Ruption of radiation-induced internal carotid artery pseudoaneurysm in a patient with nasopharyngeal carcinoma—spontaneous occlusion of carotid artery due to long-term embolizing performance

Kai-Yuan Cheng, MD,1,2 Ka-Wo Lee, MD,1,2 Feng-Yu Chiang, MD,1,2 Kuen-Yao Ho, MD,1,2 Wen-Rei Kuo, MD1,2

1 Department of Otolaryngology–Head and Neck Surgery, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan. E-mail: littlekaiyuan@yahoo.com.tw
2 Department of Otolaryngology–Head and Neck Surgery, Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan

Accepted 31 August 2007
Published online 22 January 2008 in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/hed.20753

Abstract: Background. Rupture of internal carotid artery (ICA) pseudoaneurysm is a lethal complication in patients with nasopharyngeal carcinoma (NPC). Angiography is the best diagnostic and treatment method. The aim of embolization is to block the pseudoaneurysm; but sometimes, total occlusion of great vessels is ineludible. We describe a case of NPC post-radiation therapy and with ruptured pseudoaneurysm treated by angio-embolization.

Methods. The patient had received embolization with numerous tools such as stent grafts, balloons, and bare stents with or without filter protection.

Results. After failing to pass through the narrow lumen by embolizing tools, the right ICA finally occluded spontaneously by self-thrombosis.

Conclusion. Although the angio-embolization is a good method to resolve the problems of ruptured pseudoaneurysm, there is still high mortality and morbidity. Being aware of the clinical presentations and the changes of images may alert us to predict the happening earlier.

Keywords: radiation-induced ICA pseudoaneurysm; angiography; embolization; nasopharyngeal carcinoma; self-thrombosis

Radiation-related complications in patients with nasopharyngeal carcinoma (NPC), including xerostomia, hearing impairment, chronic otitis media, chronic rhinosinusitis, neck fibrosis, trismus, dysphagia, cranial neuropathy, and carotid stenosis, have been increasingly reported depending upon the dosages.1 Rupture of irradiated great vessels is rare. Only a few cases, less than 10, have been reported in the English-language literature. We describe a case of radiation-induced internal carotid artery (ICA) pseudoaneurysm in a patient with NPC after treatment with radiotherapy.

Case Report

An 57-year-old man had a history of NPC (T2aN1M0, stage IIB) treated with 2 courses
of neoadjuvant chemotherapy (cisplatin plus 5-fluorouracil) and followed by conventional radiotherapy with the dose of 70.4 Gy in 2002. Three years later, he had received another course of radiotherapy because of local recurrence in the left nasopharyngeal area, with the dose of 40 Gy (3D-conformal radiotherapy) plus 18 Gy, 6 fractions, brachytherapy in March 2005. Since then, necrotic crusts over the bilateral nasopharyngeal wall have been found on regular examination.

Neck CT in October 2005 revealed massive soft tissue loss over the bilateral nasopharyngeal area compared with previous CT scans and obvious stricture of bilateral ICA and internal jugular vein (Figure 1).

FIGURE 1. The image on right revealed massive soft tissue loss over the nasopharyngeal space (long arrow) and obvious stricture on great vessels (small arrow) compared with the previous one (left).

FIGURE 2. Angiography revealed a huge pseudoaneurysm, measuring 1.95 × 2.46 × 2.25 cm in size, in the right internal carotid artery at nasopharyngeal level (left), and then, complete occlusion in the internal carotid artery by thrombosis (right).
Later in the same month, the patient was admitted to our hospital because of a generally ill condition. Localized infection of nasopharynx was suspected by the local findings as mucopus from nose and necrotic crusts coating over the nasopharyngeal area, despite the presence of other infection focus.

Unexpectedly, an episode of massive nasal bleeding occurred on the night before he was to be discharged. Repeat bleeding occurred twice during hospitalization; thus, conventional angiography was performed and revealed a huge pseudoaneurysm, measuring $1.95 \times 2.46 \times 2.25$ cm in size, in the right ICA at nasopharyngeal level, while the contralateral ICA showed focal luminal narrowing (Figure 2). Embolization had been tried with the tools of stent grafts, balloons, bare stents with and without filter protection, but all failed to pass through the distal end due to the narrow lumen. The procedure persisted at least for 10 hours, and the right ICA finally occluded spontaneously by self-thrombosis (Figure 2). Fortunately, there were no neurologic defects. Follow-up reporting of at least 1.5 years indicates the patient has neither neurologic complication nor nasal bleeding.

**DISCUSSION**

NPC is known to be a common malignancy in South Asia. The major treatment method is radiotherapy alone or in combination with brachytherapy. The complications of radiotherapy include xerostomia, hearing impairment, chronic otitic media, chronic rhinosinusitis, trismus, neck fibrosis, dysphagia, and even more severe ones such as temporal bone necrosis and osteoradionecrosis-related pseudoaneurysm, especially when the total dose of external beam radiotherapy is more than 72 Gy.2

The exact mechanism of pseudoaneurysm is unclear. We know that radiation could cause vascular damage such as obstruction of vasa vasorum, premature atherosclerosis, adventitial fibrosis, and necrosis of the arterial wall. Combined with high blood pressure of the great vessel, it could result in the rupture of the arterial wall and even dissection with extravasation blood.1,3,4 Other aggravating factors accelerating the production or the rupture of pseudoaneurysm, such as infection, trauma, previous surgery, or underlying cardiovascular disease or hypertension, were considered.3,5 One assumption discussed considered that brachytherapy might be a predisposing factor for skull base osteoradionecrosis.1 However, in our case, the site of the pseudoaneurysm was on the right ICA, whereas the site where we applied brachytherapy was on the left nasopharyngeal area. Localized infection was on the right nasopharyngeal space just before massive bleeding was noted in our patient.

Although the neck CT scan could not detect the pseudoaneurysm exactly, it might be still val-

<table>
<thead>
<tr>
<th>Author</th>
<th>Sex/age, y</th>
<th>Radiation course and dose</th>
<th>Presentation</th>
<th>Hemostatic tools in angiography</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mak et al5 (2000)</td>
<td>M/55</td>
<td>66 Gy</td>
<td>Right ear bleeding</td>
<td>Coils</td>
<td>Died 3 wk later because of rebleeding</td>
</tr>
<tr>
<td>Lam et al6 (2001)</td>
<td>M/65</td>
<td>2 courses, 60 plus 51 Gy</td>
<td>Right ear bleeding</td>
<td>ICA occlusion by coils</td>
<td>Left hemiplegia with impaired conscious, died 7 d later because of extensive infarction</td>
</tr>
<tr>
<td></td>
<td>M/71</td>
<td>45 Gy</td>
<td>Left ear bleeding</td>
<td>Nil</td>
<td>Died 6 wk later because of rebleeding</td>
</tr>
<tr>
<td></td>
<td>M/47</td>
<td>2 courses, 66 plus 50 Gy</td>
<td>Epistaxis</td>
<td>ICA occlusion after EC-IC bypass</td>
<td>Follow-up for 18 mo without complications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCRT 73.8 Gy plus brachytherapy 8 Gy</td>
<td></td>
<td>ICA occlusion</td>
<td>Follow-up for 3 mo without neurologic defects</td>
</tr>
<tr>
<td>Lau and Chow7 (2005)</td>
<td>M/53</td>
<td>60 Gy</td>
<td>Left ear bleeding</td>
<td>ICA occlusion after EC-IC bypass</td>
<td></td>
</tr>
<tr>
<td>Cheng (this study)</td>
<td>M/57</td>
<td>2 course, 70.4 plus 40 Gy plus brachytherapy 18 Gy</td>
<td>Epistaxis</td>
<td>ICA occlusion by self- thrombosis</td>
<td>Follow-up for 18 mo without neurologic defects or bleeding</td>
</tr>
</tbody>
</table>

Abbreviations: ICA, internal carotid artery; EC-IC bypass, external carotid–internal carotid bypass; CCRT, concomitant chemoradiotherapy.
Radiation-Induced ICA Pseudoaneurysm

The appearance rate of osteoradionecrosis-related pseudoaneurysm is quite rare. Only a few cases (fewer than 10) have been reported previously. In reviewing these cases, we could find only 4 in which the patient had received a total dose of radiation more than 72 Gy, and 5 of them had the situation of ICA being in total occlusion (Table 1).

Clinically, it could be indicated by the presentation of massive ear bleeding or severe epistaxis. Angiography is the best diagnostic and treatment method.6 The tools of endovascular therapy, such as cellulose acetate polymer, detachable balloons, wall stents, and coils, were initially considered. The aim of angiography is to block the pseudoaneurysm, but sometimes, it is difficult to be completed because of emergent massive bleeding or weakened vascular structure. Then, total occlusion of great vessels might be the only workable method. However, vascular thrombosis is a kind of complication that is not desired during this procedure, especially after long-term performance. Nevertheless, in our case, such thrombosis occluded the ICA completely, and fortunately, without any neurologic defects along with the follow-up period at least for more than 1.5 years. Typically, there is still high mortality or morbidity after the treatment of angiography6; therefore, awareness of the clinical presentations and the changes on imaging may alert us to predict the occurrence of pseudoaneurysm earlier.

Acknowledgments. The authors would like to acknowledge the assistance of the Department of Medical Imaging at Kaohsiung Medical University Hospital in the construction of the direct visualization device.

REFERENCES