

Original Article

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Surgery of Large Skull Base Meningiomas with the External Carotid Artery Ligation: Local Experience

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Abstract

The surgery for a large meningioma in the skull base region has high morbidity because of the difficulty to access location and the high vascularity of the tumor. With the recent development of microsurgery techniques and preoperative embolization, the tumor resection is more successful and less morbid. Yet preoperative embolization needs expertise on interventional neuroradiology that few hospitals in Thailand are equipped with. The author presented the experiences in using the ligation of the external carotid artery as an alternative.

In a retrospective descriptive study, ten patients with the large skull base meningiomas were treated by the ligation of the external carotid artery before the tumor resection in the same setting. The duration of operation, the completeness of tumor excision, blood loss, and intraoperative neurovascular injury were reviewed. The duration of the operation varied from 2 hours to 5 hours and 20 minutes. All had total removal of the tumors. Units of blood transfusion varied from 0 unit to 4 units. Only one case had an injury to the oculomotor nerve. With local experience, the ligation of the external carotid artery is an useful procedure for the patients with a large skull base meningioma in the setting that preoperative embolization is unavailable.

Key words: meningioma, skull base, external carotid artery ligation

Introduction

Skull base meningiomas are a group of tumors that grow along different areas under the brain or within the bottom part of the skull. The tumors once thought to be unresectable can be now accessible and operable. While the operative results for treating skull base meningiomas have been improved due to modern neuro-imaging and innovative microsurgical techniques, surgery is still accompanied by a high morbidity rate^(1,2,3,4,5). The surgical cure of a meningioma

needs the complete excision of the tumoral mass. Factors that can hinder complete resection include tumor hypervascularity (which can complicate and lengthen the operation), encasement of major arteries or cranial nerves, and tumor involvement of a dural venous sinus. The combination of preoperative transarterial embolization and recently developed skull base surgery contributes to the curability and preservation of neurological status. Yet preoperative embolization requires the expertise of an experienced interventional

radiology that few hospitals in Thailand are equipped with and an alternative is unavoidable. The external carotid artery ligation has been used to control the bleeding from various pathology of the head and neck^(6,7). The author chose it as an alternative and evaluate the 5-year experiences.

Methodology

In a retrospective descriptive study, medical records on ten patients with large skull base meningiomas (diameter greater than 3 centimeters) who underwent surgery at Ratchaburi Hospital during 2003 - 2007 were reviewed. The sites and sizes of the tumors were identified. Under general anesthesia, the ipsilateral external carotid artery had been identified and ligated at the site just distal to the origin of the superior thyroid artery before the operation for tumor

excision began. The information on times from the incision for the external carotid artery ligation to skin closure after the tumor excision was collected. The completeness of the tumor excision was noted. The degrees of intraoperative blood loss were compared by the units of blood transfusion with the threshold at the hematocrit 30 percent and the details of injuries to the neurovascular structures were recorded.

Results

Eight females and two males were the population. Age of the patients were between 20 and 78 years. The sites of the tumor were categorized into anterior skull base (3 cases) (Fig. A-1,A-2,A-3), lateral and middle sphenoid (4 cases) (Fig.L-1,L-2,L-3,L-4), medial sphenoid (2 case) (Fig.M-1,M-2) and en plaque sphenoid (1 case) (Fig.E-1). The duration of opera-

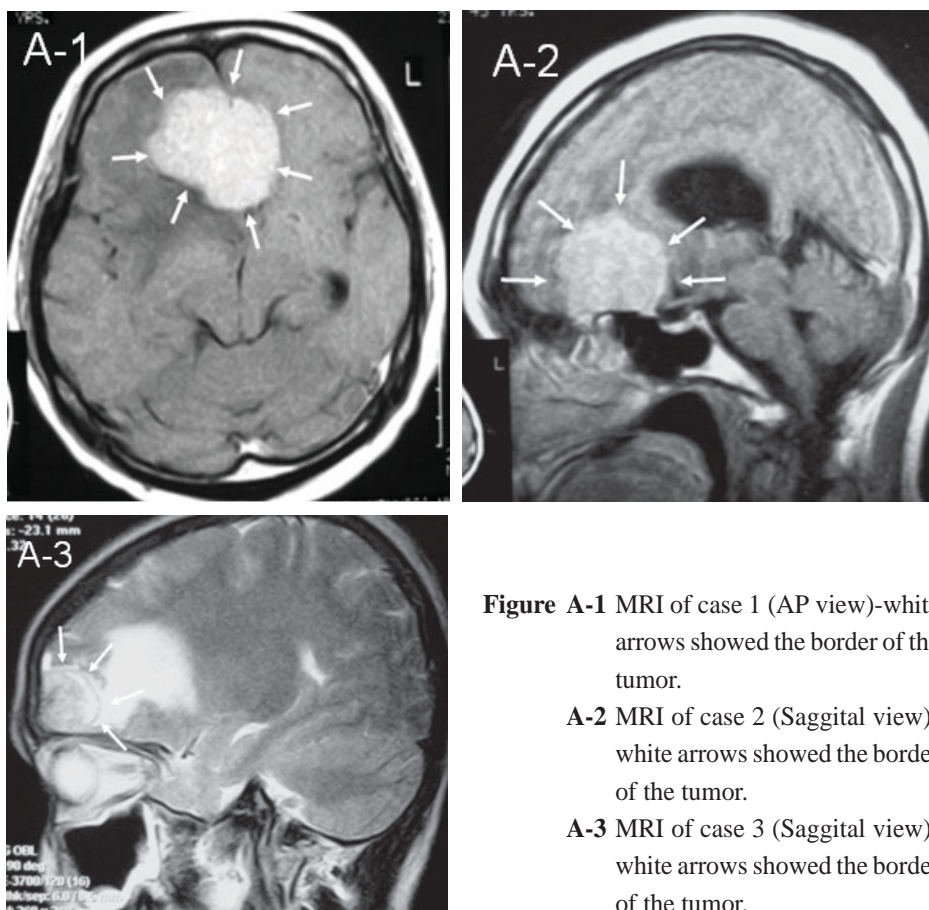


Figure A-1 MRI of case 1 (AP view)-white arrows showed the border of the tumor.
A-2 MRI of case 2 (Sagittal view)-white arrows showed the border of the tumor.
A-3 MRI of case 3 (Sagittal view)-white arrows showed the border of the tumor.

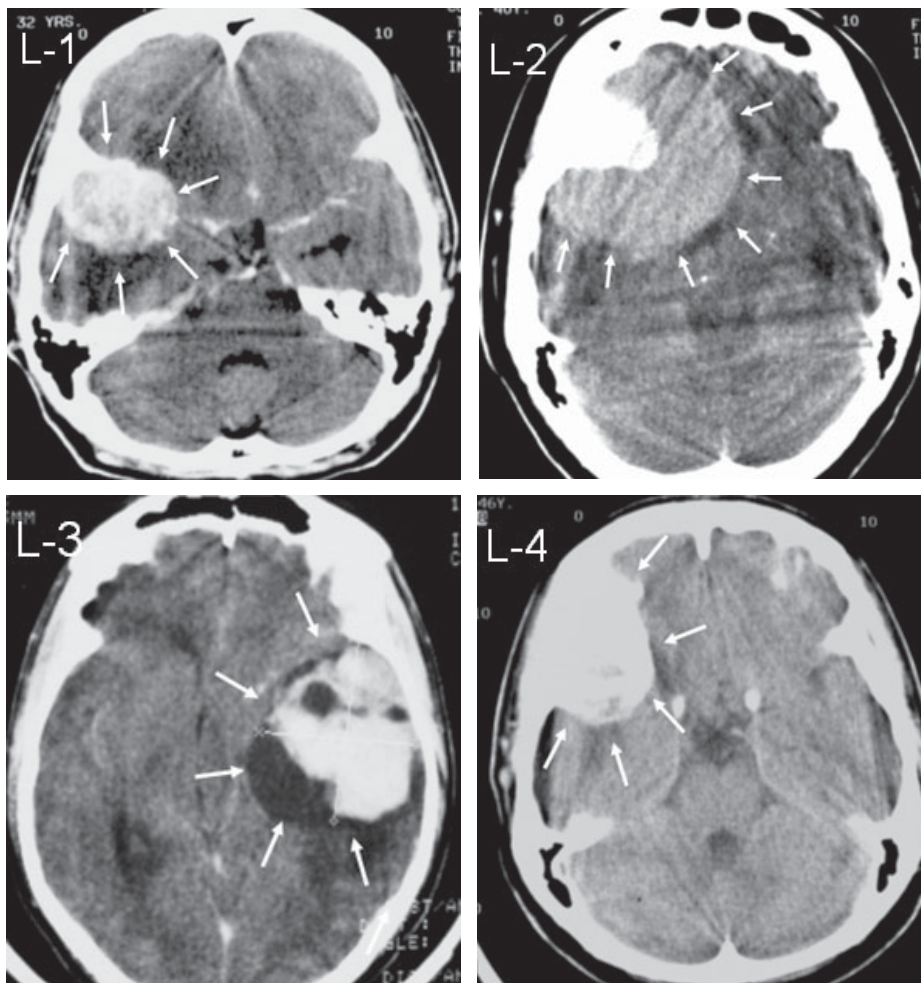


Figure L-1 CT scan of case 4 (AP view)- white arrows showed the border of the tumor.

L-2 CT scan of case 5 (AP view)- white arrows showed the border of the tumor.

L-3 CT scan of case 6 (AP view)- white arrows showed the border of the tumor.

L-4 CT scan of case 7 (AP view)- white arrows showed the border of the tumor.

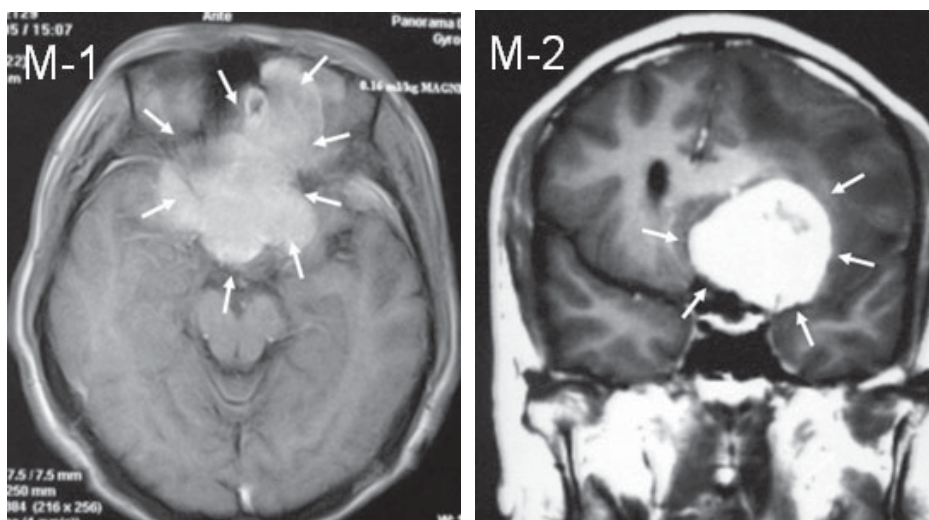


Figure M-1 MRI of case 8 (AP view)- white arrows showed the border of the tumor.

M-2 MRI of case 9 (Coronal view)- white arrows showed the border of the tumor.



Figure E-1 CT scan of case 10 (AP view-bone window)-white arrows showed hyperostosis of lateral sphenoid bone and lateral orbital bone underlying the En Plaque meningioma.

Table 1 Results of the recorded parameters.

Meningioma groups (sex/age-years)	Size (cm.)	Duration (hours/minutes)	Resection (units)	Transfusion	Injury
Anterior base					
1. F/37	6.0 × 5.2 × 6.2	4/15	total	4	no
2. F/78	5.4 × 4.3 × 5.0	2/10	total	2	no
3. F/44	3.2 × 3.2 × 3.5	2/00	total	0	no
Lat. & Mid. Sphenoid					
4. F/34	4.0 × 3.0 × 3.5	2/30	total	0	no
5. F/40	5.0 × 6.0 × 6.3	4/05	total	3	no
6. M/28	8.0 × 5.4 × 6.5	2/50	total	0	no
7. F/46	3.8 × 3.5 × 3.8	2/10	total	0	no
Medial Sphenoid					
8. F/50	5.0 × 7.2 × 7.5	5/20	total	2	CN III
9. M/21	5.0 × 4.2 × 4.0	3/45	total	0	no
En Plaque Sphenoids					
10. F/42	3.2 × 3.1 × 1.0	2/40	total	0	no

M = Male, F = Female, Lat. & Mid. = Lateral and middle, CN III = Oculomotor nerve

tion was shortest in the anterior skull base case (2 hour) and longest in the medial sphenoid case (5 hour and 20 minutes). In all 10 cases, the tumors were completely removed. As a result, there were no needs to receive blood tranfusion for 7 out of the 10 patients

and the maximum required amount was 4 units of packed red cells. In the case of medial sphenoid meningioma, ptosis developed after surgery due to the injury to the oculomotor nerve during the tumor resection. (Table 1)

Discussion

Preoperative embolization often indicates in surgery for hypervascular tumor especially in the skull base region⁽⁸⁾. Because meningiomas are usually quite vascular, devascularization of a tumor's blood supply can ease complete tumor resection by diminishing operative time and intraoperative blood loss. Preoperative embolization appears to be very useful in skull base meningioma^(9,10,11,12,13). It facilitates their surgical removal by reducing tumor vascularity. It has become the standard of care in the treatment of the tumors in many centers offering endovascular therapy. Meningiomas are primarily supplied by meningeal arteries which mainly are the branches of the external carotid system. The ligation of the external carotid artery can reduce the blood flow of the distal branches by approximately 60 percent⁽¹⁴⁾. With the limited facility, the author used the ligation as an alternative in stead of selective embolization in all 10 patients. The results were reportedly satisfactory. Intraoperative bleeding was reduced significantly resulting in low blood transfusion rate. All cases had total removal of the tumors in the rather short duration. There were possibilities that the duration of operations would have been more prolonged if intraoperative bleeding was not controlled by the ligation of the external carotid artery. The medial sphenoid meningioma grew near many important structures at the base of skull including cavernous sinus, cranial nerves (II,III,IV,V and VI) and major blood vessels. Complete resection but an injury to the cranial nerve 3 was reported in one patient with this tumor type (with the longest operation time in this series).

Conclusion

Although it is not as effective as preoperative embolization⁽¹⁵⁾, the external carotid artery ligation is an uncomplicated procedure and relatively safe and low

cost. In the setting that preoperative embolization is beyond the facilities, the ligation of the external carotid artery is an alternative for the patient with a large skull base meningioma.

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บทคัดย่อ การผูกหลอดเลือดแดง external carotid ในการผ่าตัดเนื้องอกมีนิงจิโอมาขนาดใหญ่บริเวณ
ฐานกะโหลกศีรษะ

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กลุ่มงานศัลยกรรม โรงพยาบาลราชบุรี ราชบุรี

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ที่ผ่านมารผ่าตัดเนื้องอกมีนิงจิโอมา(meningioma)ขนาดใหญ่บริเวณฐานของกะโหลกศีรษะ มีภาวะแทรกซ้อนค่อนข้างสูงเนื่องจากตำแหน่งของเนื้องอกที่เข้าถึงได้ยาก และมีการเสียเลือดระหว่างผ่าตัดมาก ในปัจจุบันจากการที่มีการพัฒนาการผ่าตัดแบบจุลศัลยกรรม รวมทั้งการเลือกอุดกั้นเส้นเลือดที่หล่อเลี้ยงเนื้องอก(preoperative embolization) ทำให้การผ่าตัดประสบความสำเร็จมากขึ้น และมีภาวะแทรกซ้อนน้อยลง แต่การเลือกอุดกั้นเส้นเลือดที่หล่อเลี้ยงเนื้องอก ต้องใช้เครื่องมือ และความเชี่ยวชาญในด้าน interventional neuroradiology ซึ่งในทุกวันนี้ มีโรงพยาบาลที่มีขีดความสามารถในด้านนี้ไม่มาก ผู้นิพนธ์ได้นำเสนอประสบการณ์ในการใช้การผูกหลอดเลือดแดง external carotid เป็นการทดแทนในผู้ป่วยจำนวน 10 รายที่มีเนื้องอกมีนิงจิโอมาในบริเวณฐานของกะโหลกศีรษะขนาดใหญ่ ซึ่งได้ผูกหลอดเลือดแดง external carotid ก่อนการผ่าตัดเอาเนื้องอกออกโดยเป็นการผ่าตัดต่อเนื่องในคราวเดียวกัน ระยะเวลาที่ใช้ในการผ่าตัด อยู่ในช่วง 2 ชั่วโมง ถึง 5 ชั่วโมง 20 นาที ทุกรายเนื้องอกได้การผ่าตัดออกหมดแบบสมบูรณ์ มีการให้เลือด 0-4 หน่วย (units) มีผู้ป่วยรายเดียวที่มีการบาดเจ็บของเส้นประสาทสมองคู่ที่ 3 จากประสบการณ์ในผู้ป่วย 10 รายนี้ พบว่า ในสถานการณ์ที่ไม่สามารถทำ preoperative embolization ได้ การผูกหลอดเลือดแดง external carotid ก่อนการผ่าตัดเอาเนื้องอกมีนิงจิโอมาขนาดใหญ่ในบริเวณฐานของกะโหลกศีรษะออก มีประโยชน์มาก

คำสำคัญ: ฐานกะโหลกศีรษะ, การผ่าตัดเนื้องอกมีนิงจิโอมา, การผูกหลอดเลือดแดง