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Case Report

Four simultaneous anterior cerebral artery aneurysms (three initially unsuspected) with surgical treatment

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ABSTRACT

Distal anterior cerebral artery aneurysms are rare, comprising approximately 6% of all intracranial aneurysms. These aneurysms tend to be smaller in size, broad-based, associated with additional aneurysms and at arterial branching sites, which can make both diagnosis and treatment difficult. Here we report a case of a 63-year-old female who presented with headache and perioral paresthesia determined to be Hunt & Hess scale grade 1. Computed tomography angiography discovered a medium-sized left A2 trunk saccular aneurysm. Intraoperatively 2 additional small blister type aneurysms not noted on initial computed tomography were discovered and treated via clipping and wrapping, respectively. Postoperatively a cerebral angiogram revealed an additional small right A2 trunk broad-based aneurysm. Preoperative evaluation of cerebral vasculature with a cerebral angiogram or high-resolution digital subtraction angiography is essential as multiple aneurysms are commonly associated with anterior cerebral artery aneurysms. The patient was successfully treated without any operative or postoperative complications and has remained symptom-free at 1 year follow up.

Case report

A 63-year-old female presented with a severe, sudden onset, and continuous pressure-like headache of 6-hour duration that awoke her, along with perioral paresthesia, evaluated as Hunt & Hess scale grade 1. The patient also reported intermittent right-hand paresthesia during the previous 2 weeks. Physical exam revealed no neurological deficits. Past medical history included hypothyroidism with previous

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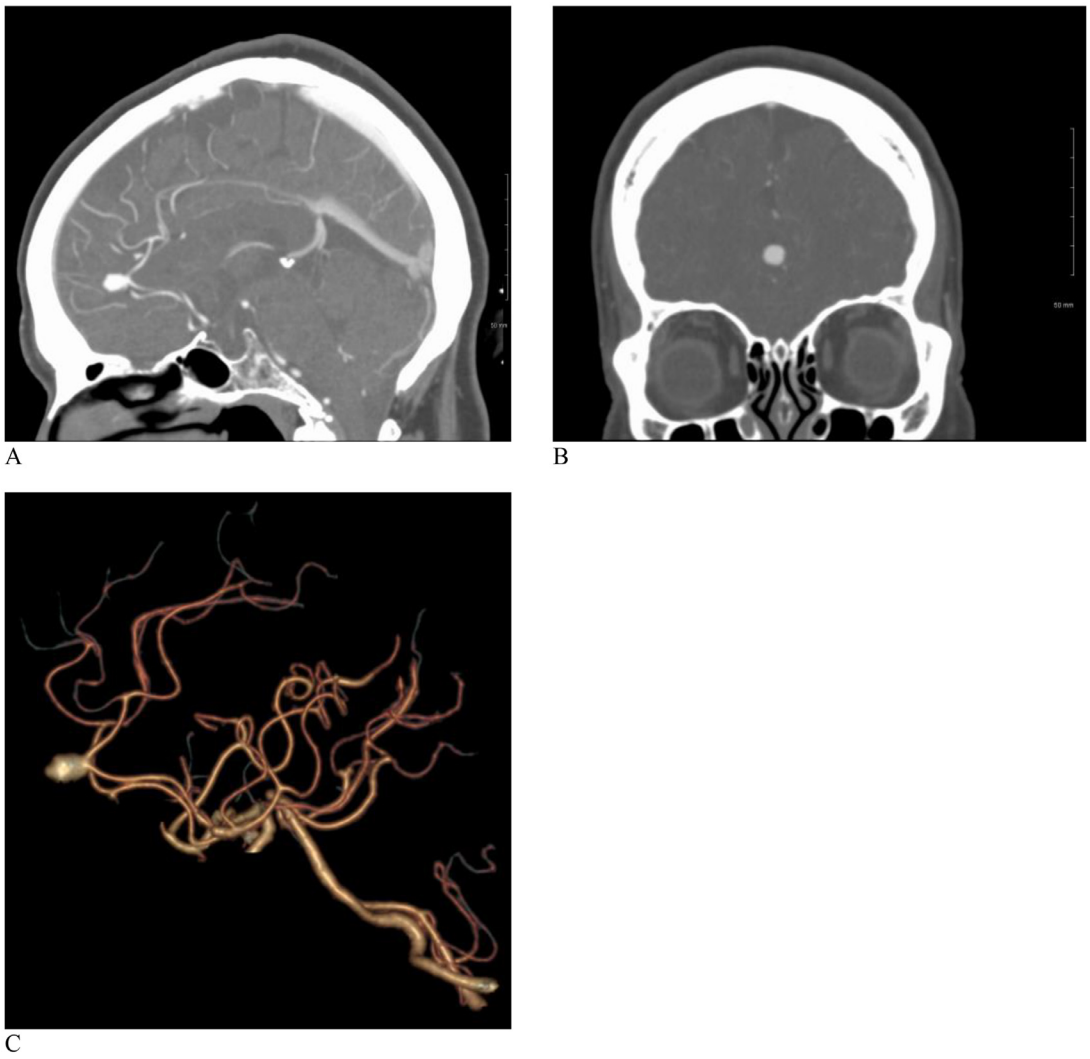

Fig. 1 – Computed tomography angiography of left A2 trunk saccular aneurysm. (A and B) are sagittal and coronal reconstructions, (C) 3D volume rendering.

total thyroidectomy for goiter, uncontrolled hypertension, diabetes mellitus, and a giant 6 × 7 cm hepatic hemangioma. Computed tomography angiography (CTA) initially revealed a medium-sized saccular distal anterior cerebral aneurysm (DACA) at the bifurcation of the A2 trunk on the left side (Figures 1 and 2) without evidence of hemorrhage. Magnetic resonance imaging with contrast demonstrated pulsation artifact due to pulsatile blood flow within the aneurysm providing further confirmation (Figure 3). The left A2 DACA aneurysm was surgically clipped with an Elgiloy over endovascular coiling due to its aspect ratio (dome/neck) of 1.88 and also due to a vessel branching anterior-inferior to the aneurysm neck. Intraoperative direct visualization of the left ACA also revealed 2 additional blister aneurysms distal to the first found on CTA. The first additional small blister aneurysm was clipped with an Elgiloy, and the second even smaller blister aneurysm was wrapped with cotton and secured with Tisseel as it was unable to be clipped. Postoperatively, a CT and cerebral angiogram showed complete resolution with clipping of the prior seen A2 saccular aneurysm on the CTA, no filling defects, and an additional clipping site at the A3 segment trunk bifurcation (Figure 4). The postoperative cerebral angiogram discovered an additional 1.5 mm broad-based aneurysm of the right A2 segment trunk bifurcation which preoperative CTA and magnetic resonance imaging did not detect (Figure 5). The remainder of the patient's hospital course was uneventful without any new neurological deficit postoperatively. At 1 year follow up, the patient is doing well without any neurological deficits, and her right A2 segment aneurysm is being conservatively managed.

Discussion

Unruptured intracranial aneurysms (ICA) frequently are encountered with a prevalence of up to 10% [1]. Several risk factors can increase the risk for developing ICAs. Our patient's risk factors include female gender, hypertension, and hypothyroidism [2,3]. However, DACA aneurysms are rare,

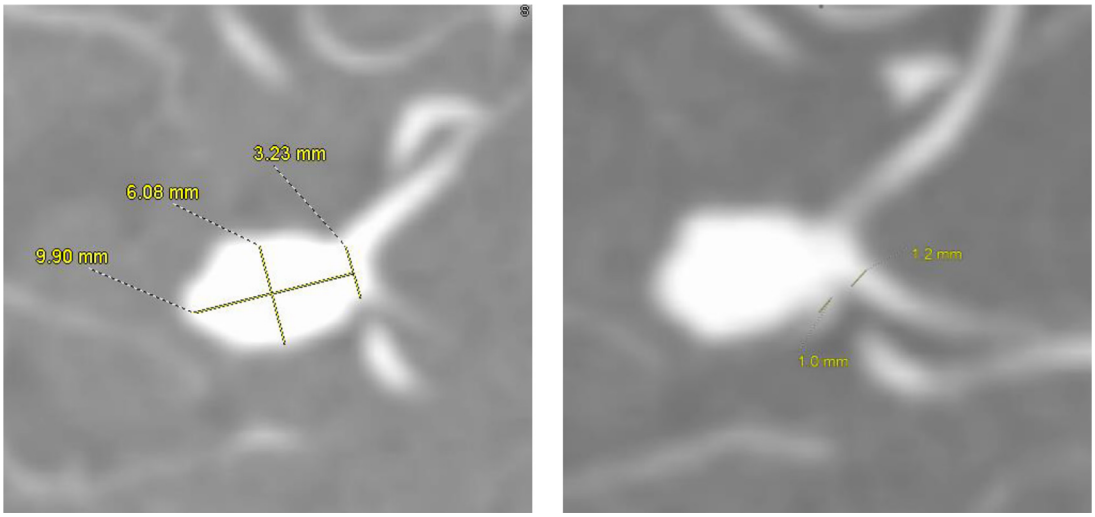

Fig. 2 – Computed tomography angiography annotation of left A2 trunk saccular aneurysm. Dome length 9.90 mm. Dome width: 6.08 mm. Neck width: 3.23 mm. Aspect ratio (Dome/Neck) 1.88. Parent artery width: 1.2 mm. Branching artery width: 1.0 mm.

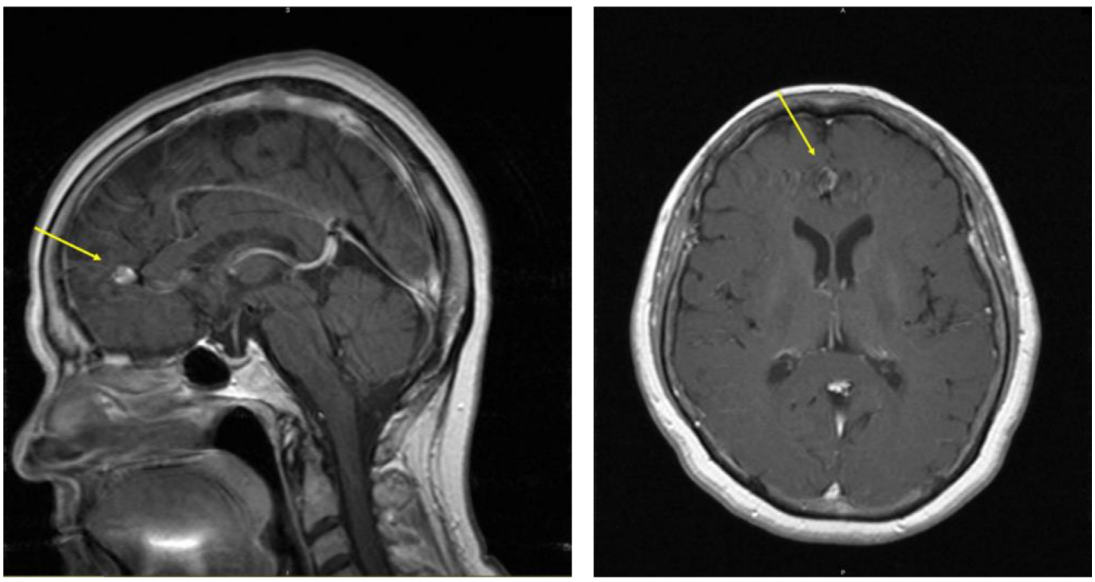

Fig. 3 – Magnetic resonance imaging T1-weighted with gadobenate dimeglumine contrast (A). Sagittal view demonstrating a 7.4 by 8.6 mm contrast-enhanced lesion (yellow arrow), (B) Coronal view demonstrating an 8.6 by 4.8 mm contrast-enhanced lesion with pulsation artifact in the phase-encoding direction (yellow arrow).

comprising approximately 6% of all ICAs. Also, A2 segment aneurysms are sporadic between 0.2%-1% of all ICAs [4]. In this case, 3 aneurysms of the same DACA branch were discovered and an additional contralateral aneurysm of the right A2 trunk bifurcation. To our knowledge, there are only 2 previous case reports of at least 3 multiple aneurysms of the same DACA branch, 3 of the left and 4 of the right DACA [5,6].

DACA aneurysms are associated with additional ICAs in approximately half of the affected patients [4]. One must be suspicious for additional aneurysms if the initial imaging is noninvasive and a solitary DACA aneurysm is discovered. Aneurysms less than 3 mm can be difficult to visualize with noninvasive imaging, with only 61% accuracy with CTA and 38% with MR angiography [7]. Appropriate preoperative planning is essential to discover these small aneurysms, as in this case, where postoperative digital subtraction catheter angiography (DSA) was able to visualize a small 1.5 mm right A2 trunk saccular aneurysm at the bifurcation of the frontal polar branch. This small aneurysm was difficult if not impossible to visualize initially on CTA (Figures 6 and 7). DSA is still the gold standard by which to evaluate ICAs preoperatively, and has a better chance of discovering small aneurysms as the estimated pixel dimensions for DSA is 2 mm compared to the 5 mm of CTA [8]. In this case, preoperative CTA and

Fig. 4 – Postoperative CT head demonstrating surgical clips.

MR angiography revealed only a single A2 segment aneurysm. However, 2 additional small blister aneurysms were visualized intraoperatively, and postoperative DSA revealed a small right A2 aneurysm. As DACA aneurysms are commonly associated with multiple ICAs in half of patients, DSA may be recommended preoperatively by the radiologist, especially if only a single DACA aneurysm is found. Also, as found in our patient, small blister type aneurysms are difficult to find on CTA. Unfortunately, this aneurysm type is also associated with both higher risk of rupture and intraoperative complications [9].

Since the decision between surgical and endovascular interventions for ICAs depends on aneurysm location and morphology, preoperative analysis is imperative [10–15]. An evaluation of the aneurysm size in all axes, shape, neck and dome width, its length, orientation, parent vessel width, and any possible branching vessels from the aneurysm or near the aneurysm neck are essential for surgical versus endovascular approach. Branching vessels are significant when considering endovascular intervention. It is also crucial to note any variant anatomy, as hypoplasia of one of the ACAs is

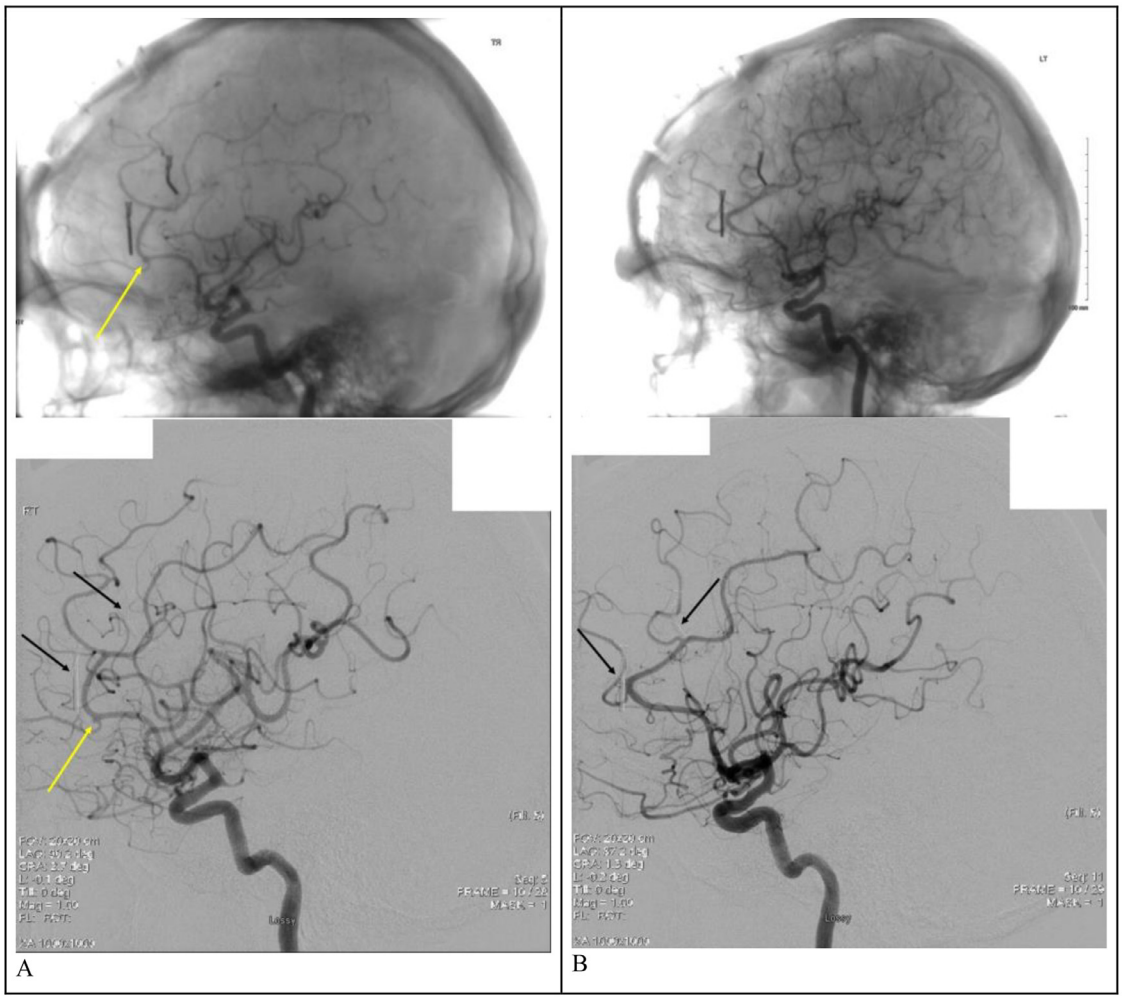

Fig. 5 – (A) Right carotid catheter angiogram with digital subtraction reveals A2 trunk aneurysm (yellow arrow) with surgical clips (black arrows), (B) Left carotid catheter angiogram with digital subtraction reveals position of left ACA surgical clips (black arrows), upper arrow shows clipping of A3 trunk bifurcation, lower arrow shows clipping of the large A2 aneurysm. (Color version of figure is available online.)

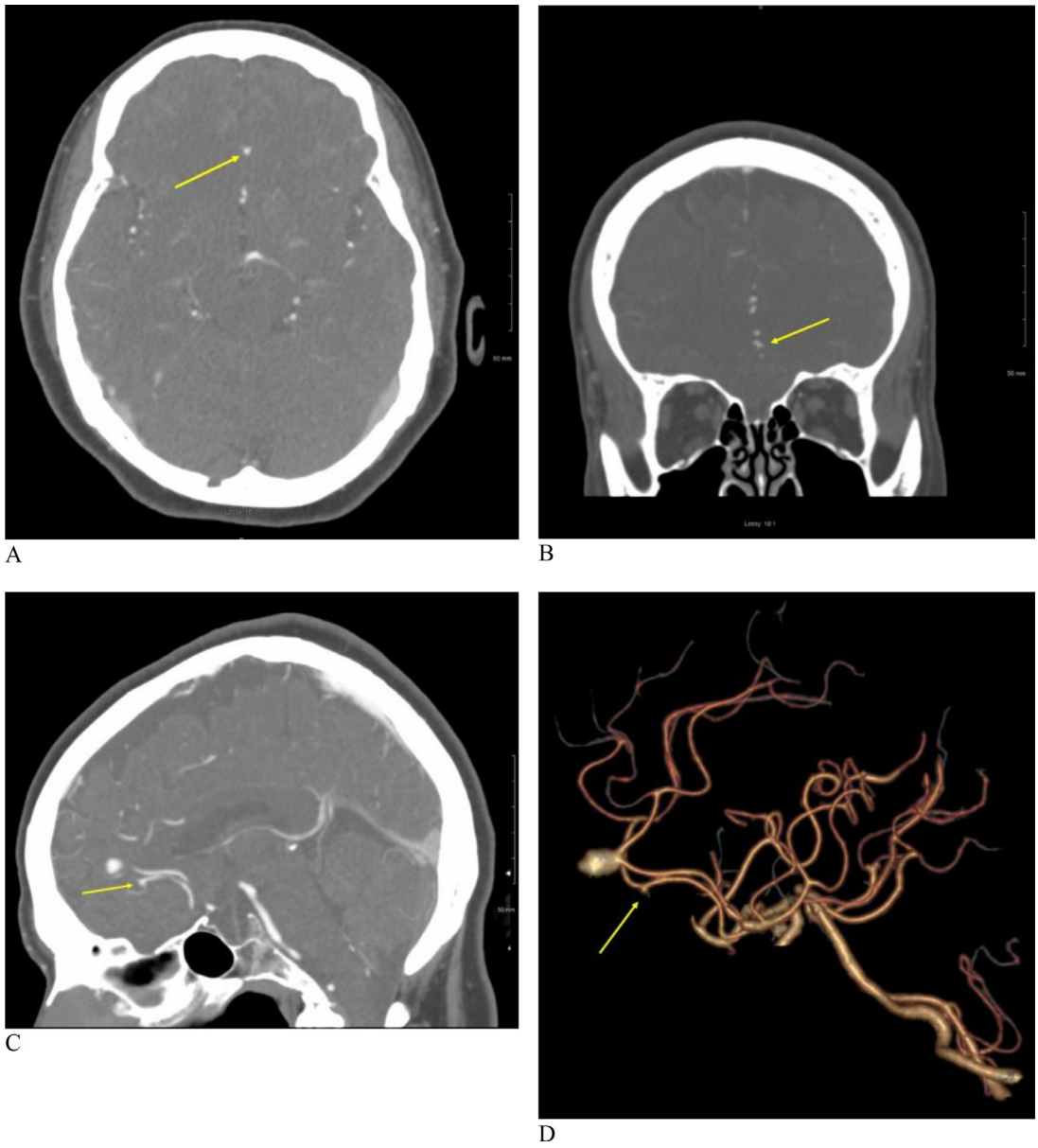

Fig. 6 – Computed tomography angiography demonstrating possible right A2 trunk saccular aneurysm (yellow arrows) (A) Axial. B and C are coronal and sagittal reconstructions. (D) 3D volume rendering. (Color version of figure is available online.)

relatively common, estimated at approximately 10% and may exclude endovascular procedures due to probable ischemic events [16]. Of further consideration, enhancement of the rim of the aneurysm may increase suspicion for filling defects due to a thrombosed aneurysm. Also, a 3D projection series may help in elucidating small blister aneurysms. While 3D projections have yet to be standardized, and thresholds for viewing widely vary, we endorse the systematic approach to evaluating these views as detailed by Tomandl et al [17]. Once an aneurysm has been found, these 3D projections can be filtered by selecting voxels of different opacities. Selecting high opacity voxels gives limited information while selecting lower opacity voxels allows the creation of a transparent 3D projection, which can give valuable information about the relationship of the aneurysm to surrounding vasculature.

Conclusion

CTA is an important first step in the approach to suspected ICAs, can lead to timely diagnosis, and provide critical information to the proceduralist on the selection and performance of further interventions. CTA has limited capability in detecting aneurysms at bifurcation points and smaller sized aneurysms less than 3 mm. This report shows that noninterventional imaging procedures as the sole approach to preoperative planning can miss additional smaller aneurysms. Also, DACA aneurysms are associated with additional ICAs in half of patients. When single DACA A2 aneurysms are encountered, it may be prudent to search for additional aneurysms with DSA. We believe initial noninterventional imaging and subsequent

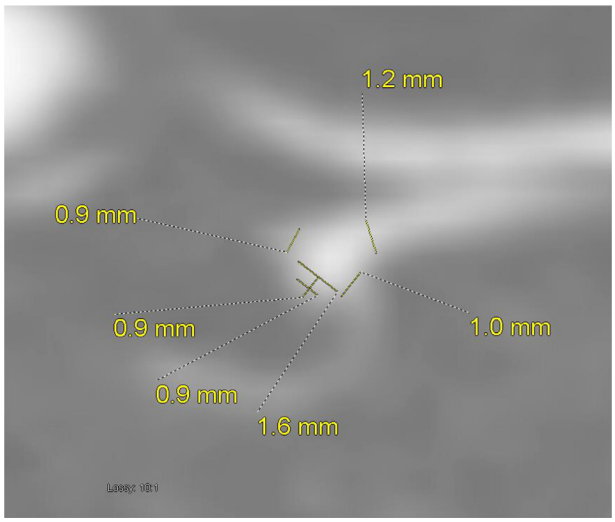

Fig. 7 – Computed tomography angiography annotation of possible right A2 trunk aneurysm. Dome length 0.95 mm. Dome width: 1.16 mm. neck width: 2.01 mm. Aspect Ratio (Dome/Neck): 0.57.

DSA for a complete evaluation of the cerebral vasculature is the best approach for definitive therapy.

Teaching point summary

Distal anterior cerebral aneurysms are rare (6% of all intracranial aneurysms) but are more often associated with additional ICAs, in up to 52% of patients [15]. Also, they are of smaller size, broad-based and associated with arterial branching sites which may make both image-guided planning and definitive therapy difficult.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2019.09.028.

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