

# When a plain CT brain looks like contrast-enhanced- never forget polycythemia

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## DESCRIPTION

A 26-year-old man, suffering from complex congenital cyanotic heart disease (CCHD) with Eisenmenger complex, presented with seizures. Non-contrast CT (NCCT) scan of brain showed chronic infarct with encephalomalacic changes in the left high parietal region with vividly hyperdense intracranial arteries and venous sinuses (figure 1). Haemoglobin value was 253 g/L with 81% haematocrit.

Hyperdensity of the cerebral vasculature on NCCT results commonly from acute stroke ('dense artery sign' in acute arterial infarction), subarachnoid haemorrhage or cerebral venous sinus thrombosis (CVST). However, diffuse hyperdensity involving intracranial arteries simultaneously with dural venous sinuses on NCCT is reported in hemoconcentration and polycythemia.<sup>1,2</sup> While polycythemia vera has been discussed to be associated with this striking finding, association of secondary polycythemia in an adult with complex CCHD is unique.<sup>1-3</sup>

Flowing blood measures 40 HU on CT scan at 45% haematocrit. As the normal adult grey matter measures 39 HU and normal haematocrit is 42%–52%, normal cerebral vessels appear isodense or minimally hyperdense on NCCT.<sup>2</sup> A linear relationship is reported between haemoglobin level and the contrast of dural sinuses compared with cerebral grey matter, indicating that high haemoglobin level causes increased density of cerebral vessels on NCCT.<sup>1</sup> However, increased attenuation of venous sinuses is characteristically found in CVST. While attenuation values of more than 70 HU suggest

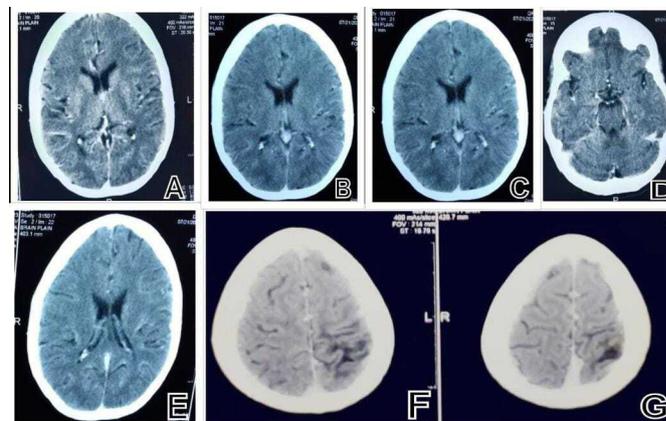
CVST, less than 70 HU favours polycythemia.<sup>4</sup> In our case, CVST was ruled out on MR venography and the attenuation values ranged from 60 HU to

## Patient's perspective

My son has been suffering from some congenital heart disease diagnosed at the age of 2 years, but could not be operated. He had multiple convulsions on the day of admission. Doctors ordered CT scan, which was abnormal. After performing further sophisticated imaging, the doctors assured us that there was no active bleed in the brain. They also informed us that the convulsions and abnormal CT imaging was due to excessive red cell mass secondary to his heart disease. My son is doing well after getting blood thinner (aspirin) and antiepileptics (given by patient's mother).

## Learning points

- ▶ Seizures in congenital cyanotic heart disease can be due to hypoxic spells, cerebral venous sinus thrombosis (CVST), embolic infarct or abscess due to infective endocarditis and vascular congestion secondary to polycythemia.
- ▶ Polycythemia and CVST can mimic each other with respect to neurological symptoms clinically and radiologically on non-contrast CT brain. Moreover, CVST itself being a complication of polycythemia, these two must be differentiated to guide therapeutic decision-making.



**Figure 1** Non-contrast CT images of the brain show diffusely hyperdense cerebral arteries, venous sinuses and cisterns (A to E). Gliotic foci are also noted in the high parietal lobe on the left side (F, G).

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## Images in...

68 HU, correlating with hyperdense sinuses without thrombosis. The gliotic area in the left parietal region was probably due to old venous infarct. As polycythemia mimics CVST on NCCT brain, shares few similar neurological symptoms clinically and CVST being a complication of polycythemia, these two must be differentiated to guide further management.<sup>4 5</sup>

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### REFERENCES

- 1 Ben Salem D, Osseby GV, Rezaizadeh-Bourdariat K, *et al.* [Spontaneous hyperdense intracranial vessels seen on CT scan in polycythemia cases]. *J Radiol* 2003;84:605–8.
- 2 Varwate P, Ilangovan G, Balganesan H, *et al.* Non-Enhanced CT Mimicking Contrast Enhanced CT - A Case Report on Polycythemia. *J Radiol Case Rep* 2019;13:10–16.
- 3 Gayathri S, Prasad A, Sachdeva N, *et al.* Unique features of polycythemia observed on plain non contrast CT scan of head. *J Pediatr Neurosci* 2010;5:27–9.
- 4 Black DF, Rad AE, Gray LA, *et al.* Cerebral venous sinus density on noncontrast CT correlates with hematocrit. *AJNR Am J Neuroradiol* 2011;32:1354–7.
- 5 Healy JF, Nichols C. Polycythemia mimicking venous sinus thrombosis. *AJNR Am J Neuroradiol* 2002;23:1402–3.

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