

Case Report

Rare cerebrovascular anomalies in a patient with Cornelia De Lange Syndrome

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Abstract

Background: Cornelia De Lange (CDL) is a rare genetic syndrome characterized by short stature, intellectual disability, skeletal abnormalities, and distinctive facial features. We present a case of CDL with several rare cerebrovascular anatomic variants that impacted the treatment of a direct cavernous carotid fistula (CCF).

Case Description: This 32-year-old male CDL patient suffered a direct, traumatic CCF on the left and presented to our institution for endovascular management. Cerebral angiography revealed several anatomic variants, including hypoplastic external carotid arteries bilaterally. The vascular territory typically supplied by the internal maxillary arteries was fed by a prominent vessel arising from the internal carotid artery (ICA) in the expected location of the vidian artery. This anatomic variant directly impacted management due to retrograde filling of the fistula, necessitating coil embolization at its origin from the left ICA.

Conclusion: Advance knowledge of cerebrovascular variants associated with CDL may help interventionalists prepare to approach such cases. Additionally, further inquiry into the function of proteins encoded by genes associated with CDL could better our understanding of vascular development in the brain.

Key Words: Anatomic variants, cavernous carotid fistula, Cornelia De Lange Syndrome, internal maxillary artery, vidian artery

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Quick Response Code:**INTRODUCTION**

Cornelia De Lange (CDL) is a rare genetic syndrome inherited in an autosomal dominant manner but more commonly resulting from *de novo* mutations in the NIPBL, SMC1A, and SMC3 genes.^[1-3] CDL patients demonstrate short stature and various neurological, craniofacial, gastrointestinal, and musculoskeletal anomalies.^[6-8] However, anatomic variation of the cerebrovasculature has not been previously reported.

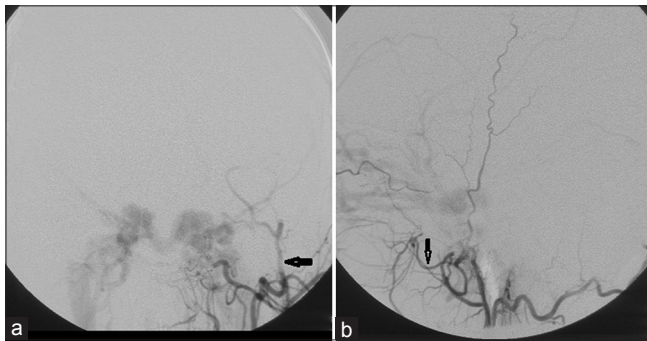
CASE REPORT

The patient is a 32-year-old male, previously diagnosed with CDL syndrome, who presented with left exophthalmos and chemosis following closed head trauma. Physical examination revealed a carotid bruit with auscultation over the left temporal area suggestive of direct traumatic cavernous carotid fistula (CCF).

Left common carotid angiogram demonstrated complete passage of blood from the left internal carotid artery (ICA)

into the left cavernous sinus, with shunting into the right cavernous sinus, and subsequent drainage via the bilateral jugular veins. Additionally, the territory typically supplied by the left internal maxillary artery (IMAX) was fed by a prominent vessel originating from the horizontal segment of the left ICA [Figure 1a and b]. Diagnostic right common carotid angiogram demonstrated similar variant anatomy [Figure 2a and b] as well as cross-filling of the left anterior circulation via a patent anterior communicating artery. Subsequent opacification of the left ICA and CCF were indicative of steal phenomenon.

Investigation of the posterior circulation via right vertebral injection revealed a large fenestration or unfused middle segment of the basilar artery. In addition, the distal basilar artery was unfused and the superior cerebellar arteries arose from the P1 segments of the posterior cerebral arteries bilaterally. A very prominent left posterior communicating artery fills the left supraclinoid ICA and bilateral cavernous sinuses (via direct CCF) in a retrograde fashion [Figure 3].



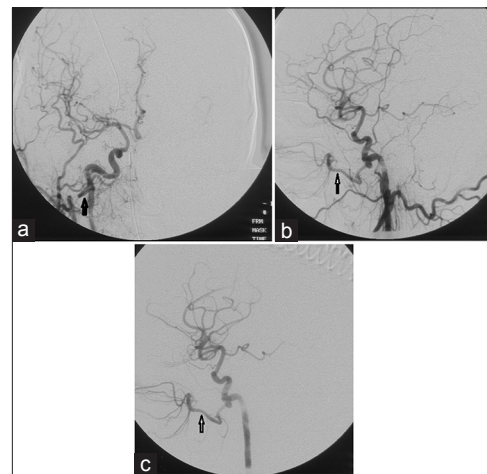
Figures 1 (a and b): AP and lateral left CCA injection demonstrating complete passage of blood from the left internal carotid artery (ICA) into the left cavernous sinus, with shunting into the right cavernous sinus. A vessel supplying the IMAX territory is noted to arise from the petrous segment of the left ICA



Figure 3: Right vertebral artery angiogram showing a large fenestration or unfused middle segment of the basilar artery. The distal basilar artery was unfused and the superior cerebellar arteries arose from the P1 segments of the posterior cerebral arteries bilaterally. A very prominent left posterior communicating artery fills the left supraclinoid ICA and bilateral cavernous sinuses (via direct CCF) in a retrograde fashion

ICA and bilateral cavernous sinuses (via direct CCF) in a retrograde fashion [Figure 3].

Coil embolization was first performed from above, through a microcatheter advanced from the right vertebral artery across the left posterior communicating artery and into the left ICA. Following occlusion the superior cavernous portion of the left ICA, the fistula was trapped by coil-embolization of the inferior cavernous portion from below. Subsequent left CCA injection revealed retrograde filling of the CCF from branches of the putative IMAX via prominent anastomoses from external carotid artery at the same site [Figure 4]. Therefore, care was taken to coil-embolize the left IMAX origin, which had reverse blood flow from the collaterals into the CCF. Successful occlusion of the left ICA, including the aberrant IMAX origin, resulted in obliteration of the CCF [Figure 5]. On follow-up examination 2 weeks after



Figures 2 (a-c): AP and lateral right CCA injection demonstrating hypoplastic ECA with absent IMAX. A vessel supplying the IMAX territory arises from the petrous ICA in the expected region of the vidian artery. This finding is better appreciated on the selective ICA injection



Figure 4: Lateral left CCA injection reveals back-filling of CCF from branches of the putative internal maxillary artery via prominent anastomoses from external carotid artery at the same site



Figure 5: Lateral left CCA injection following coil embolization of the left ICA from below, at the origin of the putative left IMAX, results in occlusion of the cavernous carotid fistula

embolization, the patient's carotid bruit, proptosis, and conjunctival injection had resolved. Further imaging was deferred unless new or recurrent symptoms developed.

DISCUSSION

CDL syndrome has been associated with abnormalities affecting almost every organ system. Several genes implicated in CDL control fetal limb and face development, in addition to other structures. Neurological features include ventriculomegaly, frontal lobe white matter hypoplasia, and vermian hypoplasia.^[9] Given that craniofacial development occurs in step with cerebrovascular embryogenesis, it is interesting to note the low-set ears and high-arched palate characteristic of CDL. We describe anatomical variants of the cerebrovasculature heretofore unreported in a patient suffering this condition. In particular, bilateral origin of arteries supplying the IMAX territory from the ICAs is extremely rare and to our knowledge unreported in the literature.

Human fetal anatomic studies have described a primitive maxillary artery originating from the cavernous segment of the ICA, which may persist in the setting of contralateral agenesis.^[4,5] The presented case demonstrates fully developed internal carotids; it is the normal IMAX arising from the external carotid artery (ECA), which is absent. During embryogenesis, the primitive mandibular artery arises from the first aortic arch at 4–5 mm development. The vidian artery (VA)

then arises from remnants of the mandibular artery as it regresses. As the ECA forms from the ventral pharyngeal artery, its IMAX division assimilates the VA.^[10] The adult VA is therefore typically diminutive and only seen on angiography as a small vessel arising from the petrous ICA or IMAX. We hypothesize the vidian ICA became the dominant supply in this case, replacing IMAX bilaterally, possibly related to ECA hypoplasia during embryogenesis.

CONCLUSION

CDL is a rare genetic syndrome that may be associated with rare anatomical variants of the cerebrovasculature. Such anatomical variants should be sought and characterized during initial diagnostic angiography, as they may add complexity to the treatment of routinely encountered neurointerventional diseases. Further investigation into the relationship between genes involved in CDL syndrome and associated vascular variants may lead to a better understanding of cerebrovascular development.

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