

Double Oxymoron Crisis: Posterior Circulation Intracranial Bleeding with Anterior Circulation Ischemic Stroke—A Management Dilemma

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ABSTRACT

Blood flow to the brain is mainly through anterior circulation *via* bilateral internal carotid arteries and through posterior circulation *via* bilateral vertebral arteries. The anterior circulation is for the respective side with the communication with the anterior communicating artery. The posterior flow is with the single basilar artery formed from vertebral arteries. There are collaterals present but the main vasculature determines most of the flow. This dynamic is normally balanced except in pathological conditions where flow is compensated from other vessels through the circle of Willis. It is rare to see a competing flow on each side and further, it is more complex when one region has a restricted flow and while another region has hyperdynamic

Keywords: Autoregulation, Brain, Cerebral circulation, Neurotrauma.

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INTRODUCTION

Blood flow to the brain is mainly through anterior circulation *via* bilateral internal carotid arteries and through posterior circulation *via* bilateral vertebral arteries. The anterior circulation is for the respective side with the communication with the anterior communicating artery. The posterior flow is with the single basilar artery formed from vertebral arteries. There are collaterals present but the main vasculature determines most of the flow.¹ This dynamic is normally balanced except in pathological conditions where flow is compensated from other vessels through the circle of Willis. It is rare to see a competing flow on each side and further, it is more complex when one region has a restricted flow and while another region has hyperdynamic.

CASE DESCRIPTION

A 66-year-old right-handed male patient with a past medical history of hypertension, obesity, and hyperlipidemia. There was a remote history of possible Von Willebrand disease. He presents with hemiparesis, alerted mental status, severe hypertension of 210/138 mm Hg, and acute respiratory failure. He was intubated and an emergent CT head (Fig. 1A) showed acute pontine hemorrhage with early hydrocephalus. He was given 6000 units of humate and an external ventricle device inserted in the operating room. The diffuse weakness did not change, more on the left side as compared to the right. His admission CTA of the head showed multi-focused atherosclerosis. His follow-up MRI and MRA brain showed right-sided acute ischemic changes and restricted flow in M1 right MCA (Figs 1B to D). There was restriction flow of left MCA M1 also. (Figs 1B to D). Initial management to reduced systolic BP to 140 mm Hg followed by a gradual increase to 160 mm Hg to avoid any further increase in hemorrhage. The patient underwent a tracheostomy and was discharged to acute neurological rehab.

To our knowledge, this is the first commentary on a combination of anterior acute ischemia stroke with posterior

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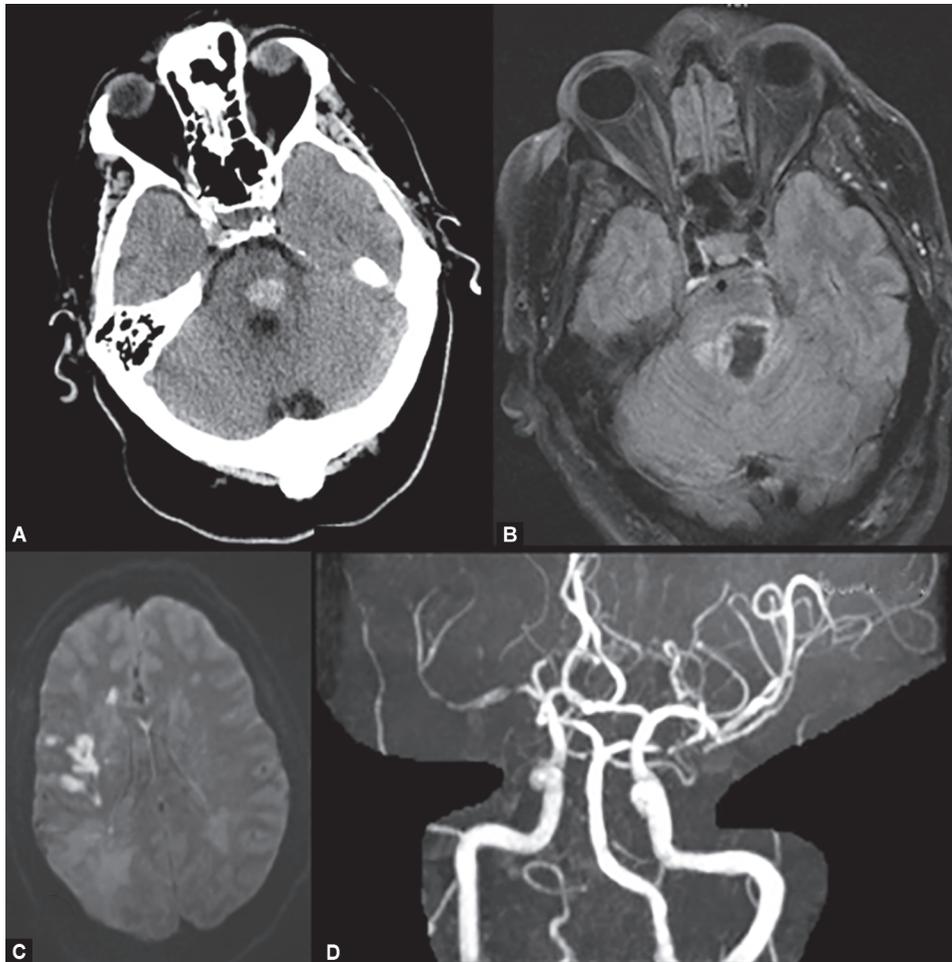
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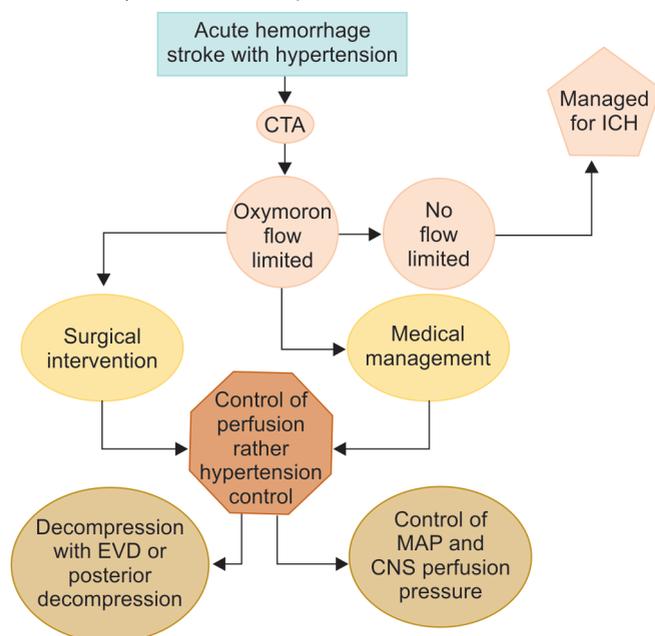
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hemorrhagic stroke. This patient basilar artery was full size, without any narrowing, and a question was brought up about dilatation to compensate for the anterior circulation limitation. Older records confirmed that the patient was seen in the clinic for uncontrolled hypertension with good compliance. This might be due to anterior circulation limitation with secondary symptomatic response to increasing the flow by increasing the systemic blood pressure. With the combination of systemic hypertension and full-size basilar artery, the central control failed to lead to pontine hemorrhage. The management for control of systemic hypertension response in these patients is done with an invasive arterial line, short-acting antihypertensive, and close neurocritical care monitoring. The low flow anterior circulation is highly dependent on systemic flow and perfusion pressure. The posterior circulation hemorrhage is managed surgically if obstructive hydrocephalus is present or cerebellar hemorrhage is causing posterior fossa hypertension. An initial drop in systolic blood pressure should be 20% of the presentation if the competing flow shows a limitation on imaging. Further reduction of flow is directly guided by invasive



Figs 1A to D: Imaging showing flow dynamics: (A) Non-contrast CT head with pontine hemorrhage; (B) MRI with focal edema and hemorrhage; (C) DWI showing patchy ischemic changes in the anterior circulation; (D) MRA confirming restricted flow in the anterior circulation while opposite seen with robust and possible dilated basilar artery

Flowchart 1: A proposed neurocritical care management pathway for contradictory carinal flow and perfusion issues



monitoring, intervention for the bleeding, and the response of the initial medical management. If there is a surgical intervention, the management changes to a further reduction in systemic systolic pressure (Flowchart. 1). The cerebral perfusion pressure is determined by mean arterial pressure besides other factors.² These factors play an important role before full medical management, after surgical management, and medical management after a neurosurgical intervention.³

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