Repair of Extra-Cranial Internal Carotid Artery Aneurysm with Application of Modified Carotid Shunt: A Case Report

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Aneurysms of the extracranial internal carotid artery (ICA) are uncommon. These lesions usually present with symptoms of transient ischemic attacks (TIA) from emboli and cranial nerve dysfunction from compression. The primary objective of treatment is to prevent a permanent neurologic deficit arising as a result of atheroembolism. The resection of an ICA aneurysm with restoration of flow is the preferred method of treatment. The authors present the case of a 32-year-old woman diagnosed with an ICA aneurysm. The patient underwent aneurysmectomy using an autologous saphenous vein graft with ICA blood flow being maintained using a carotid-to-carotid shunt, which was modified from an intravenous catheter set. This modified carotid shunt is easy to prepare for use and is of low cost. The authors do not expect this shunt to represent the standard commercially available shunt; but in some institutes, where commercial shunts are not available, this shunt may be suitable used.

Keywords: *Aneurysm, Internal carotid artery (ICA), Modified carotid shunt*

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Extracranial aneurysms of the carotid artery are extremely uncommon. The most frequent site of carotid artery aneurysms is on the common carotid artery, particularly at its bifurcation[1]. The middle and distal portions of the internal carotid artery are the next most common sites[1]. Atherosclerosis is responsible for 46% to 70% of all carotid artery aneurysms[1]. Aneurysms at the point of bifurcation are usually fusiform, whereas those located in the ICA are saccular[2]. The treatment of extracranial ICA aneurysms has been evolving within the specialty of vascular surgery. For most patients, the primary objective of treatment is to prevent a permanent neurologic deficit arising as a result of the atheroembolism. The resection of the aneurysm with restoration of flow is the preferred method of treatment[3-5]. Even if the use of shunts remains controversial, most experts currently recommend repair of a carotid aneurysm in good results with shunt selectively[6]. Because standard commercial shunts are not available at our institute. Accordingly, the authors modified a temporary carotid shunt from an intravenous catheter set jointly with an angiocatheter sized 10 French and a heavy silk tourniquet. This modified carotid shunt is functional and acceptable results have been achieved with selected patients; however this modified shunt can not stand along side a standard commercial shunt, which is of a much higher quality and standard.

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Case Report

A 32-year-old woman presented with a 10-month history of headaches, tenderness a pulsatile mass on the right side of the neck and episodes of dysphagia. She experienced an episode of TIA 4 months previously. On examination a rounded pulsatile mass 4.5 cm in diameter in the right peritonsillar region and a pulsatile mass 2.5 cm in diameter in the right lateral area of the neck in proximity to the submandibular area was discovered. A computerized

tomography scan confirmed an aneurysm of the right ICA. A preoperative duplex scan was not performed. Angiography demonstrated that the aneurysm was saccular and localized at the middle ICA segment, and some ectatic parts were seen at the distal end next to the aneurysmal part (Fig. 1). It was observed that this patient had no connection between the left and the right circulatory system at the Circle of Willis. The other systemic review was normal. A past medical history did not reveal any hypertension, dyslipidemia or prior cigarette use.

The patient was intubated under visualization with a flexible bronchoscope. The patient was then placed in a supine position with the neck hyperextended and turned away from the operative side. An incision was made along the anterior border of the sternocleidomastoid muscle from the mastoid process to a point two-thirds the distance to the sternoclavicular joint. The incision was carried through the platysma muscle exposing the anterior border of the sternocleidomastoid muscle which was retracted laterally to expose the carotid sheath. The internal jugular vein was mobilized laterally to expose the carotid bifurcation and the vagus nerve. The common carotid artery, the proximal part of the external and internal carotid artery were dissected and encircled with a vessel loop. The distal part of the ICA was dissected circumferentially at a point 1 cm distal to the aneurysm and ectatic part, where clamping control is limited. After intravenous heparinization with a dosage of 1 mg per kg body weight, the proximal and mid portion of the external carotid artery (ECA) including the proximal ICA were occluded. Because our institute has no standard carotid-to-carotid shunt, the authors prepared a modified carotid shunt using an intravenous fluid catheter set and a heavy silk tourniquet (Fig. 2). The previously prepared shunt, with an anchoring tie around it was inserted proximally in the opening arteriotomy of the ECA and the tourniquet was tightened. After that, the other tip of the shunt was brought to the ICA at a point beyond the ectatic part and tightened (Fig. 2). After the shunt had been secured, flow was restored and ipsilateral cerebral perfusion was reestablished. The time for inlaying the shunt was no more than 60 seconds. During the operation, the aneurysmal wall was opened, thrombus was removed and aneurysmectomy was performed, but the authors did not dissect the entire aneurysm wall because this may have resulted in injury to the intraoral mucosa; and, in order to avoid injury to the hypoglossal, glossopharyngeal and vagal nerves. Revascularization was created with a saphenous vein graft end-to-end anastomosis to reestablish flow in the ICA, in situation of distal ICA was not clamped. Finally, the patient's head was laid down for flow flushing debris and air bubbles simultaneously while releasing all vascular clamps. The shunt was removed and the arteriotomy site of the ECA was repaired with a saphenous vein graft patch.

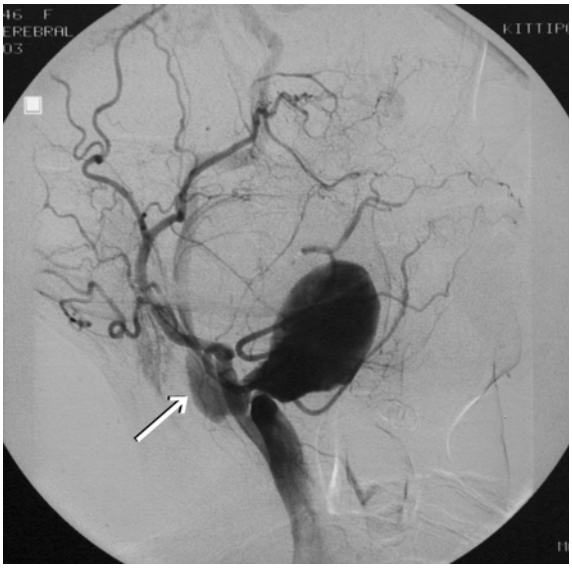

Fig 1. Preoperative carotid angiography of saccular aneurysm located at middle ICA. Arrow shows ectatic part, suggesting a dysplastic lesion

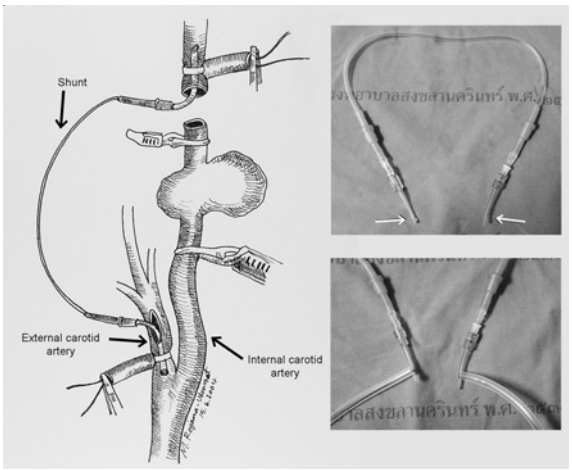

Fig 2. (Right upper) French 10 carotid shunt modified from an intravenous fluid catheter set. Arrows show angiocatheter tips inserted into the proximal ECA and the distal ICA. (Right lower) Heavy silk tourniquets tightened (Central) Intraoperative shunt functioning

Meticulous hemostasis was obtained to prevent cervical hematoma and possible respiratory embarrassment. A surgical drain was not used. The patient was kept in a mild respiratory alkalotic condition where $PaCO_2$ was kept between 25-32 mmHg for a prophylaxis cerebral edema. The immediate postoperative period was uneventful; no arrhythmias or fluctuation in blood pressure were observed. The patient was extubated within 10 hours postoperatively and the intensive care unit length of stay was 18 hours. The patency of the revascularization conduit was verified two months postoperatively with a duplex scan and angiography (Fig. 3). The patient did not have any neurological deficit. The patient had improved quality of voice and was relieved of dysphagia. The pathological diagnostic result of the right ICA wall showed an atherosclerotic change of the intima. The surgical result was satisfactory.

Discussion

Aneurysm of the extracranial carotid arteries is a rare lesion with the majority involving the common carotid bifurcation[6,7]. Approximately one third of these lesions are located at the internal carotid artery (ICA). Proximal ICA aneurysms are more frequent in patients over 50 years of age with a predominant atherosclerosis etiology, whereas aneurysms associated with trauma, congenital defects, fibromuscular dysplasia, infection and degeneration with chronic dissection are located more distally[8]. Aneurysms involving the external carotid artery are less frequent[8]. Retrospective studies show that nonoperative treatment is associated with a stroke risk as high as 50%[8,9]. Winslow[10] reported a 71% mortality in nonoperated ICA aneurysms. Most experts in vascular surgery currently recommend repairing of carotid aneurysms, even in asymptomatic patients. Mortality after proximal ICA ligation is as high as 30%[10].

Fig 3. Postoperative follow-up carotid angiography after being revascularized by a saphenous vein graft

The direct repair or alternative resection of the aneurysm with the restoration of blood flow remains the gold standard for treatment of the ICA aneurysm[8-10]. Operative results are generally good but cranial nerve dysfunction has been reported in about 44% of patients[8]. To reduce the neurological risks from operative treatment, carotid-to-carotid shunts have been introduced. The use of shunts remains controversial; good results have been reported by groups who shunt selectively[6] and by others who never use shunts at all[8]. With operative strategies, the authors find surgical treatment involving the re-establishment of arterial continuity with carotid-to-carotid temporary shunts is preferable. To date, there has been little experience with endoluminal exclusion techniques for these ICA aneurysms[6].

The authors created a temporary carotid shunt by using an intravenous fluid catheter which is easy to use, economical and safe. However, this modified shunt should not be viewed as an alternative to the standard commercial shunt, which has been accepted worldwide and is commonly used. The authors hope that, in a select number of complicated ICA aneurysms, the procedure can be performed safely with this modified shunt in collaboration with specific surgical competencies and good anesthetic techniques when the standard commercial shunt is not available.

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การผ่าตัดซ่อมแซมเส้นเลือดแดง Internal carotid ส่วนนอกกะโหลกศีรษะ ที่มีภาวะโป่งพองด้วยทางเชื่อมส่งเลือดประยุกต์: รายงานผู้ป่วย 1 ราย

วรวิทย์ จิตติถาวร, เจริญเกียรติ ฤกษ์เกลี้ยง, อภิรักษ์ เชษฐเผ่าพันธ์, ประเสริฐ วศินานุกร, วรพงษ์ เชาว์ชูเวช, ธวัช ชาญชยานนท์

ภาวะโป่งพองของเส้นเลือดแดง Internal carotid ส่วนที่อยู่นอกกะโหลกศีรษะเป็นภาวะที่พบได้ไม่บ่อย โดยปกติมักแสดงอาการในลักษณะของ transient ischemic attacks จากก้อน emboli และการทำหน้าที่ผิดปกติของเส้นประสาทสมองจากการกดเบียดของเส้นเลือดที่มีภาวะโป่งพอง จุดประสงค์หลักของการรักษาเพื่อป้องกันผลแทรกซ้อนต่อระบบประสาทจากการหลุดลอยไปของก้อน atheroembolism การตัดเส้นเลือดที่โป่งพองออกจากระบบไหลเวียน และการซ่อมแซมทางเดินของระบบไหลเวียนให้เป็นไปในทิศทางปกติ เป็นการรักษาที่เป็นที่ยอมรับ คณะผู้รายงานได้นำเสนอ ผู้ป่วยหญิงไทย อายุ 32 ปี ที่ได้รับการวินิจฉัยภาวะโป่งพองของเส้นเลือดแดง internal carotid ผู้ป่วยได้รับการผ่าตัดเส้นเลือดบริเวณที่โป่งพองออก ในระหว่างการซ่อมแซมทางเดินเลือดด้วยเส้นเลือดดำ saphenous การไหลเวียนอย่างต่อเนื่องในเส้นเลือดแดง internal carotid ได้รับการประคับประคองโดยใช้ชุดสายให้สารน้ำทางหลอดเลือดดำมาประยุกต์เป็นทางเชื่อมส่งเลือดระหว่างเส้นเลือดแดง carotid ทางเชื่อมส่งเลือดประยุกต์ชิ้นนี้มีความสะดวกในการเตรียม ใช้งานง่าย และราคาถูก คณะผู้รายงานมิได้มุ่งหวังให้ทางเชื่อมส่งเลือดประยุกต์ชิ้นนี้เข้ามาแทนที่ทางเชื่อมส่งเลือดมาตรฐานซึ่งเป็นที่ยอมรับโดยทั่วไป เพียงแต่ในบางสถาบันที่ไม่มีความพร้อมสำหรับทางเชื่อมส่งเลือดมาตรฐาน ทางเชื่อมส่งเลือดประยุกต์ชิ้นนี้อาจมีความเหมาะสมในการนำมาใช้ได้