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Case Report

Use of Dyna CT in evaluation and treatment of pseudoaneurysm secondary to craniofacial tumor resection: Case report and diagnostic implications

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Abstract

Background: Digital subtraction angiography (DSA) is considered the gold standard for the evaluation of head and neck vascular abnormalities. It serves as a useful diagnostic and, in many cases, therapeutic tool for treatment of acute head and neck bleeding.

Case Description: We report the case of a patient who presented with life threatening, uncontrollable epistaxis several weeks after resection of a large recurrent chondrosarcoma of the nasal cavity and anterior skull base. A DSA study, with an adjunctive C-arm computed tomography (CT) (Dyna CT), was ultimately helpful in revealing and precisely localizing a large anterior ethmoidal artery pseudoaneurysm adjacent to the tumor resection cavity.

Conclusion: This additional information helped define the arterial anatomy in postoperative region, allowed precise localization and direct ligation of the pseudoaneurysm to resolve the bleeding with a favorable patient outcome.

Key Words: Craniofacial chondrosarcoma, dyna CT, ethmoidal pseudoaneurysm

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INTRODUCTION

Digital subtraction angiography (DSA) is considered the gold standard for the evaluation of craniocervical vascular abnormalities.[1,5] Dyna computed tomography (CT) is an emerging form of rotational angiography based on X-ray that acquires CT-like 3D volumes using a fixed fluoroscopic C-Arm.[3,4]

We report a case of a patient who presented with life threatening, uncontrollable epistaxis weeks after resection of a recurrent craniofacial chondrosarcoma. A DSA study, with adjunctive Dyna CT, was ultimately helpful in revealing an anterior ethmoidal artery pseudoaneurysm adjacent to the tumor cavity. The adjunct of Dyna CT was crucial in localizing, diagnosing and treating a rare and fatal vascular lesion.

CASE REPORT

A 24-year-old, otherwise healthy, male initially presented with a large, recurrent chondrosarcoma of the anterior skull base. This was the third recurrence in the last 5 years, with the tumor showing signs of aggressive growth. Radiotherapy had been previously attempted with no

success. Gross total resection transcranially of the tumor with skull base reconstruction was successfully achieved, and patient was discharged home with no issues. The patient then developed severe, life-threatening epistaxis, 3 weeks postresection, for which he was rehospitalized. CT and magnetic resonance imaging (MRI) could not identify the source of bleeding. Brisk arterial bleeding despite intraoperative nasal packing prompted endoscopic and surgical exploration. Initially, the source was thought to be along the right skull base. A right Lynch incision was made during surgical exploration to ligate the right anterior ethmoidal artery. This incision started at the medial aspect of the eyebrow and continued inferiorly halfway down the nasal sidewall, and provided access to the anterior and posterior ethmoidal arteries as well as to the orbital apex, optic nerve, and entire orbital roof. However, this did little to control the brisk bleeding from the nasal cavity and facial incision, and did not allow for localization of the bleeding.

When the source could not be identified on surgical exploration, the wound was packed again and the patient emergently transferred to the DSA suite. The right carotid injections revealed postoperative alterations and failed to identify a definitive source of bleed. Subsequent left internal carotid injection revealed a large (12×10 mm) pseudoaneurysm arising from the anterior ethmoidal branch of the ophthalmic artery [Figures 1 and 2]. A C-arm CT (Dyna CT) carried out in the DSA suite further demonstrated cross-sectional bone anatomy and precisely localized this pseudoaneurysm in the medial anterior left orbit [Figures 3 and 4]. This additional anatomic distinction could not be attained with the DSA study alone.

The treatment options consisted of endovascular embolization versus surgical ligation. Although technically feasible, endovascular embolization via the ophthalmic artery was felt to be associated with an unacceptable risk of visual loss. However, with the precise localization of pseudoaneurysm on Dyna CT, the surgical approach was deemed more desirable and lower risk. Prompt surgical ligation with excellent hemostasis was achieved.

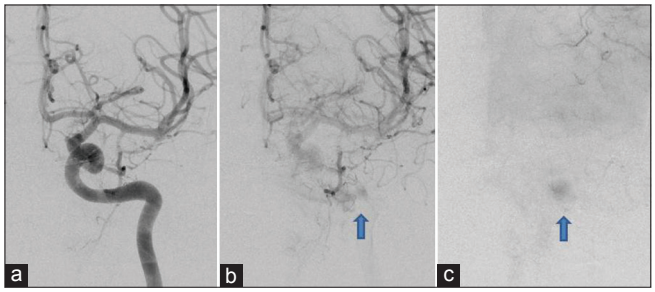

Figure 1: Sequential DSA images from a L ICA injection in AP projection are demonstrated.The pseudoaneurysm is appreciated as an area of ill defined blush (Arrows - Images B, C). Note that the pseudoaneurysm is under-appreciated in terms of its size and difficult to precisely locate

The patient was transferred to the intensive care unit and monitored closely. He was extubated the following day with no recurrent epistaxis. Patient was eventually discharged to home at his baseline 5 days after being readmitted.

DISCUSSION

This report presents a rare case in which an ethmoidal artery pseudoaneurysm was the source of severe, pulsatile epistaxis weeks after surgical resection of a nasal cavity, anterior skull-base chondrosarcoma. More importantly, it highlights the value of DSA and specifically of C-arm (Dyna) CT, a relatively new addition to the armamentarium of neuro-interventionists.

Surgical exploration and ligation of an arterial bleeding source can be challenging, particularly in the context of markedly abnormal anatomy. This holds even more true with previously resected lesions with altered anatomy.[2]

While a DSA by itself adequately delineated the abnormal bleeding vessel and its origination, the C-arm CT provided further anatomical knowledge of the location of the lesion in relation to the orbital and sinus walls and ultimately provided greater understanding of the relationship of the lesion to the surgical cavity. This information obtained by Dyna CT was considered invaluable for operative planning in this difficult case.

Pseudoaneurysms comprise less than one percent of all intracranial aneurysms. While already so rare, the majority of pseudoaneurysms in the literature have been associated with the internal carotid artery (ICA) and anterior cerebral artery (ACA).[2] Ethmoidal artery pseudoaneurysms have only occasionally been listed in rare case reports. Whether spontaneous or iatrogenic, pseudoaneurysms have been known to complicate a wide variety of intracranial procedures, including tumor resections, stereotactic

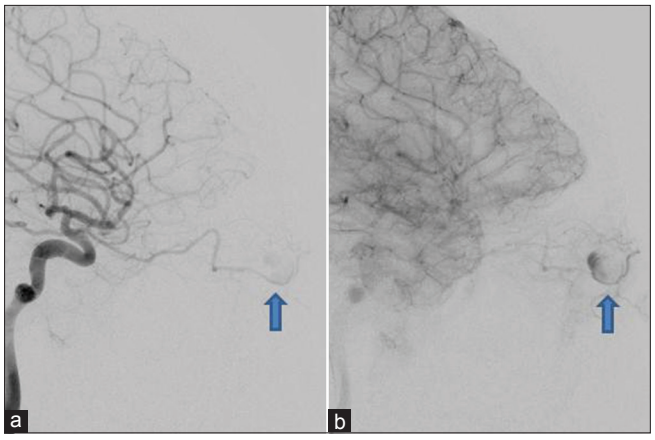

Figure 2: Lateral views of L ICA injection again demonstrate the pseudoaneurysm (Arrows).There is difficulty in locating exact point of communication of the pseudoaneurysm with the parent vessel and understanding the true extent or size of this lesion

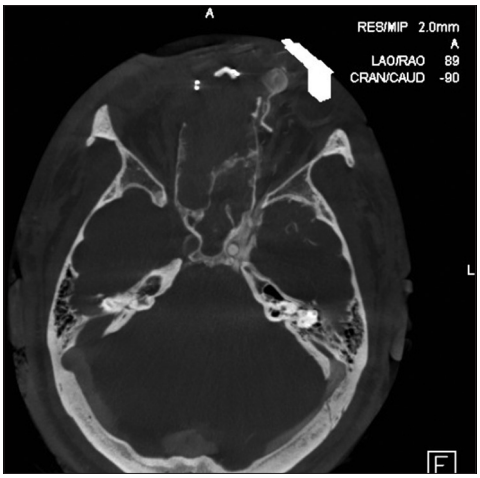

Figure 3: Axial slice of Dyna CT showing ethmoidal pseudoaneurysm in left orbital region

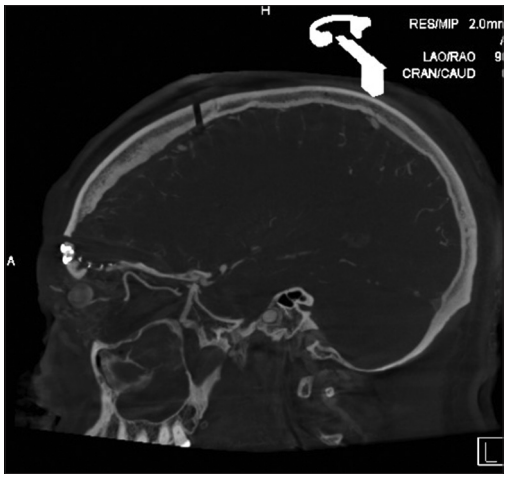

Figure 4: Sagittal slice of Dyna CT showing vascular-to-osseous anatomical location of ethmoidal pseudoaneurysm

biopsies, and transsphenoidal pituitary surgeries. Nevertheless, their development following such procedures is relatively rare. One series of 250 pituitary adenomas reported one patient (0.4%) in whom a pseudoaneurysm developed after transsphenoidal resection.[1]

Iatrogenic pseudoaneurysms are typically considered high risk for rupture, with consequent subarachnoid hemorrhage, carotid-cavernous fistula (CCF) or epistaxis.[1] Intracranial or transnasal hemorrhage or CCF formations typically occur early, within days or weeks after diagnosis.[1] Certain literature also states that morbidity and mortality rates for rupture are similar to subarachnoid hemorrhage from a ruptured saccular aneurysm.[5]

Treatment of these lesions is typically challenging. Direct surgical repair of such lesions involve clipping, wrapping, trapping, and ligation.[5] This is often difficult due to location, and definitive treatment may entail parent vessel sacrifice or arterial reconstruction with bypass grafting.[5] Endovascular therapy does show promise as another alternative, and has been widely utilized.[5] In this particular case, this would have required navigation via the ophthalmic artery and a small but definite risk of visual loss or impairment.

Traditionally, DSA has been the standard method in diagnosing and characterizing cerebrovascular lesions.[5] Recent advances in MR angiography and 3D CT angiography have allowed for less invasive diagnostic techniques.[4] Nevertheless, from an overall clinical decision-making standpoint, higher spatial and temporal resolution is crucial in picking the most appropriate option to reduce false negatives.[4]

Dyna CT, which is generally used with DSA, is another valuable imaging option and provides complementary information. Dyna CT is able to provide additional soft tissue and bony details, enhance the 3D interpretation of DSA without requiring various oblique projections, repeated selective angiography, higher doses of contrast and radiation, and longer examination times.[3,4]

Furthermore, Dyna CT precisely delineates the topographic relationship between the vascular lesion and surrounding osseous structures, thus making surgical planning more accurate.[4] This technique, with the addition of conventional DSA, has already been proven to be superior to CT and MR angiography in the volumetric assessment of aneurysms, complementary to DSA for characterization of cerebral arteriovenous malformations, arteriovenous fistulas, and many other vascular abnormalities.[1,3]

The use of Dyna CT certainly contributes in minimizing the disadvantages of conventional DSA encountered by neuro-interventionists.[3,4] Its routine use to obtain more detailed vascular information not only provides more accurate anatomy, but it also proves to be very helpful in surgical treatment of vascular lesions.[3]

CONCLUSION

In this report, we presented a rare case in which a pseudoaneurysm was found to be the source of persistent epistaxis weeks after a craniofacial-skull base tumor resection. CT/MRI and initial surgical exploration were not able to reveal the source of and control the bleeding. Further imaging with DSA and Dyna CT were used to diagnose and locate a large pseudoaneurysm. This additional information, with the help of increased resolution and accurate localization via the Dyna CT, enabled the team to successfully complete a direct repair with favorable clinical outcome.

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