

## Technical Notes &amp; Surgical Techniques

Characteristics intracranial epidermoid cyst between two hospital from developed vs developing institution and literature review<sup>☆</sup>

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## ABSTRACT

**Introduction:** Intracranial epidermoid tumors are slow-growing lesions, which may recur after incomplete resection (surgery), but may do so over many years. These slow growing benign tumors encase and surround nerves and arteries rather than displacing them and the treatment of choice is radical surgery. Therefore the clinical symptoms are varies. The incidence of intracranial epidermoids is between 0.3% and 1.8% of all brain tumors. Whether the characteristics of tumor are related with culture of clinical neurologic in different developed and developing institution has not been discussed yet.

**Methods:** Between 2015 until 2017, we collected data from two institutions, Keio University hospital Tokyo Japan and Hasan Sadikin Hospital Padjadjaran University Bandung Indonesia. We collect 16 patients from Keio University hospital (KUH) and 10 patients from Hasan Sadikin hospital (HSH).

**Results:** In which the 11 cases is located in infratentorial and 5 cases were in supratentorial region at KUH. Meanwhile in HSH, we found that 10 patients were in infratentorial. The characteristic of cranial nerve palsy and/or neurological deficits are mainly similar in infratentorial region whether from KUH or HSH, including supratentorial epidermoid are also similar. At KUH, the location of epidermoid is located in the CPA (cerebellopontine angle) in 8 patients, 3 in suprasellar region, 1 in Meckel's cave, 1 in 4th ventricle, 1 in medulla, 1 in petroclival and 1 in occipital lobe. In HSH, the lesions are located in infratentorial in which 5 patient in CPA, 4 in petroclival region and 1 case in Meckel's cave. In infratentorial lesion the CNs (cranial nerves) palsy were found in CN IV, V, VI, VII, VIII, and none in IX, X, XI, XII. In supratentorial lesion the chief complaint was mainly headache.

**Conclusion:** The epidermoid of the brain are mostly located in the infratentorial region rather than in supratentorial. The CNs deficit are commonly arose in infratentorial lesion meanwhile the supratentorial region symptom is headache. It is reasonable if the patient came with infratentorial multiple CNs palsy to be suspicious for epidermoid benign tumor in the intracranial. Those characteristics are found in both developed and developing hospitals.

## 1. Introduction

Approximately 0.3–1.8% epidermoid is representing of all intracranial tumors. Intracranial epidermoid tumors are slow-growing lesions, which may recur after incomplete resection (surgery), but may do so over many years. They are frequently located in the supra-infratentorial mainly in cerebellopontine angle (CPA, 40%) and suprasellar cisterns (18%). and is less commonly located in sylvian fissure, cerebral and cerebellar hemispheres, and lateral and fourth ventricles. Symptoms are related with the location and the involvement of supra-

infratentorial cranial nerves (CNs) [1]. Nevertheless the surgical challenging is related with the cranial nerves involvement pre operatively. There are nine cranial nerves in the infratentorial, from CNs IV to XII and those CNs will present the symptoms if the tumor involving the nerves. Meanwhile in the supratentorial region the CNs that possibly to be involved in epidermoid cysts are CN III, IV, V, VI with the location in the parasellar region [3]. Epidermoid tumor commonly occurs within the third or fourth decade of life. These cysts are more commonly seen in men than women. Intracranial epidermoid cysts are well-circumscribed lesions [9].

<sup>☆</sup> This paper has not been presented or published previously.

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**Table 1**  
Keio University Hospital.

No	Gender	Location	Tentorial	Recurrence	Removal rate	Complication	Pre Op KPS	Post Op KPS
1	Male	Right Meckel's cave	Supratentorial	No	GTR	Yes	90	90
2	Male	Right CP angle	Infratentorial	No	GTR	Yes	80	70
3	Female	4th ventricle	Infratentorial	No	GTR	No	90	100
4	Female	Left CP angle	Infratentorial	No	GTR	Yes	60	50
5	Male	Left CP angle	Infratentorial	No	GTR	Yes	100	90
6	Male	Midline suprasellar	Supratentorial	no follow-up data	GTR	No	80	100
7	Male	Occipital lobe	Supratentorial	Yes	STR	No	80	80
8	Male	Medulla	Infratentorial	Yes	STR	No	100	100
9	Female	Midline suprasellar	Supratentorial	Yes	STR	No	100	100
10	Female	Right petroclival	Infratentorial	Yes	STR	No	100	100
11	Male	Right CP angle	Infratentorial	Yes	STR	Yes	90	90
12	Male	Left CP angle	Infratentorial	No	GTR	Yes	100	100
13	Female	Left CP angle	Infratentorial	Yes	STR	No	100	100
14	Male	Bilateral CP angle	Infratentorial	Yes	PR	No	100	90
15	Male	Midline suprasellar	Supratentorial	Yes	PR	No	100	100
16	Female	Right CP angle	Infratentorial	No	GTR	No	90	100

Note: GTR = Gross total removal, STR = Subtotal removal, PR = Partial removal, KPS = Karnofsky Performance Score.

**Table 2**  
Hasan Sadikin Hospital.

No	Gender	Location	Tentorial	Recurrence	Removal rate	Complication	Pre Op KPS	Post Op KPS
1	Female	Right petroclival	Infratentorial	Yes	STR	No	70	80
2	Male	Left petroclival	Infratentorial	Yes	STR	No	70	70
3	Female	Left petroclival	Infratentorial	Yes	STR	No	100	100
4	Male	Left CP angle	Infratentorial	Yes	STR	Yes	90	90
5	Male	Right CP angle	Infratentorial	No	GTR	Yes	100	100
6	Male	Right CP angle	Infratentorial	No	STR	No	100	100
7	Male	Left Meckel's cave	Supratentorial	No	GTR	Yes	90	90
8	Female	Left CP angle	Infratentorial	No	GTR	Yes	80	70
9	Male	Left CP angle	Infratentorial	No	GTR	Yes	90	90
10	Male	Right petroclival	Infratentorial	No	GTR	Yes	90	100

Note: GTR = Gross total removal, STR = Subtotal removal, KPS = Karnofsky Performance Score.

Epidermoid cysts are having a similar growth pattern of the epidermal cells of the skin and develop from remnants of epidermal elements during closure of the neural groove and disjunction of the surface ectoderm with neural ectoderm between the third and fifth weeks of embryonic life. These epidermoid contain cheesy and flaky white soft putty like contents. These slow growing benign tumors encase and surround nerves and arteries rather than displacing them and the treatment of choice is radical surgery. Therefore the clinical symptoms and surgical technique are varies. In developed countries, the early diagnostic can be obtained immediately compare to those from developing countries, so that in this study we try to investigate the clinical characteristics between both hospitals.

## 2. Methods

Between 2015 until 2017, we collected data from two institutions, Keio University hospital Tokyo Japan and Hasan Sadikin Hospital Padjadjaran University Bandung Indonesia. We collect 16 patients from Keio University hospital (KUH) and 10 patients from Hasan Sadikin hospital (HSH). We reviewed the medical record before and after surgery.

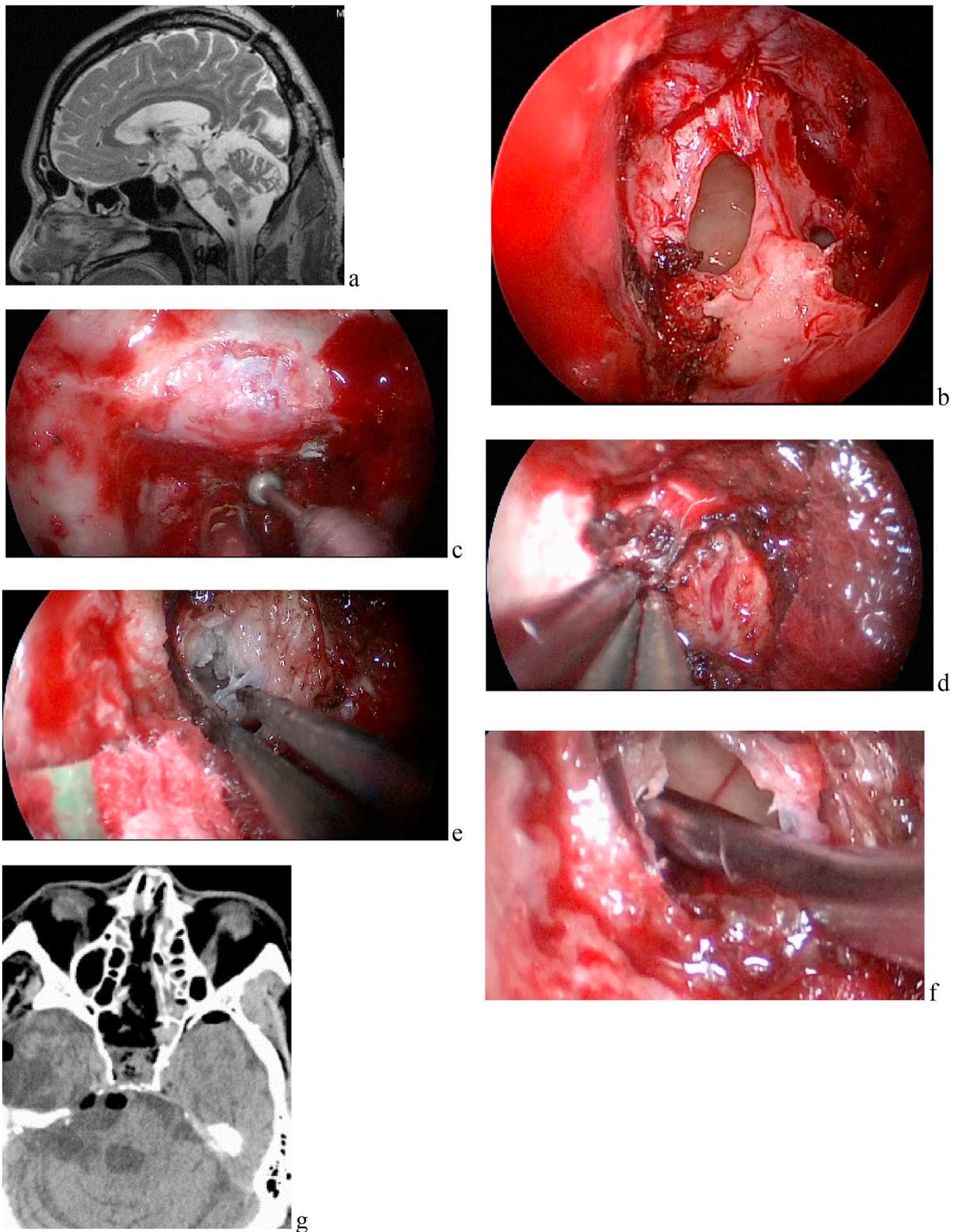
## 3. Results

The gender was male in 10 patients, in which the 11 cases is located in infratentorial and 5 cases were in supratentorial region at KUH. Meanwhile in HSH, we found that 9 patients were in infratentorial. The characteristic of cranial nerve palsy and/or neurological deficits are mainly similar in infratentorial region whether from KUH or HSH, as well as in supratentorial epidermoid. At KUH, 10 patients are male and

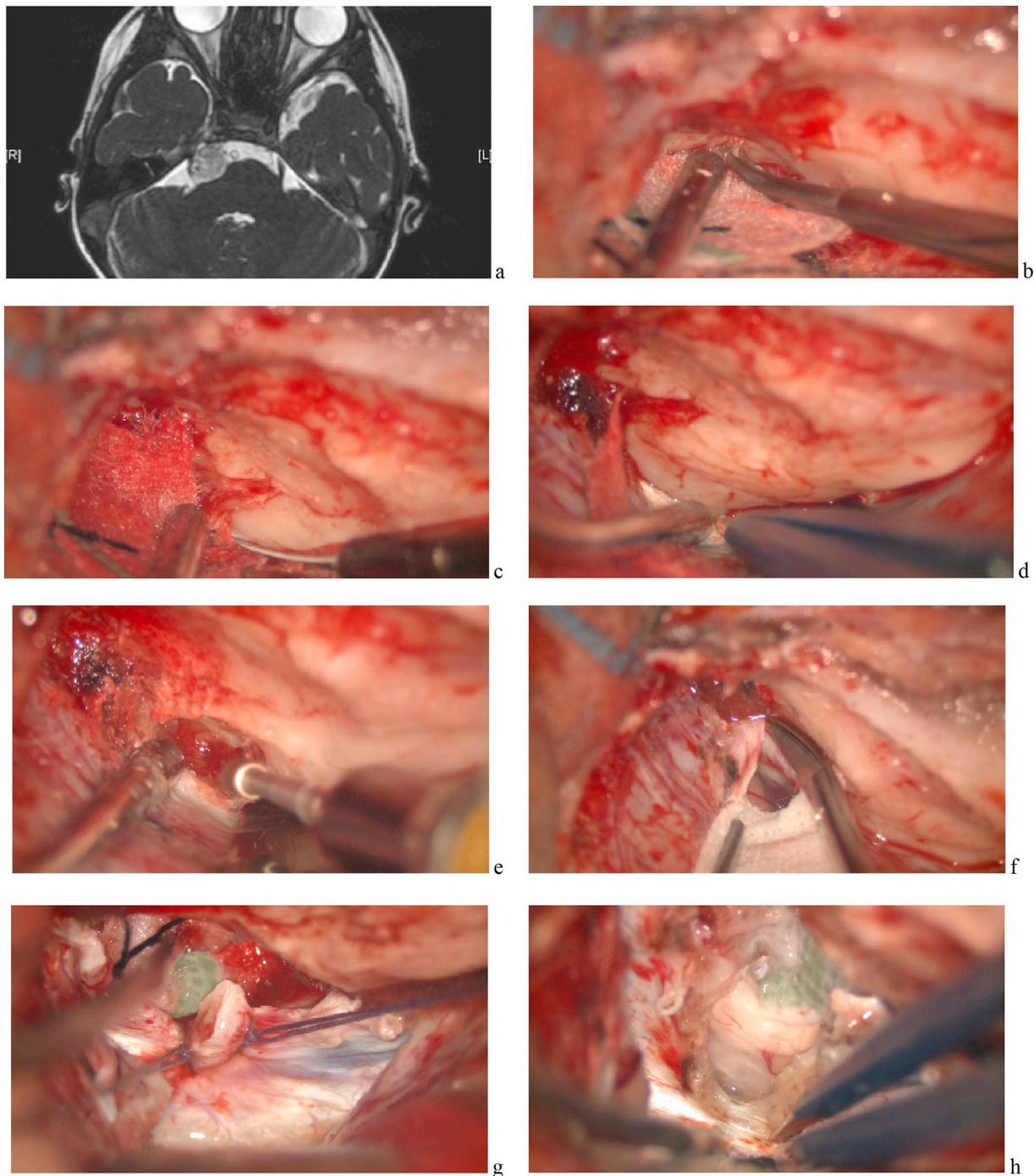
the location of epidermoid is located in the CPA (cerebellopontine angle) in 8 patients, 3 in suprasellar region, 1 in Meckel's cave, 1 in 4th ventricle, 1 in medulla, 1 in petroclival and 1 in occipital lobe (Table 1). In HSH, dominated also by male in 7 patients. The lesions are located in infratentorial in which 5 patient in CPA, 4 in petroclival region and supratentorial in 1 case in Meckel's cave. In infratentorial lesion the CNs (cranial nerves) palsy were found in CN IV, V, VI, VII, VIII, and none in IX, X, XI, XII. In supratentorial lesion the chief complaint was mainly headache (Table 2).

In KUH, from 16 patients, there were 8 patients with gross total removal, 6 patients subtotal removal and 2 patients partial removal. The recurrent patients were 8 and 7 with no recurrent but 1 patient was not be able to followed up. Although the gross total removal was achieved in 8 patients, 6 patients with subtotal removal and 2 patients with partial removal but the recurrent case still occurs in subtotal and partial tumor removal. The 6 cases are having complication after surgery. The surgical techniques in KUH were using endonasal transphenoidal surgery (Fig. 1) and microsurgery (Fig. 2). The choice of technique was depending on the tumor location. Based on the Karnofsky performance scoring (KPS) pre-operative and post-operatively, in KUH, 3 patients were improved, 9 patients had similar KPS and 4 patients were decreased, although the decreasing score not more than 10 point (Table 1).

In HSH from the 10 cases 50% (5 cases) were in gross total removal and 5 cases were in subtotal removal. There were 6 cases with complications after surgery. In HSH, all patients were underwent microsurgical technique for tumor removal (Fig. 3). There were 2 patients were having improvement in KPS, 7 patients had similar KPS and 1 patient was decreased (Table 2).



**Fig. 1.** Endonasal Transphenoidal surgery at Keio University Hospital. a) MRI imaging showing hyperintense inhomogenously mass in T2, suggested epidermoid, b) showing ostium sphenoid in nasal phase, c) drilling sellar floor, d) opening the duramater, e) removing the epidermoid, f) tumor removed, g) CT post operative showed gross total removal.



**Fig. 2.** Microsurgery by anterior transpetrosal approach (Kawase approach) at Keio University Hospital.

a) MRI imaging showing hyperintense inhomogenously mass in T2, suggested epidermoid, b) Cutting middle meningeal artery, c) dissecting and preserving GSPN (greater superficial petrosal nerve), d) exposing petrous apex (Kawase's triangle), e) drilling petrous apex, f) opening temporal lobe duramater, g) ligating superior petrosal sinus, h) cutting tentorium, i) removing epidermoid medial to trigeminal nerve, j) mobilizing trigeminal nerve to remove the tumor, k) tumor removed gross totally, l) CT scan post operative, tumor removed.

#### 4. Discussion

The goal of surgical treatment was complete removal of the tumor with its capsule. However, if it was difficult to separate The capsule in places where it adhered closely to nerves, vessels or the brainstem, small fragments of the capsule were left to avoid the risk of serious neurological deficits due to inadvertent damage to these structures [4].

Epidermoid cysts are benign, usually congenital brain tumors that

are formed between 3 and 5 weeks of fetal life due to abnormal trapping of ectodermal cells, later developing into the epidermis, within the nervous tissue during neural tube closure. During the same period of embryogenesis, the otic and optic vesicles are also being formed, and inclusion of ectodermal cells within these structures results in the most common intracranial location of epidermoids, i.e. in the cerebello-pontine angle and in the parasellar region [2,8]. It is suspected, that cysts located within the fourth ventricle result from ectodermal cell

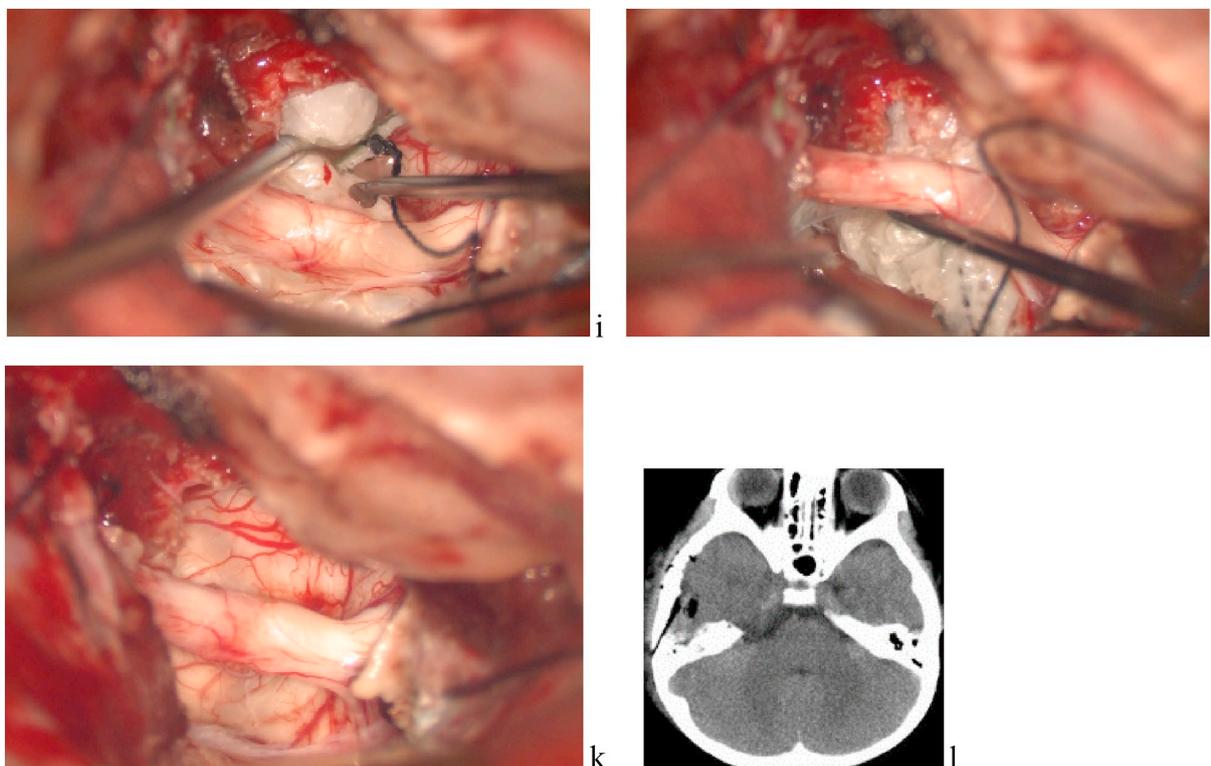


Fig. 2. (continued)

misplacement before neural tube closure, and cysts located epidurally or within the diploe are formed after neural tube closure [8]. The incidence of epidermoid cysts has been estimated at about 1% of all brain tumors [6]. Nearly half of them occur in the cerebellopontine angle and they are the third most common brain tumors in this location after schwannomas and meningiomas, comprising 5–7% of tumors in this region [13].

Whereas long-term survival is generally good in patients with epidermoid tumors, due to their indolent growth pattern, recognition and proper diagnosis is important. Unlike more liquid cysts, which may be evacuated using a less extensive approach, maximal removal of epidermoid tumors requires adequate exposure to allow capsular resection when possible. Although relief of mass effect and debulking is usually sufficient for management of epidermoid tumors, capsular resection decreases regrowth and malignant transformation, a rare phenomenon related to a subtotal excision of the cystic wall and an inflammatory response to recurrent cystic rupture or foreign body reaction, and also prevents recurrences, which were reported in 4.5% in a group of patients with 79.5% total or subtotal resection and a median follow-up duration of 8 years. This becomes a significant factor mainly in those patients whose original surgery was performed in younger ages because it tends to reoccur after many years or decades [5,7,10–12].

In both hospitals, the initial presentation of these slow-growing cysts is related to its local mass effect, such as hearing impairment, trigeminal neuralgia, facial palsy, diplopia, headaches, seizures and altered mental status [10]. The KPS (Karnofsky Performance Score) are not significantly different in both institution, 25% (4 cases of 16 patients) in KUH and 10% (1 case of 10 patients) in HSH. Complications are seems related with many factors such as location of tumors, experiences, tools and so on, in KUH 6 patients (37.5%) in which all

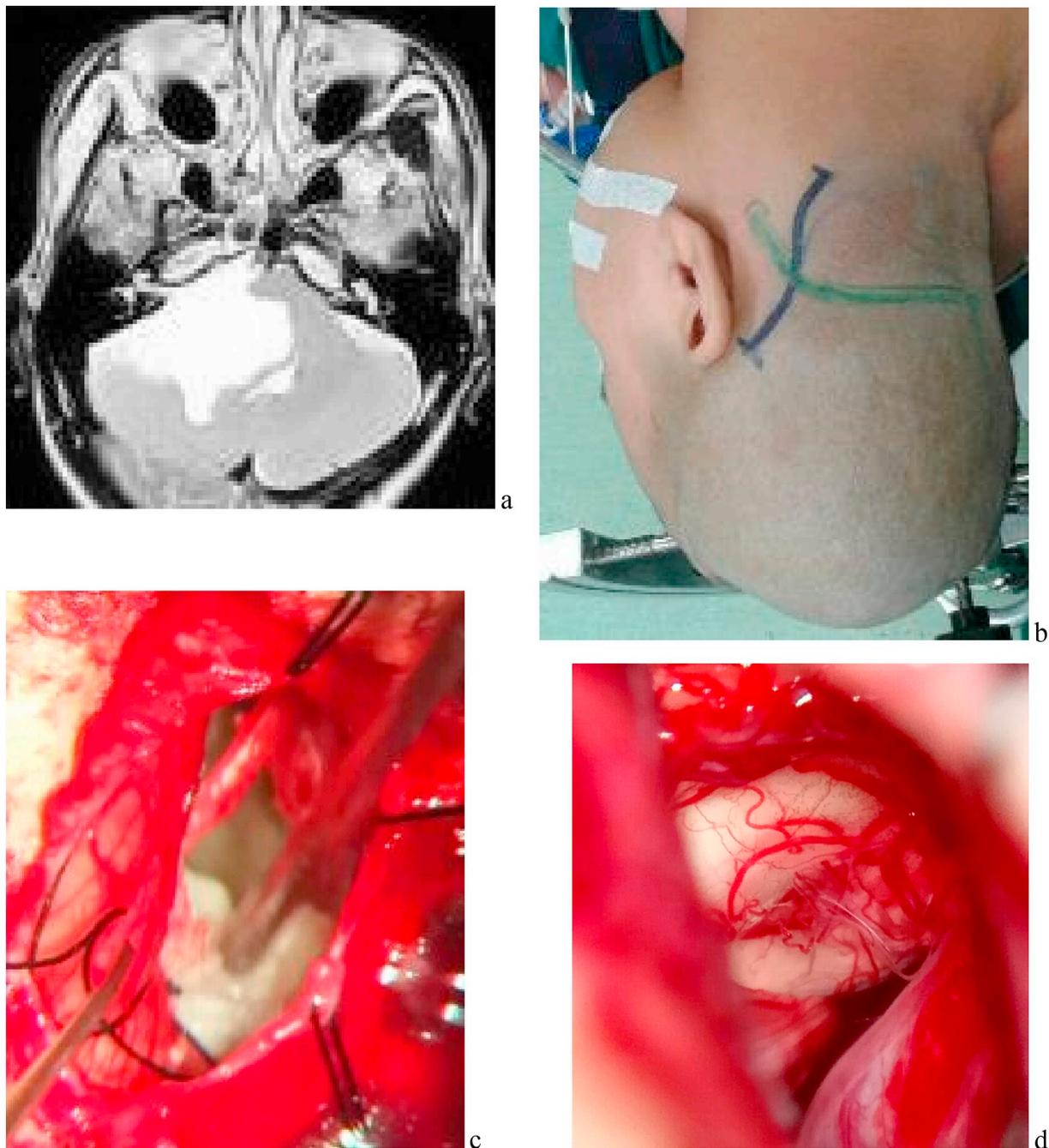
patients improved during the times, meanwhile in HSH they have 6 patients (60%) with complications but 4 patients were improved and 2 remained neurological deficits of abducens and facial palsy. It is reasonable due to no availability intraoperative monitoring during surgery in HSH. The endoscopic endonasal approach was not performed in Hasan Sadikin Hospital since the tools was not available in this hospital.

## 5. Conclusion

We have collected data of epidermoid patients and studied in both developed and developing institutions. The epidermoid of the brain are mostly located in the infratentorial region rather than in supratentorial. The CNs deficit commonly arose in infratentorial lesion meanwhile the supratentorial region symptom is headache. It is reasonable if the patient came with infratentorial multiple CNs palsy to be suspicious for epidermoid benign tumor in the intracranial. Those characteristics are found in both developed and developing hospitals. The initial symptoms and clinical course are the same in both hospital however the advanced technology and strategy may give the difference KPS as well as complication rate after surgery. It was unavoidable that the multimodal instruments usage may give a better outcomes in epidermoid tumor removal.

## Author contributions

Conception and design: Agung Budi Sutiono. Acquisition of data: all authors. Critical revising the article: Agung Budi Sutiono, Masahiro Toda, Kazunari Yoshida.



**Fig. 3.** Epidemoid tumor removal at Hasan Sadikin Hospital.

a) MRI imaging showing hyperintense inhomogenously mass in T2, suggested huge epidermoid, b) retrosigmoid skin incision and position, c) removing the tumor, d) Tumor removed.

#### Declaration of Competing Interest

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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