Review of an 11-year Experience in Retrosigmoid Approach for Treatment of Acoustic Neuromas

Su Lone Lim, MRCSED, Albert Wong Sii Hieng, FRACS

Department of Neurosurgery, Sarawak General Hospital, Jalan Tun Ahmad Zaidi Adruce, Kuching, Sarawak 93586, Malaysia

SUMMARY

This study reviews surgery on acoustic neuromas by the second author using retrosigmoid approach from January 2000 to June 2010 in the state of Sarawak. There was a total of 32 patients in this study. The commonest presenting symptom was hearing loss (81.3%), followed by headache and tinnitus (each 37.5%), ataxia (34.4%) and facial numbness (21.9%). Twenty-seven patients (84.4%) had large tumor (≥ 3cm) while 5 patients (15.6%) had medium size tumor (1.5-2.9cm). The mean tumor size was 3.6 cm. Facial nerve outcome was good to moderate in 93.7% (House and Brackmann Grade I-IV). The most common complications were CSF leak with 3 patients(9.4%) and facial numbness with 2 patients(6.3%). All either resolved with treatment or improved. There was no mortality. Excision of acoustic neuromas using retrosigmoid approach could achieve acceptable facial nerve outcome with a low incidence of morbidity without mortality.

KEY WORDS:
Acoustic neuroma, vestibular schwannoma, retrosigmoid, cerebellar oedema, developing country

INTRODUCTION

Acoustic neuromas or vestibular schwannomas are benign tumours that arise from the Schwann cells of the vestibular branch of the Vestibulocochlear nerve (CN VIII). The incidence is approximately 1 per 100,000 person-years[1]. These are slow growing tumours with an average growth rate of approximately 2mm per year[2]. In Sarawak, patients tend to present late with large tumours. A large tumour causes compression on the brainstem and making excision a surgical expediency. The development of microsurgical techniques and intra-operative facial nerve monitoring had greatly improved the surgical outcome and thus the quality of life especially with preservation of facial nerve[3,4]. Most patients regard facial nerve function as the most important indication of surgical success[5]. Acoustic neuroma excision via retrosigmoid approach is one of the approaches utilized by the neurosurgeons in the absence of the translabyrinthine service.

OBJECTIVE

This study reviews the acoustic neuromas that were operated by the second author in Sarawak over an 11-year period. It also provides the demographics, presenting features and the outcome of this group of patients in a developing country.

MATERIALS AND METHODS

This study used both retrospective and prospective data collection on acoustic neuroma cases operated by the second author from January 2000 to June 2010. All the cases were operated via retrosigmoid approach with intraoperative facial nerve EMG monitoring. Hearing preservation was not a consideration as most of the patients had lost their hearing prior to surgery. Patients with Neurofibromatosis type II were excluded. Final diagnoses were all histopathologically confirmed schwannomas. Patients' presenting symptoms, CT/MRI findings and postoperative facial nerve function and postoperative complications were analyzed.

Facial nerve function was assessed using the House-Brackmann (H-B) Grading System[6]. Various authors used different measurements to categorize tumour size[7-10] (Table I). The tumor size in this study was measured using the largest single pre-operative tumour diameter and it was classified as intracanalicular, <1.5cm, 1.5-2.9cm and ≥3cm based on the classification of tumour size by Briggs RJ *et al*[7]. The tumour remnant was assessed using the largest postoperative surface area of the residual compared to the largest preoperative surface area of the tumour from the contrasted axial MRI scans. This was calculated as the percentage of the former compared to the later.

RESULTS

A total of 38 patients with acoustic neuromas were operated in this 11-year period. However, 6 patients were excluded as 3 patients had incomplete data collection and another 3 were patients with NF II. Hence a total of 32 patients with 25 females and 7 males were analyzed in this study. The mean age was 50.4 years (range 28-69). It occurred slightly more often on the left side (left: right = 20:12). The mean follow up was 40.1 months.

The commonest presenting symptom was hearing loss (81.3%), followed by headache and tinnitus (each 37.5%), ataxia (34.4%), facial numbness (21.9%), dizziness (15.6%), facial weakness (12.5%), visual impairment (6.3%) and others. This is displayed in Table II. The mean duration of symptoms was 36 months and the longest being 11 years.

Table III shows the tumour size distribution. Twenty-seven patients (84.4%) had large tumor (≥3cm) while 5 patients (15.6%) had medium size tumor (1.5-2.9cm). The mean tumor size was 3.6 cm (range 1.5-5.2cm). There was neither intracanalicular tumour nor tumour <1.5cm in this series.

This article was accepted: 29 March 2013
Corresponding Author: Albert Wong Sii Hieng, Department of Neurosurgery, Sarawak General Hospital, Jalan Tun Ahmad Zaidi Adruce, Kuching, Sarawak 93586, Malaysia Email: wonghm96@yahoo.com

There were only 2 cases that needed ventriculoperitoneal shunts for hydrocephalus. The first case came to us for the excision with a prior shunt insertion. One case had an external ventricular drainage prior to the tumour excision. The hydrocephalus resolved after the tumour excision subsequently.

FACIAL NERVE OUTCOME

This study shows that 68.7% patients had good facial nerve outcome (H-B grade I-II), 25.0% patients had moderate outcome (H-B grade III-IV) and 6.3% patients got a poor outcome (H-B grade V-VI). Overall 93.7% of the patients had a good to moderate facial nerve function (H-B grade I-IV). This is shown in Table IV. Table V illustrates the analysis of facial nerve outcome versus tumour size.

Of the 27 patients with large tumour (≥3cm), 20 (74.1%) patients had a good facial nerve outcome, 5 (18.5%) with moderate and 2 (7.4%) had a poor outcome. This is displayed in Table VI. Twelve patients of this group(≥3cm) had complete excision with 70% good, 20% moderate and 10% poor outcome. Two of the <3cm tumour with complete excision had a good and moderate outcome respectively.

POSTOPERATIVE COMPLICATIONS

A summary of the complications is shown in Table VII. The most common problem encountered was CSF leak, it occurred in 3 patients (9.1%). They were resolved with lumbar drain insertion. Two patients (6.3%) with postoperative facial numbness and 1 patient (3.1%) each developed lower limb deep vein thrombosis (DVT), cerebellar signs, Abducens nerve palsy, wound infection and cerebellar oedema (the case illustration). All resolved with treatment or improved. There was no mortality in this series.

Postoperative scans during the follow up period showed there were 14 cases (44%) with complete excision. The average tumour remnant was 4.2% for the rest of the 18 patients. Two patients with residual tumour were treated with radiosurgery for tumour recurrence during the follow up and the tumours remained static 10 years after surgery.

CASE ILLUSTRATION

A 69 years old lady presented with a left sided hearing loss for 5 years in 2002. However she refused treatment.

In 2007 she deteriorated with worsening gait and a left facial numbness. The MRI scan showed a 3 cm tumour with obstructive hydrocephalus. This is shown in Figure 1. She underwent a left retrosigmoid craniotomy and excision of the acoustic neuroma on the 1 October 2007 with facial nerve monitoring and ultrasonic aspiration device. The tumour was completely excised with preservation of the facial nerve without sacrificing any veins. The postoperative CT scan showed complete excision with a small haematoma(1 cm) at the tumour bed in Figure 2.

She required a ventriculoperitoneal shunt on day eight. Her Glasgow Outcome Scale (GCS) was fifteen and her left facial nerve function was normal (H-B grade I). On the postoperative day twelve, she started to have right sided body weakness but her GCS remained fifteen. CT brain was repeated which showed a slightly larger left cerebellar hemorrhage (1.5cmx1.5cm) with surrounding oedema. This is shown in Figure 3. Subsequent CT brain 4 days after the onset showed that the brainstem and cerebellar oedema was more extensive as shown in Figure 4. CT brain with contrast showed no sinus thrombosis.

She became very sick and an emergent posterior fossa decompressive craniectomy was performed on the same day. Her GCS remained poor with E1VtM2 immediately after operation. Her right pupil was fixed and dilated and the left pupil was small but very sluggish. She had a tracheostomy and the family was informed of the worse outcome scenario. Further investigations with CT angiogram and MRI scan did not review any vertebro-basilar artery dissection nor thrombosis as a cause for the cerebellar swelling and haemorrhage. However, she started to improve twelve days later until discharge. When was seen 10 months later she was walking normally with complete facial nerve preservation (H-B grade I). It was postulated with the full recovery of the patient that this might be a case of venous ischaemia albeit not from the dural main sinuses.

DISCUSSION

The main objective of the surgery is the complete excision of the tumour whenever possible without compromising patient life and postoperative quality of life[7]. This includes preservation of facial nerve function and other neurological functions.

Intraoperative facial nerve monitoring is essential in all cases especially in large tumours[11-14]. All of the cases were operated using retrosigmoid approach with intraoperative EMG facial nerve monitoring. All patients had objective signals except for a case of incorrect wire connection. After adequate time for the muscle relaxant to wear off some of the early loss of signals invariably returned. Initial CSF drainage, bone resection to the sigmoid sinus with minimal cerebellar retraction are crucial during the early part of the operation[14,15].

This study shows that using retrosigmoid approach, 68.7% patients obtained good facial nerve function, 25.0% with moderate outcome and 6.3% with poor outcome. Overall, 93.7% of the patients had good to moderate facial nerve function. Of the 27 patients with large tumour (≥3cm), 74.1% patients had good facial nerve function. Larger reported series also show good facial nerve outcome for large tumour using retrosigmoid approach[7-10,13,16]. There were 4 patients who presented with facial weakness. One of patients who was previously operated in another center, came with facial nerve palsy (H-B grade IV) with a small tumour (1.5x1cm), her facial nerve weakness remained unchanged postoperatively. For the remaining 3 patients, 2 of them improved by 1 grade and 1 remained unchanged postoperatively.

There were two previous reports in Malaysia on the operative treatment of acoustic neuroma. Azmi MN *et al.* previously reported facial nerve outcome with H-B grade I-IV in 93.2% using translabyrinthine approach[17]. Their tumours were

Table I: Different classification of tumour size

Briggs RJ[7] J Clin Neurosci 2000	Samii M[8] J Neurosurg 2006	Zhang X[9] J Clin Neurosci 2005	Misra BK[10] Neurol India 2009
Intracanalicular	T1 intrameatal		
Small < 1.5cm	T2 intrameatal and extrameatal		Small <2cm
Moderate	T3 a,b cerebellopontine cistern,		Medium 2-3cm
1.5 – 2.9cm	reaching brainstem		
Large ≥ 3cm	T4 a,b compression, dislocation brainstem and compress 4th ventricle	Large ≥ 4 cm	Large >3cm

Table II: Presenting symptoms

Symptoms	Number (percentage)
Hearing loss	26 (81.3%)
Headache	12 (37.5%)
Tinnitus	12 (37.5%)
Ataxia	11 (34.4%)
Facial numbness	7 (21.9%)
Dizziness	5 (15.6%)
Facial weakness	4 (12.5%)
Visual impairment	2 (6.3%)
Diplopia	1 (3.1%)
Dysphagia	1 (3.1%)
Ear pain	1 (3.1%)
Facial pain	1 (3.1%)
Facial spasm	1 (3.1%)
Hemiparesis	1 (3.1%)
Voice change	1 (3.1%)

Table III: Tumour size distribution

Tumour size	Number	Percentage (%)
Intracanalicular	0	0
Small < 1.5cm	0	0
Medium 1.5cm to 2.9 cm	5	15.6
Large ≥ 3cm	27	84.4

Table IV: Overall facial nerve function outcome

Facial nerve outcome	House-Brackmann Grade	Percentage	Percentage	Percentage
Good	H-B I	28.1%	68.7%	93.7%
	H-B II	40.6%		
Moderate	H-B III	9.4%	25.0%	
	H-B IV	15.6%		
Poor	H-B V	6.3%	6.3%	
	H-B VI	0		

Table V: Facial nerve outcome in relation to tumour size

Tumour size	House-Brackmann Grade					
	I	II	III	IV	V	VI
Intracanalicular	0	0	0	0	0	0
< 1.5 cm	0	0	0	0	0	0
1.5 – 2.9 cm	2	0	2	1*	0	0
≥ 3 cm	7	13	1	4	2	0
Percentage (%)	28.1	40.6	9.4	15.6	6.3	0

(*) This patient was preoperatively grade IV.

Table VI: Facial nerve outcome for large tumour (≥ 3cm)

Facial nerve outcome	House-Brackmann Grade	Number (Percentage)	Percentage	Percentage
Good	H-B I	7 (25.9%)	74.1%	92.6%
	H-B II	13 (48.1%)		
Moderate	H-B III	1 (3.7%)	18.5%	
	H-B IV	4 (14.8%)		
Poor	H-B V	2 (7.4%)	7.4%	
	H-B VI	0		

Table VII: Complications

Problems	Number (percentage)
CSF leak	3 (9.4%)
Facial numbness	2 (6.3%)
Abducens nerve palsy	1 (3.1%)
Cerebellar oedema	1 (3.1%)
Cerebellar signs	1 (3.1%)
Lower limb DVT	1 (3.1%)
Wound infection	1 (3.1%)

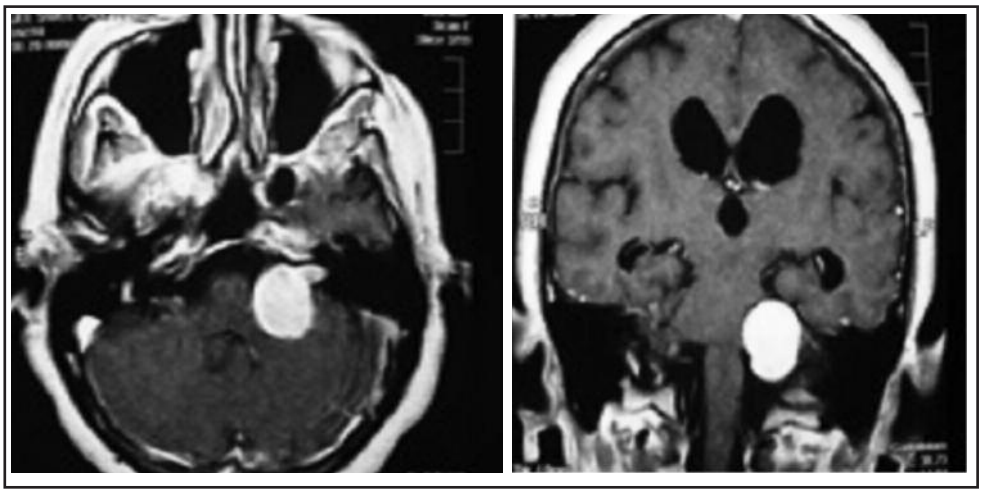

Fig. 1: Preoperative MRI brain scan shows the left acoustic neuroma.

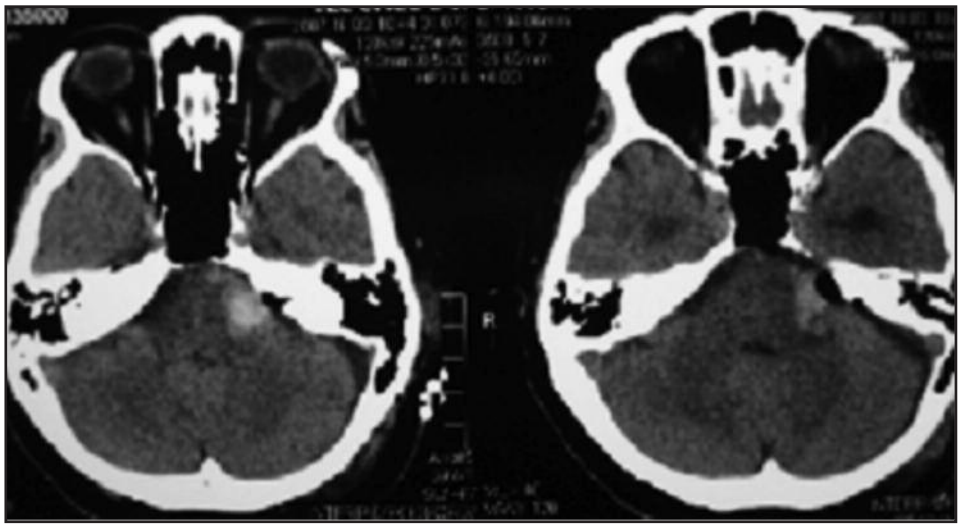

Fig. 2: CT brain post operative day one shows a small haematoma(1 cm) at the tumour bed.

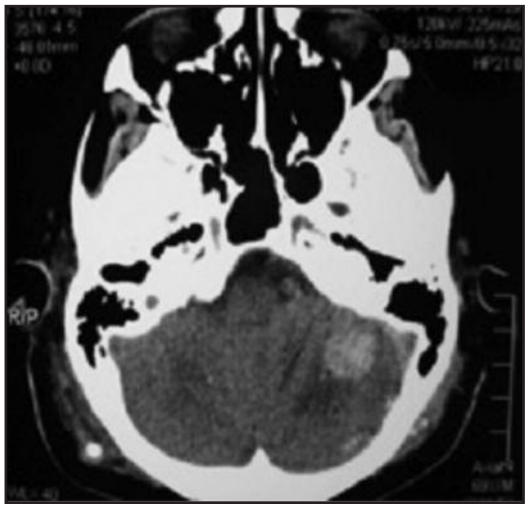

Fig. 3: CT brain on day twelve when patient developed right sided weakness shows a slight increase in oedema and haematoma(1.5cm) in the left cerebellum

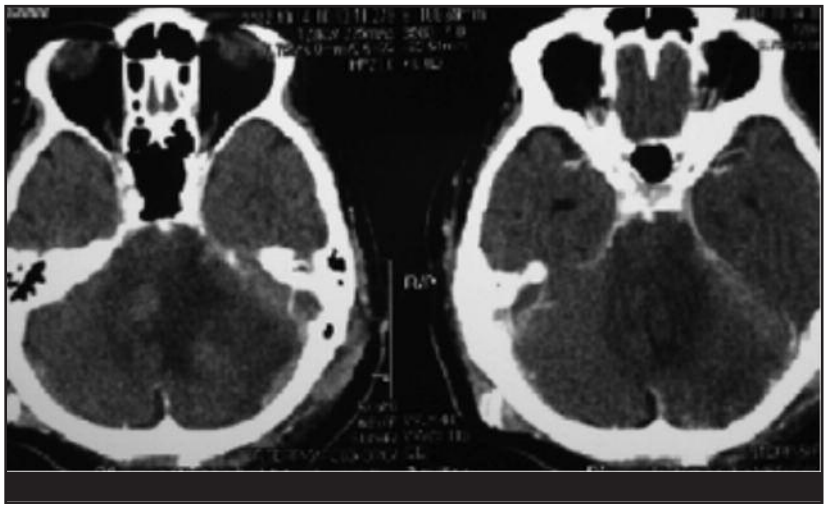

Fig. 4: CT brain 4 days after the onset of deterioration shows worsening oedema of the brainstem and cerebellum.

almost all intracanalicular. Philip R *et al.* reported a good to acceptable facial nerve outcome (H-B grade I-IV) in 62% using either retrosigmoid (56%) or translabyrinthine approach (44%)[18]. All their tumours were larger than 2 cm. On the other hand, in the absence of translabyrinthine service in Sarawak, excision of acoustic neuroma via retrosigmoid approach is the option used. This is the only series locally where only retrosigmoid approach is used for all the cases in contrast to the two previous reports.

Patients with acoustic neuromas tend to be diagnosed late in Sarawak as evident by the mean duration of symptoms of 36 months and the longest being 11 years. In fact, most of them, 27 patients (84.4%) were diagnosed to have large tumour (≥ 3cm), with a mean tumour size of 3.6cm (1.5-5.2cm). These large tumours caused significant compression to the brainstem preoperatively. This could be attributed to the lack of awareness and knowledge in the disease itself of the general public or even the medical healthcare personnels locally.

Three (9.4%) of the patients developed CSF leak postoperatively. This was successful managed with lumbar drain insertion without open surgery. Other series reported incidence of postoperative CSF leak ranging from 2-11% [7-10,13,18]. There was neither devastating complication nor mortality in this study.

The illustrated case with cerebellar oedema showed that with perseverance and continous support the patient could still recover from an almost helpless situation. The literature review showed this is very uncommon. Crocker M. *et al.* reported a case of extensive venous sinus thrombosis following acoustic neuroma exicision using retrosigmoid approach. It was due to bone wax application to the emissary vein and the patient recovered fully [19]. Bone wax packing causing venous sinus thrombois was reported before[20]. However, there was neither bone wax packing nor venous sacrifice for the above-mentioned illustrated case. In fact her MRI scan did not review venous sinus thrombosis. This could have recanalised. Complications relating to venous sinus thrombosis after posterior fossa surgery were also reported using translabyrinthine or subocciptal approach[21].

There were a few limitations in the state during the early period. The first case was operated based on the CT scan alone as the hospital did not have a MRI machine and the patient was deteriorating. She recovered fully with H-B grade II facial nerve preservation. Instrumentation was limited and it was overcome by adaptations or use of borrowed equipment like the facial nerve monitor from other services. Despite severe limitation in ICU bed, post operative ICU care of the patient was insisted upon at least for the first few postoperative days.

There are several other constraints in this study. As this is both a retrospective review and a prospective study, the tracing of the notes and scans was a major challenge especially for the retrospective part. Three patients were excluded due to incomplete data collection but none of them had a post operative mortality. Some patients had difficulty in their follow up due to the great distance to the nearest neurosurgical clinic or their poor financial background. We had to send out our medical assistant to look for some of them in their villages. The facial nerve function assessment pre and post operatively was not blinded.

CONCLUSION

Our patients usually presented late with an average duration of symptoms of 36 months. The most common symptoms being hearing loss, headache and tinnitus.The House and Brackmann grade I-II facial nerve function for tumour ≥ 3cm was 74.1%. The overall patients with House and Brackmann grade I-IV facial nerve function outcome was 93.7% and for those with tumour ≥ 3cm was 92.6%. Cerebellar oedema can result in a serious morbidity but still a chance of full recovery. Retrosigmoid approach could be safely performed with acceptable facial nerve outcome without mortality.

ACKNOWLEDGEMENT

All the staff in our hospital who have worked hard to care for these patients and to Mr Carldrige for tracing some of the cases.

REFERENCES

1. Propp JM, McCarthy BJ, Davis FG, Preston-Martin S. Descriptive epidemiology of vestibular schwannomas. Neuro Oncol. 2006 Jan; 8(1): 1-11.
2. Selesnick SH, Johnson G. Radiologic surveillance of acoustic neuroma. Am J Oto. 1998; 19: 846-9.
3. Lassaletta L, Alfonso C, Del Rio L, Roda JM, Gavilan J. Impact of facial dysfunction on quality of life after vestibular schwannoma surgery. Ann Otol Rhinol Laryngol. 2006; 115: 694-8.
4. Marouf R, Noudel R, Roche PH. Facial nerve outcome after microsurgical resection of vestibular schwannoma. Prog Neurol Surg. 2008; 21: 103-7.
5. Ho SY, Hudgens S, Wiet RJ. Comparison of postoperative facial nerve outcomes between translabyrinthine and retrosigmoid approaches in matched paired patients. Laryngoscope. 2003; 113: 2014-20.
6. House J, Brackmann D. Facial nerve grading system. Otolaryngol Head Neck Surg. 1985; 93: 146-7.
7. Briggs RJ, Fabinyi G, Kaye AH. Current management of acoustic neuromas: review of surgical approaches and outcomes. J Clin Neurosci. 2000; 7: 521-6.
8. Samii M, Gergannov V, Samii A. Improved preservation of hearing and facial nerve function in vestibular schwannoma surgery via the retrosigmoid approach in a series of 200 patients. J Neurosurg. 2006; 105: 527-35.
9. Zhang X, Fei Z, Chen YJ, *et al.* Facial nerve function after excision of large acoustic neuromas via the suboccipital approach. J Clin Neurosci. 2005; 12: 405-8.
10. Misra BK, Purandare HR, Ved RS, Bagdia AA, Mare PB. Current treatment strategy in the management of vestibular schwannoma. Neurol India. 2009 May-Jun; 57(3): 257-63.
11. British Association of Otorhinolaryngologists – Head & Neck Surgeons Clinical Practice Advisory Group. Clinical Effectiveness Guidelines Acoustic Neuroma (Vestibular Schwannoma). BAO-HNS Document 5; Spring 2002.
12. Oka N, Yamakami I, Yamaura A. Consideration on intraoperative facial nerve monitoring – a newly designed facial nerve stimulator-monitor. Clin Pharmacol Ther. 1995; 5: 1315-9.
13. Yamakami I, Uchino Y, Kobayashi E, Yamaura A, Oka N. Removal of large acoustic neurinomas (vestibular schwannomas) by the retrosigmoid approach with no mortality and minimal morbidity. J Neurol Neurosurg Psychiatry. 2004 Mar; 75(3): 453-8.
14. Ojemann RG. Retrosigmoid approach to acoustic neuroma (vestibular schwannoma). Neurosurgery. 2001; 48: 553-8.
15. Chen L, Chen LH, Ling F, Liu YS, Samii M and Samii A. Removal of vestibular schwannoma and facial nerve preservation using small subocciptal retrosigmoid craniotomy. Chin Med J. 2010; 123(3): 274-80.
16. Zhao X, Wang Z, Ji Y, *et al.* Long-term facial nerve function evaluation following surgery for large acoustic neuromas via retrosigmoid transmeatal approach. Acta Neurochir (Wien). 2010 Oct; 152(10): 1647-52. Epub 2010 Jun 12.
17. Azmi MN, Lokman BS, Ishlah L. The translabyrinthine approach for acoustic neuroma and its common complications. Med J Malaysia. 2006 ; 61: 72-5.
18. Philip R, Prepageran N, Raman R, Jennifer LP, Waran V. Surgical management of large acoustic neuromas: A review. Med J Malaysia. 2009 Dec; 64(4): 294-7.
19. Crocker M, Nesbitt A, Rich P, Bell B. Symptomatic venous sinus thrombosis following bone wax application to emissary veins.Br J Neurosurg. 2008 Dec; 22(6): 798-800.
20. Hadeishi H, Yasui N, Suzuki A. Mastoid canal and migrated bone wax in the sigmoid sinus: technical report. Neurosurgery. 1995;36:1220-3; discussion 1223-4.
21. Keiper GL Jr, Sherman JD, Tomsick TA, Tew JM Jr. Dural sinus thrombosis and pseudotumor cerebri: unexpected complications of suboccipital craniotomy and translabyrinthine craniectomy. J Neurosurg. 1999; 91: 192-7.