuroscience

DE GRUYTER OPEN

KEYHOLE SURGERY OF PINEAL AREA TUMORS - PERSONAL EXPERIENCE IN 22 PATIENTS

Zbigniew Kotwica[1*],
Agnieszka Saracen[2],
Piotr Kasprzak[3]

[1]*Faculty of Health Sciences and Physical Education, K.Pulaski University of Technology and Humanities in Radom, Radom, Poland*

[2]*Department of Neurosurgery, Faculty of Health Sciences and Physical Education, K. Pułaski University of Technology and Humanities, Radom, Poland*

[3]*Department of Neurosurgery, Faculty of Medicine, Medical University of Łódź, Poland*

Abstract

Background: Pineal area tumors are challenging for surgery due to their location. However, the removal of the lesion is critical for further treatment and survival of the patients Material and methods: 22 patients with pineal area tumors were surgically treated via keyhole medial suboccipital craniotomy and supracerebellar midline approach All the patients were operated in the sitting position with the use of operating microscope and microsurgical technique. Results: All patients survived surgery in a perfect condition, and no one patient worsened after surgery. No complications due to the sitting position were noted. Conclusions: Surgical removal of pineal area tumors via small suboccipital craniotomy is safe and with the use of microsurgical techniques the results of surgical treatment are excellent. The sitting position of the patients gives a better view to the surgeon. We did not observe any intraoperational complications due to the sitting position.

Keywords

• pineal area tumors • keyhole surgery • supracerebellat approach • sitting position

Received 28 August 2017
accepted 7 December 2017

Introduction

Tumors of the pineal area are uncommon and they consist of 0.5-1% of all intracranial tumors [1,2]. These lesions are challenging to access due to the deep surgical field and the surrounding associated critical neurovascular structures. The most prevalent pineal tumors are pineocytomas, pineoblastomas and primitive neuroectodermal tumors (PNET) [3-8]. In addition, glioblastomas [9,10], metastatic tumors [11,12], vascular malformations [13], papillary tumors [14], meningiomas [5,16] and neurocytomas [17,18] can also occur.

Advanced microsurgical techniques combined with improved pre-operative management and post-operative critical care methods have made aggressive surgical resection of the tumor a mainstay of management. Although different surgical approaches are used, the subtentorial-supracerebellar approach is the most common [19-23].

In this paper we report our experience in the surgical treatment of pineal area tumors.

Material and Methods

For the past 15 years, we have surgically treated 22 patients with pineal area tumors. All the patients were surgically treated by the senior author (ZK). The patients were between 21-62 years old, with the median age at 44 years old. Magnetic resonance (MR) and computed tomography (CT) examinations revealed tumor of the pineal area in all of the patients (Figure 1). All of them reported suffering from headaches, while two of them presented diplopia and another one with Parinaud's syndrome. Two of the patients were tetraparetic, one of them for 2 weeks, while the other for 2 years. The former patient developed sudden tetraparesis two weeks earlier and the MR study revealed cavernous angioma with intra-lesional hemorrhage. The second patient has a history of tetraparesis for 2 years in addition to being diagnosed of a large tumor in the third ventricle which was not surgically treated previously. The tumor was 6 cm long and filled the third ventricle with expansion to both lateral ventricles (Figure 2). All the other tumors were between 1.5-3 cm in diameter.

All patients were operated in the sitting position and the subtentorial-supracellebellear approach was used for all of them. A keyhole medial suboccipital craniectomy measured at 2.5 x 2.5 cm was made, the dural flap was excised and then the tumor was resected. The sitting position gives a better view to the posterior part of the third ventricle as the cerebellum is located downwards in this position which gives a larger view to the area of interest. The use of operating microscope and microsurgical technique has enabled the removal of the tumor without damaging the internal cerebral veins and the basal veins of Rosenthal. For all the patients except one, a bipolar coagulation and suction was enough to remove the tumor. As for the remaining patient with cavernous angioma, a laser was used for the removal of the lesion.

Results

All the patients have survived the surgery with no complications. The two patients who presented tetraparesis before surgery

* *E-mail: zbikot1590@wp.pl*

did not improve neurologically. All the other patients did not have any neurological deficits. For three of the patients who presented diplopia or Parinaud's syndrome before surgery, the deficit was cured after the removal of the tumor. Histopathological examinations revealed pineocytoma in seven of the patients, pineoblastoma in three, PNET in six, glioblastoma multiforme (grade IV) in two, metastatic tumor from pulmonary cancer in two, cavernous angioma in one, and central neurinoma in one of them. For the tetraparetic patient with a large pineocytoma in the third and lateral ventricles, the tumor was macroscopically removed totally. For patients with malignant tumors, adjuvant therapy in the forms of chemotherapy and radiotherapy was followed after the surgical resection.

The follow-up studies have revealed all nine but one of the patients with benign lesion were alive 2 to 11 years after surgery with no symptoms of tumor recurrence. The one patient who had large pineocytoma and persistent tetraparesis died a year after surgery from non-cerebral reasons. The patient with cavernous angioma and tetraparesis did not improve neurologically and was still alive 5 years after surgery with no change in the neurological status. For the six patients with PNET, two died within the first 6 months after surgery, another two of them died 2 years after surgery, and the remaining two are still alive at the time of writing this article, being 7 and 22 months after surgery, respectively. For the two patients with grade IV glioblastoma, they died 8 and 11 months after surgery due to tumor recurrence. For the two patients with metastatic tumors, they died within 2 years after surgery from extracranial complications of pulmonary carcinoma. Lastly, two of the three patients with pineoblastoma are still alive at the time of writing this article, being 11 and 23 months after surgery, respectively. The remaining deceased patient died 2 years after the removal of pathological mass due to tumor recurrence with involvement of the cerebral trunk.

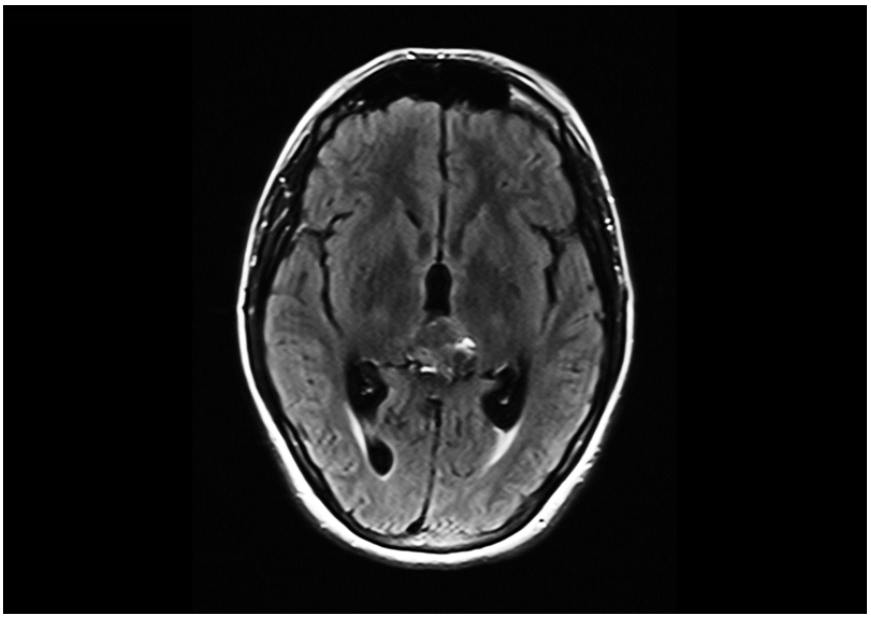

Figure 1. MR T1 axial image: tumor of the pineal area, PNET in histopathological examination

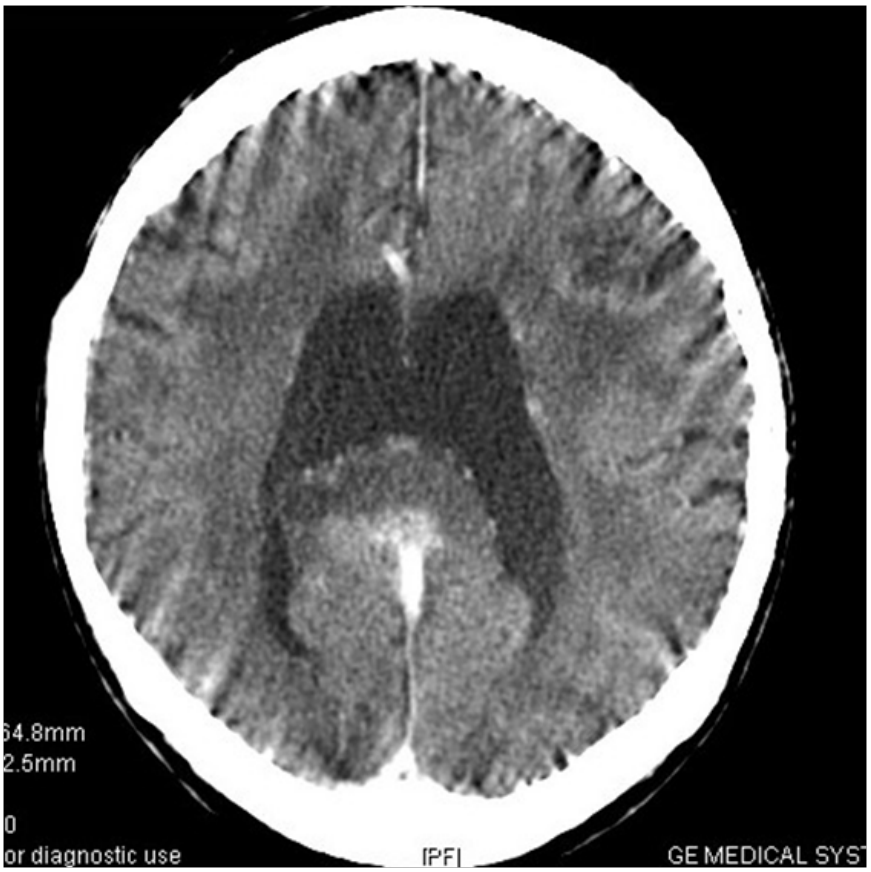

Figure 2. CT study axial view: large pineal area tumor involving the third ventricle with expansion to both lateral ventricles – benign pineocytoma.

Discussion

Pineal tumors are uncommon and mainly occur in children and adolescents. In adults, these

tumors are rare. Most pineal tumors originate from the pineal gland – pineocytoma and pineoblastoma [1-7, 24], some other tumors in this area are PNET, glial tumors, metastatic lesions, meningiomas, papillary tumors [1-8]. Other lesions such as central neurinoma [17,18] and cavernous angioma [13] are extremely rare.

In our study, pineocytomas, pineoblastomas and PNET are the most prevalent. In addition, there were also two patients with high grade gliomas, two with pulmonary carcinoma metastasis, one with central neurinoma, and lastly another one with cavernous angioma.

Surgical treatment of these tumors is the best method. The extensive variety of possible histological subtypes makes it imperative to establish a tissue diagnosis in patients with pineal region tumor. Management decisions regarding adjuvant therapy, prognosis, and follow-up strategies vary based on the histological diagnosis [2, 4, 5, 24]. The patients were healthy after total removal of the benign tumors in our study. For malignant lesions, surgery makes it possible to obtain histopathological diagnosis which is crucial for further oncological treatment [2, 4, 5]. For pineoblastoma, PNET or glioblastoma, the median time of survival is short - not exceeding 6 months. In some cases, the patients were alive even 5-7 years after surgical treatment followed by oncological therapy [2, 4, 5, 25]. Some authors have stated that radiotherapy following biopsy of the tumor can give very satisfactory results [1, 2, 4, 5], while the surgical removal of the tumor gives a longer survival time. However, it must be pointed out that radiotherapy does not give results which are comparable to the total resection of the tumor for benign lesions.

Several surgical approaches have been used [19-24]. Recently, some reports have shown very good results of treatment with minimally invasive surgical procedures such as key hole craniotomy [19,20] and endoscopic approach [25]. We prefer the minimally invasive approach – a small median suboccipital craniotomy together with the patient in a sitting position [26]. It allows a direct supracerebellar approach to the pineal area, and the deep cerebral veins can be seen and avoided easily. Despite the minimal skull opening, the operation field was big enough to remove the lesion and the resection was not limited by the exposure. With careful surgical manoeuvers, the eventual air embolism can be avoided easily, as well as those systemic pressure complications which could occur due to the sitting position [2,6]. No air embolism or blood pressure disturbances were observed in our patients. The amount of blood loss was minimal. We believe such approach allows the pineal area to be seen, as well as the whole third ventricle to be assessed fully if the removal of the pathological mass is complete.

The clinical symptoms of pineal area tumors are minor. The patients mainly present symptoms of obstructive hydrocephalus. For larger tumors, the symptoms of quadrigeminal plate involvement appear. Tetraparesis could occur in very large lesions. In our study, we have observed two very rare lesions in this area – central neurinoma and cavernous angioma.

We have observed no surgical complications - systemic or neurological. No patient was worsened after surgery. The follow-ups depend on the histopathological appearance of the lesions. For benign lesions, the patients were healthy after total removal.

Conclusion

Surgical treatment of pineal area tumors is the method of choice in the treatment of these lesions. With a minimally invasive subtentorial-supracerebellar approach, we did not observe any surgical complications in all of the 22 patients. The sitting position does not produce any systemic complications and its advantages allow this surgical approach to be a method of choice for surgery of the pineal gland area.

Declaration

The authors declare no conflicts of interest

References

[1] Sajko T., Kudelic N., Lupret V., Lupret V. Jr., Nola I.A., Treatment of pineal region lesions: our experience in 39 patients, Coll. Antropol., 2009, 33, 1259-1263.

[2] Motiei-Langroudi R., Sadeghian H., Soleimani M.M., Seddighi A.S., Shahzadi S., Treatment Results for Pineal Region Tumors: Role of Stereotactic Biopsy Plus Adjuvant Therapy vs. Open Resection, Turk. Neurosurg., 2016, 26, 336-40.

[3] Aboul-Enein H., El-Aziz Sabry A.A., Hafez Farhoud A., Supracerebellar infratentorial approach with paramedian expansion for posterior third ventricular and pineal region lesions, Clin. Neurol. Neurosurg., 2015, 139, 100-109.

[4] Lee J., Wakabayashi T., Yoshida J., Mamagement and survival of pineoblastoma: an analysis of 34 adults from the brain tor registry of Japan, Neurol. Med. Chir. (Tokyo), 2005, 45, 132-142.

[5] Biswas A., Mallick S., Purkait S., Roy S., Sarkar C., Bakhshi S., et al., Treatment outcome and patterns of failure in patients of non-pineal supratentorial primitive neurectodermal tumor: review of literature and clinical experience form a regional cancer center in north India, Acta Neurochir. (Wien), 2015, 157, 1251-1266.

[6] Yamamoto I., Pineal region tumor: surgical anatomy and approach, J. Neurooncol,, 2001, 54, 263-275.

[7] Thaher F., Kurucz P., Fuellbier L., Bittl M., Hopf N.J., Endoscopic surgery for tumors of the pineal region via a paramedian infratentorial supracerebellar keyhole approach (PISKA), Neurosurg. Rev., 2014, 37, 677-684.

[8] Bruce J.N., Ogden A.T., Surgical strategies for treating paients with pineal region tumors, J. Neurooncol., 2004, 69, 221-236.

[9] Stowe H.B., Miller C.R., Wu J., Randazzo D.M., Ju A.W., Pineal Region Glioblastoma, a Case Report and Literature Review, Front. Oncol., 2017, 12, 123.

[10] Sugita Y., Terasaki M., Tanigawa K., Ohshima K., Morioka M., Higaki K., et al., Gliosarcomas arising from the pineal gland region: uncommon localization and rare tumors, Neuropathology, 2016, 36, 56-63.

[11] Lassman A.B., Bruce J.N., Fetell M.R., Metastases to the pineal gland, Neurology 2006, 10, 1303-1304.

[12] Park J.H., Hong Y.K., Primary malignant melanoma in the pineal region, J. Korean Neurosurg. Soc., 2014, 56, 504-8.

[13] Sinson G., Zager E.L., Grossman R.I., Gennarelli T.A., Flamm E.S., Cavernous malformations of the third ventricle, Neurosurgery, 1995, 37, 37-42.

[14] Edson M.A., Fuller G.N., Allen P.K., Levine N.B., Ghia A.J., Mahajan A., et al., Outcomes After Surgery and Radiotherapy for Papillary Tumor of the Pineal Region, World Neurosurg., 2015, 84, 76-81.

[15] Inoue A., Ohnishi T., Kohno S., Ohtsuka Y., Nakamura Y., Mizuno Y., et al., Two cases of pineal-region meningiomas derived from arachnoid membrane over the vein of Galen without dural attachment, World J. Surg. Oncol., 2015, 13, 226.

[16] Maiti T.K., Nagarjun M.N., Arimappamagan A., Mahadevan A., Pandey P., Hemangiopericytoma of pineal region: case report and review, Neurol. India, 2014, 62, 460-462.

[17] Chen Ch.L., Shen Ch.Ch., Wang J., Lu Ch.H.., Lee H.T., Central neurocytoma: a clinical, radiological and pathological study of nine cases, Clin Neuro.l Neurosurg,, 2008, 110, 129-136.

[18] Messing-Junger A.M., Riemenschneider M.J., Reifenberger G., A 21-year-old female with a third ventricle tumor, Brain Pathol., 2006, 16, 87-88

[19] Kulwin C., Matsushima K., Malekpour M., Cohen-Gadol A.A., Lateral supracerebellar infratentorial approach for microsurgical resection of large midline pineal region tumors: techniques to expand the operative corridor, J. Neurosurg., 2016, 124, 269-276.

[20] Bonney P.A., Boettcher L..B, Cheema A.A., Maurer A.J., Sughrue M.E., Operative results of keyhole supracerebellar-infratentorial approach to the pineal region. J. Clin. Neurosci., 2015, 22, 1105-1110.

[21] Yağmurlu K., Zaidi H.A., Kalani M.Y., Rhoton A.L. Jr., Preul M.C., Spetzler R.F., Anterior interhemispheric transsplenial approach to pineal region tumors: anatomical study and illustrative case, J. Neurosurg., 2017, 13, 1-11.

[22] Mottolese C., Szathmari A., Ricci-Franchi A.C., Beuriat P.A., Grassiot B., The sub-occipital transtentorial approach revisited base on our own experience. Neurochirurgie, 2015, 61, 68-175.

[23] Sonabend A.M., Bowden S., Bruce J.N., Microsurgical resection of pineal region tumors, J. Neurooncol., 2016, 130, 351-366.

[24] Hernesniemi J., Romani R., Albayrak B.S., Lehto H., Dashti R., Ramsey C., et al., Microsurgical management of pineal region lesions: personal experience with 119 patients. Surg. Neurol., 2008, 70, 576-583.

[25] Gu Y., Hu F., Zhang X., Purely endoscopic resection of pineal region tumors using infratentorial supracerebellar approach: How I do it. Acta Neurochir. (Wien), 2016, 158, 2155-2158.

[26] Lindroos A.C., Niiya T., Randall T., Romani R., Hernesniemi J., Niemi T., Sitting position for removal of pineal region lesions: the Helsinki experience, World Neurosurg., 2010, 74, 505-513.