Balloon catheter occlusion for cavernous carotid artery injury during transsphenoidal hypophysectomy

Case report

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During transsphenoidal hypophysectomy for pituitary ablation in a patient with disseminated breast cancer, brisk arterial hemorrhage occurred during separation of adhesions between the pituitary gland and the wall of the cavernous sinus. Hemorrhage was controlled by placement of a Prolo balloon catheter into the internal carotid artery (ICA) that occluded the site of hemorrhage. The patient experienced no neurological sequelae. The cervical ICA was easily exposed for insertion of this double-lumen catheter. With the image intensifier already in position, injection of contrast material through the arteriography lumen allowed precise localization of the site of injury and directed positioning of the balloon for control of the hemorrhage.

KEY WORDS: transsphenoidal hypophysectomy, carotid artery injury, intracavernous carotid artery aneurysm, carotid-cavernous fistula, balloon catheter

The anatomical variations of the location of the intracavernous carotid artery make the artery vulnerable to possible laceration, perforation, or avulsion during the course of transsphenoidal hypophysectomy. Fortunately, this complication has rarely been experienced. The patient presented here experienced brisk arterial hemorrhage during transsphenoidal hypophysectomy. The technique of using a double-lumen Prolo balloon catheter to occlude the site of hemorrhage is described.

Case Report

This 58-year-old woman was well until 2 months before admission, when a mass was noted in the left breast on routine physical examination. Axillary and supraclavicular adenopathy was present. Chest x-ray film revealed multiple pulmonary nodules, and a radionuclide bone scan showed increased uptake in the lower cervical and upper thoracic spine, consistent with metastatic carcinoma. Biopsy of the left breast revealed infiltrating ductal carcinoma. Estrogen receptors were markedly positive. As part of her therapy, the patient was referred for transsphenoidal hypophysectomy.

During the course of transsphenoidal hypophysectomy, difficulty was encountered in separating the pituitary gland from the wall of the right cavernous sinus, and this resulted in some degree of venous bleeding. The enucleator was used to separate the gland further, and the carotid artery was entered, with brisk arterial hemorrhage resulting. The bleeding was initially controlled by Gelfoam and bulk cotton packing. Attempts at removing the packs led to recurrent hemorrhage. At this point, the decision was made to attempt to control the hemorrhage by placement of a double-lumen Prolo balloon catheter at the site of carotid laceration. The image intensifier was already in position for the transsphenoidal procedure. The double-lumen Prolo balloon catheter manufactured by Edwards Laboratories, 17221 Redhill Avenue, Santa Ana, California.
Balloon occlusion for intraoperative carotid injury

drapes were readjusted and the neck was prepared. An incision was made along the anterior border of the sternocleidomastoid muscle. The common, internal, and external carotid arteries were isolated at the level of the bifurcation. The common carotid artery (CCA) was cross-clamped with a Fogarty clamp. A small incision was made in the common carotid artery with a No. 11 scalpel blade, and the double-lumen Prolo balloon catheter was inserted. The usual technique of placement and use of this catheter for treatment of carotid-cavernous fistulas has been described in detail in previous publications.21,22 The catheter was advanced under image intensification to the level of the carotid siphon. The angiographic port was used to inject contrast material so as to identify the site of hemorrhage. The balloon was then inflated, and this resulted in a significant reduction in the amount of bleeding. Introduction of a small pack of Gelfoam and Surgicel pledgets into the area resulted in complete hemostasis. The CCA was doubly ligated with umbilical tapes, and the remaining portion of the catheter was tucked under the sternocleidomastoid muscle. The CCA was used as the insertion point for the catheter rather than the internal carotid artery (ICA), which is normally used. Had placement of the balloon been unsuccessful, the CCA would have been ligated. The hypophysectomy was completed. The patient awoke from the procedure without neurological deficit. She subsequently died 1 year later from disseminated breast carcinoma.

Discussion

Injury to the cavernous ICA has previously been reported during transsphenoidal procedures for pituitary ablation, adenoma removal, and repair of cerebrospinal fluid leaks secondary to trauma.2,5,6,11,19,24,30 Iatrogenic cavernous carotid injury has been reported to occur during parasinus sinus operations.12,15,24,29,31 Thromboendarterectomy,4 and percutaneous radiofrequency trigeminal rhizotomy.26 Tears of the ICA at this site have also been reported due to head trauma.10,16,20,26-28

Anatomical studies have shown that the two cavernous carotid arteries can approach within 4 mm of one another in the sella turcica.1,23 In a study by Bergland, et al.,1 22% of the human specimens examined demonstrated distortion of the lateral pituitary gland by the carotid artery. Renn and Rhoton23 measured the distance between the two carotid arteries along their course, and found that the shortest distance between the two vessels was in the supraclinoid area in 82% of the specimens, in the cavernous sinus in 14%, and in the sphenoid sinus in 4%.23 Both studies showed a mean separation at the closest point of 12 mm.1,23 Hardy9 reported seeing the carotid artery within the sella in four patients at surgery. He noted that in one case the structure did not pulsate, but when punctured with a No. 26 needle, red blood was aspirated. This observation demonstrated that the cavernous carotid artery does not necessarily lie within the confines of the cavernous sinus, contrary to classical anatomical descriptions.9

The methods of management of cavernous carotid artery injury reported in the literature have included packing to tamponade the initial hemorrhage. However, symptomatic false aneurysm formation has often developed subsequently, and recurrent, and often massive, epistaxis has occurred with rupture of the aneurysm.2,12,13,15,16,20,24,26-28,30,31 Carotid-cavernous fistulas developed in a few patients.16,19,31 Epistaxis was more common than carotid-cavernous fistula formation, since the wall of the cavernous sinus was also torn. The risk of delayed definitive treatment is exemplified by one patient in whom massive epistaxis resulted in his death prior to scheduled surgical repair.16

Successful definitive treatment for this problem has included carotid ligation,12,24,30 gradual ICA occlusion using a Selverstone6 or Crutchfield clamp,11 and trapping procedures13,15,19,20,26,28,31 described by Hamby7,8 There has been one unsuccessful attempt at balloon obliteration.15 Standard carotid-cavernous fistulas can be managed with balloon catheter occlusion,3,10,21,22 direct repair using hypothermic cardiac arrest,18 trapping procedures,7,8 or electrothrombosis.10

The injury of the cavernous carotid artery presented in this paper was managed using a Prolo double-lumen balloon catheter.21,22 The operative setup for transsphenoidal hypophysectomy can be utilized to the surgeon's advantage should this complication occur. The image intensifier is already in position with the appropriate lateral projection of the sella. The neck can be easily redraped for exposure of the carotid artery. The angiographic port of this catheter can be used to inject contrast material and visualize the exact site of injury of the vessel. The balloon can then be adjusted to this location and inflated to occlude the tear. With a carotid tear, a detachable balloon catheter has no advantage over the use of this fixed balloon catheter. The ICA must be sacrificed. The cavernous sinus has also been torn in the majority of these cases, and therefore it is not possible to tamponade the outflow from the carotid artery into the cavernous sinus by placing a detachable balloon within the sinus. The use of the balloon prevents retrograde flow from the cranial ICA and thereby saves the patient a craniotomy for occluding the supraclinoid ICA.

Although this patient suffered no neurological se-
and sequelae, about 20% of patients will develop cerebral ischemia with sacrifice of one carotid artery. Among the cases cited above of injury to the cavernous carotid artery treated by proximal carotid ligation, only one developed cerebral infarction. With the exigencies of uncontrollable arterial hemorrhage from trauma to a carotid cavernous artery, however, this degree of risk must be accepted in an effort to preserve life. Moreover, segmental occlusion with a balloon positioned accurately at the site of hemorrhage will prevent the intracavernous steal of blood passing retrograde from the supraclival carotid artery. The providential availability of this double-lumen balloon catheter with sealant valve during this procedure implemented effective handling of a potentially serious complication.

References

Manuscript received February 11, 1981.

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