

Cerebral Gas Embolism - A Serious Complication of CO₂ Angiography

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Received June 12, 2015; Revised June 19, 2015; Accepted June 25, 2015

Abstract Carbon dioxide angiography is routinely used for vascular imaging and endovascular procedures. It is very useful in patients with allergy to iodinated contrast agents or with poor renal function. It is relatively safe to use. We describe first case of cerebral gas embolism leading to multiple bilateral ischemic strokes in a patient receiving carbon dioxide angiography for workup of thrombosed arm arteriovenous fistula.

Keywords: thrombosed, arteriovenous, digital subtraction angiography, stroke

Cite This Article: SUMIT KAPOOR, Nariman Nezami, Ross Mazo, and Jyotsana Thakkar, "Cerebral Gas Embolism - A Serious Complication of CO₂ Angiography." *American Journal of Medical Case Reports*, vol. 3, no. 8 (2015): 227-230. doi: 10.12691/ajmcr-3-8-2.

1. Introduction

Carbon Dioxide (CO₂) angiography has become a widely used modality for vascular imaging and endovascular procedures [1,2]. Its applications include digital subtraction angiography, aortography, venography, renal arteriography, visceral angiography, transcatheter embolization, angioplasty and stenting, endovascular abdominal aortic aneurysm repair and TIPS placement [1-8]. It is particularly useful in patients who are hypersensitive to iodinated contrast or have compromised renal function [9]. We report the first case of CO₂ gas embolism causing multiple diffuse bilateral strokes in a patient undergoing CO₂ angiogram for thrombosed AV fistula.

2. Case Description

A 54 year old Male with past medical history of Diabetes Mellitus, Hypertension, Coronary artery disease and kidney transplant in 2007 for End stage renal disease, was admitted to a vascular center for outpatient CO₂ angiography for signs and symptoms concerning for Right upper extremity ischemia from thrombosed right arm Arteriovenous fistula. Immediately post procedure, his mental status deteriorated and developed focal neurologic deficits (Left upper extremity weakness and left facial droop). He was intubated for airway protection due to poor mental status and was transferred to our hospital for hyperbaric oxygen therapy for possible CO₂ cerebral gas embolism. Head CT did not reveal acute stroke. MRI brain showed multiple bilateral white matter infarcts in frontal, parietal and occipital lobes (MR images 1 to 5). Transesophageal echocardiography showed no cardiac thrombus or intracardiac shunts. His ICU course was

complicated by Acute respiratory distress syndrome, septic shock, seizures, pneumonia and renal failure requiring renal replacement therapy. There was no meaningful improvement in his mental status and underwent tracheostomy and PEG tube placement as per family wishes and transferred to nursing home.

3. Discussion

CO₂ is widely used as an intravascular contrast agent for imaging of the arterial and venous circulations. It is particularly useful in patients with renal insufficiency or those who have allergy to iodinated contrast agents. It is a colorless and odorless gas which is 20 times more soluble in blood than oxygen. It forms bubbles in the vessels which completely dissolve in 2-3 minutes. Therefore, repeated injections of CO₂ are given 2-3 minutes apart so that it does not accumulate and form large bubbles in vessels. It has low viscosity leading to better filling and visualization of the collateral vessels in the vascular occlusive diseases. Adverse effects reported due to CO₂ angiography are related to the dose and air contamination. Pain at the injection site during peripheral venography and nausea and abdominal pain during celiac arteriography have been reported [2,10]. CO₂ trapped in aortic aneurysm may lead to colonic ischemia [2,10]. Injection of excessive volumes of CO₂ or air contamination can lead to vapor lock in the pulmonary artery and severe hypotension that persists for 30 seconds and improves with placing the patient in left lateral decubitus or trendelenburg position [2]. There are no absolute contraindications for CO₂ angiography but should not be used for imaging of thoracic aorta and arterial vasculature above the diaphragm due to the risk of carotid, spinal and coronary artery gas embolism. It should be avoided in patients with pulmonary hypertension since it increases the pulmonary artery

pressure and in patients with known intracardiac shunts or pulmonary AV malformations as it may cause paradoxical embolism. We report first case of upper extremity CO₂ angiography causing carotid artery gas embolism leading

to diffuse bilateral ischemic strokes. In our case, the explanation is that thrombosed AV fistula led to retrograde movement of the CO₂ bubbles and entered bilateral cerebral circulation.

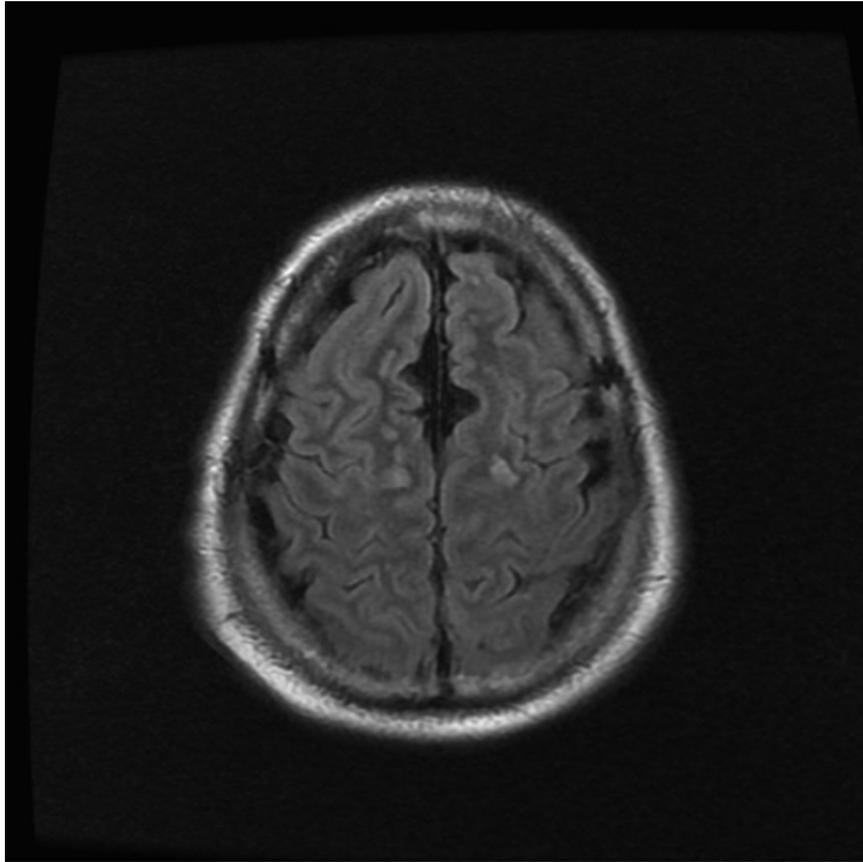


Figure 1. MRI Image 1

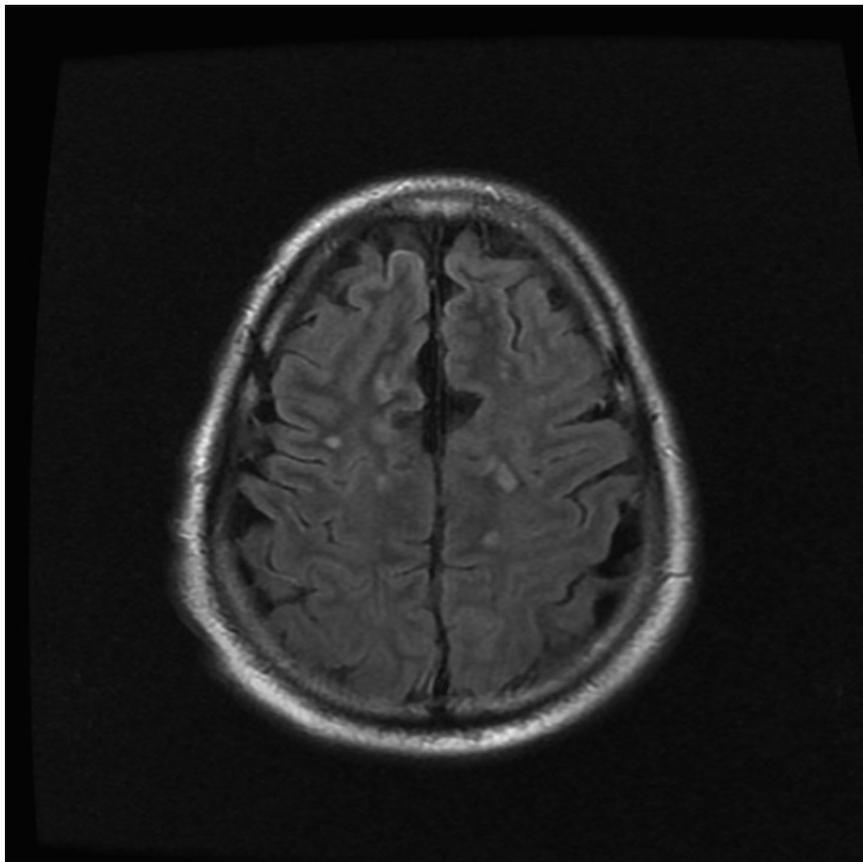


Figure 2. MRI Image 2

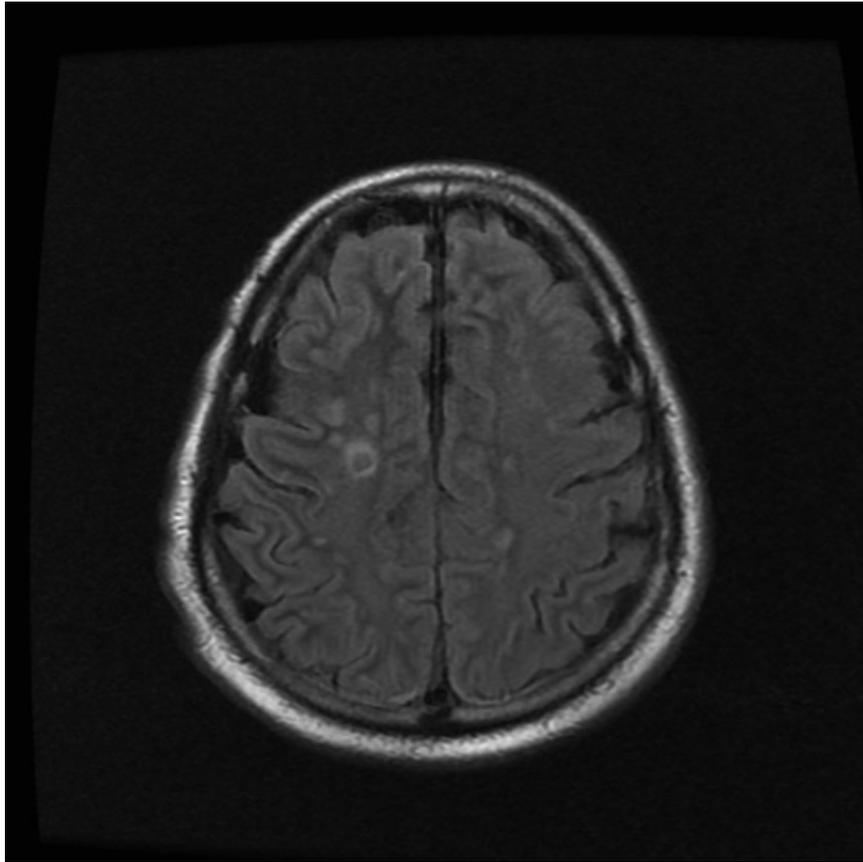


Figure 3. MRI Image 3

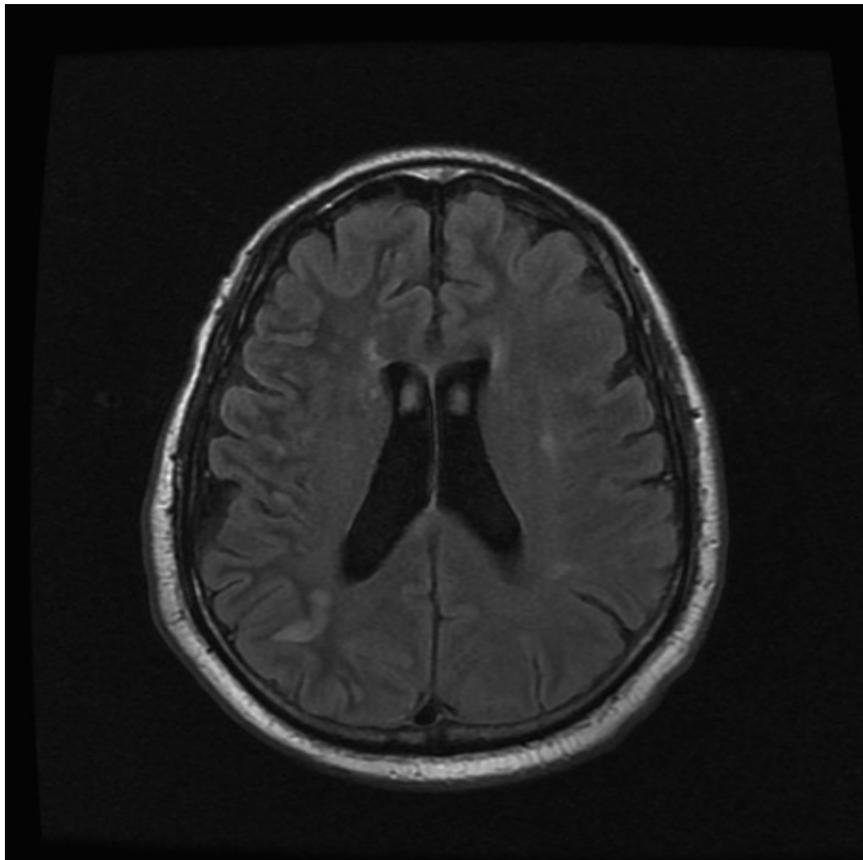


Figure 4. MRI Image 4

4. Conclusion

Intensivists should be aware of the reported adverse effects of CO₂ angiography since we care for this patient population in our ICUs. We report first case of cerebral

gas embolism due to CO₂ angiography which left patient debilitated with tracheostomy and feeding tube.

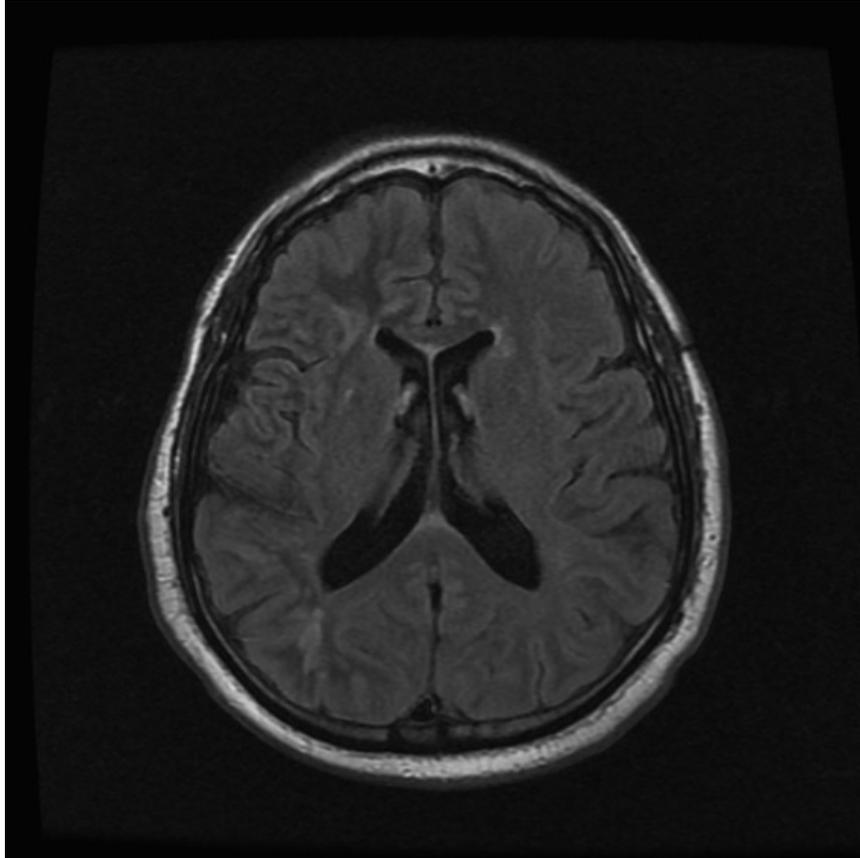


Figure 5. MRI Image 5

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