Deep Cerebral Venous Thrombosis: An Illustrative Case with Reversible Diencephalic Dysfunction

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ABSTRACT: *Background:* Isolated thrombosis of the deep cerebral veins is rare and its diagnosis can be difficult. Mortality is often high and little is known about the long-term prognosis. *Case report:* We report a 24-year-old woman with akinetic mutism and extensive bilateral thalamic lesions. CT and MRI allowed early diagnosis by demonstrating thrombosis within the internal cerebral veins, without the need for angiography. Heparin treatment was used safely despite the presence of thalamic and intraventricular hemorrhage. After five weeks, the patient recovered rapidly and remains well at 18 months. Serial MRI showed dramatic resolution of the imaging abnormalities. *Conclusions:* The clinical features and characteristic neuroimaging appearance of deep cerebral venous thrombosis should be recognized by physicians caring for stroke patients. Deep cerebral venous thrombosis can produce extensive venous congestion and vasogenic edema without early infarction. Excellent clinical recovery is possible even after severe and prolonged neurological deficits.

RÉSUMÉ: Thrombose veineuse cérébrale profonde: un cas type présentant une dysfonction diencéphalique réversible. *Introduction:* La thrombose isolée de veines cérébrales profondes est rare et son diagnostic peut être difficile. La mortalité est souvent élevée et on connaît mal le pronostic à long terme. *Étude de cas:* Nous rapportons le cas d'une femme de 24 ans ayant présenté un mutisme akinétique et des lésions thalamiques bilatérales étendues. Le CT scan et la résonance magnétique ont permis de poser le diagnostic d'emblée en démontrant une thrombose dans les veines cérébrales internes, sans recourir à l'angiographie. Le traitement à l'héparine a été utilisé sans complication malgré la présence d'hémorragies thalamiques et intraventriculaires. Cinq semaines après l'événement, la patiente avait récupéré et son état était bon 18 mois plus tard. Des examens répétés par résonance magnétique ont montré une résolution dramatique des anomalies observées initialement. *Conclusions:* Les manifestations cliniques et les images neuroradiologiques caractéristiques de la thrombose veineuse cérébrale profonde devraient être connues des médecins qui traitent des patients atteints d'accidents vasculaires cérébraux. Une thrombose veineuse cérébrale profonde peut provoquer une congestion veineuse étendue et un oedème vasogénique sans infarcissement précoce. Une excellente récupération clinique est possible même si le patient présente des déficits neurologiques sévères et prolongés.

Rapid and accurate diagnosis of stroke is essential because of the increasing availability of acute treatment options. Clinicians caring for stroke patients need to be familiar not only with the common arterial stroke syndromes, but also with early recognition and management of cerebral venous thrombosis (CVT). Cerebral venous thrombosis can involve the dural sinuses, superficial cortical veins, or deep venous system, either alone or in combination.[1] Deep cerebral venous thrombosis (DCVT) is the least common form of CVT, with only about 60 reported cases. Deep cerebral venous thrombosis can present as an acute neurological emergency with life-threatening bilateral destruction of thalamus, basal ganglia, and subcortical white matter. This paper illustrates the clinical and neuroimaging features that allow early diagnosis, and emphasizes that excellent recovery is possible despite prolonged diencephalic dysfunction.

CASE REPORT

A previously healthy 24-year-old student was admitted to the intensive care unit in an akinetic mute state. She was found "catatonic" on her apartment floor after family could not contact her for three days. She had been well until one week earlier, when she developed severe

headache, nausea, and vomiting. Her only medication was the oral contraceptive pill. Examination revealed temperature 37.9°C, pressure sores on the skin, and mild meningismus. She was awake but mute. She had minimal spontaneous movement, flat affect, and followed only simple commands. There was bilateral facial weakness and asymmetric quadriparesis (grade 3–4/5) with hyperreflexia and extensor plantar responses. Pupils were reactive to light (4 mm). There was no papilledema. There was impaired upward gaze and an abduction palsy of the left eye.

White blood cell count was 12 x 10^9/L (normal 4–11). Other routine laboratory studies, drug screen, pregnancy test, and chest x-ray were negative. Brain computed tomography (CT) (Figure 1) revealed mild symmetric bilateral hypodensity in the thalamus and basal ganglia, initially interpreted as carbon monoxide poisoning. Further neuroradiological interpretation revealed increased density within the deep cerebral veins, and a small amount of blood in the right occipital horn. CSF showed xanthochromia, elevated RBC (1600) and WBC (35), normal glucose (3.9), and increased protein (1.9 g). Initial management consisted of ceftriaxone, ampicillin, and acyclovir for possible central nervous system infection, as well as neurosurgical consultation, after which nimodipine was given for possible subarachnoid hemorrhage with vasospasm. Cultures of blood, urine, and CSF were negative. Brain magnetic resonance imaging (MRI) the next day revealed extensive signal abnormalities within the thalamus and basal ganglia bilaterally (Figure 2a), accompanied by hyperintense signal on T1-weighted images in the internal cerebral veins, vein of Galen, and straight sinus, diagnostic of thrombosis of the deep venous system. Superior sagittal and lateral sinuses were patent on magnetic resonance venography. Anticoagulation with intravenous heparin was initiated. MRI one week later showed asymptomatic hemorrhagic transformation within the thalamus bilaterally.

She remained in an abulic, amnestic state with periods of agitation and psychosis. Despite the severity of imaging abnormalities, a rapid recovery of function began after five weeks, coinciding with recovery from her anterograde amnesia. MRI at two months revealed recanalization of the vein of Galen, straight sinus, and one of the internal cerebral veins, and dramatic reduction in the thalamic lesions. She continued to improve, and achieved full functional recovery with return to university classes and office work. At four months, neurological examination was normal except for mild impairment of recent memory. Hematological investigations identified protein C deficiency. She remains on long-term oral anticoagulation, off the oral contraceptive pill, and free of recurrent thrombotic events. At 18 months, MRI shows almost complete resolution of the lesions except for two small residual foci of abnormal signal within the thalami suggesting infarction (Figure 2b).

DISCUSSION

Deep cerebral venous thrombosis is a treatable, often life-threatening, neurological emergency. It should be considered in the differential diagnosis of unexplained coma, akinetic mutism, abulia, and bilateral thalamic lesions. DCVT can masquerade as subarachnoid hemorrhage, meningitis, encephalitis, and basilar artery territory infarction. Our patient's presentation initially suggested aneurysmal subarachnoid hemorrhage, with headache, meningismus, and blood on CT and in the CSF.

Compared to dural sinus thrombosis, DCVT is rare (nine out of 135 cases in the largest series of CVT), has a higher mortality, and is more likely to present acutely with impaired conscious-


Figure 1: *Noncontrast axial CT scan from a patient with deep cerebral venous thrombosis. Note the bilateral hypodensities in the thalami and left corona radiata, and increased density in the internal cerebral veins and vein of Galen.*

ness and long tract signs.[1,2] In a retrospective review of 49 patients with DCVT, the presenting features were confusion, coma, or mental status changes (76%); headache (63%); nausea and/or vomiting (41%); hemiparesis (33%); seizure (14%); fever (12%); papilledema (10%); and aphasia (6%).[2] Residual memory impairment due to thalamic involvement has been described and was present in our patient.[3] The CSF is often abnormal with RBC in two-thirds of patients, pleocytosis in one-third, and increased protein.[1] Milder forms of DCVT with a favourable prognosis are being increasingly recognized with MRI.[3,4]

The typical imaging findings of DCVT may be evident on CT and confirmed by MRI (Figures 1 and 2). On noncontrast CT a hyperdense "cord sign" in the diencephalic region indicates acute thrombosis within the internal cerebral veins, vein of Galen, or straight sinus; bilateral symmetric hypodensity within the thalamus, basal ganglia, and corona radiata represents edema or infarction.[5] MRI confirms the diagnosis by demonstrating clot in the deep cerebral veins.[6] The pattern of edema, which is clearly evident on MRI, distinguishes venous infarcts from arterial occlusive disease. Hemorrhagic transformation of the ischemic tissue may be evident. Serial MRI studies can monitor clot extension or recanalization.[7] With MRI, conventional angiography is now seldom necessary for diagnosis. Recent reports suggest diffusion- and perfusion-weighted MRI, or magnetic resonance spectroscopy, may add prognostic information in the acute stage by distinguishing reversible vasogenic edema (viable tissue) from irreversible venous infarction.[8,9]

Anticoagulation is considered the treatment of choice, even in the presence of hemorrhagic infarction.[1,10-12] In a retrospective review of treatment outcome for DCVT, heparin or local

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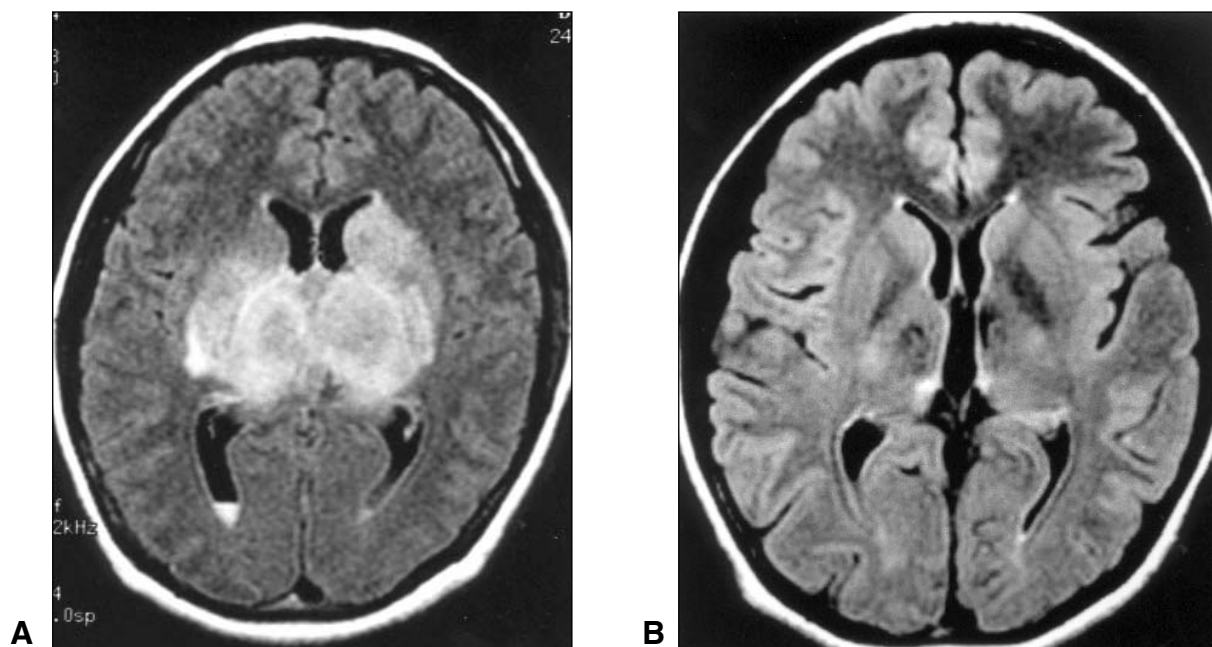
Figure 2: *Axial brain MRI fluid-attenuated inversion-recovery (FLAIR) sequences.*
(a) Initial scan showing abnormal hyperintensity in the thalamus bilaterally, extending into the basal ganglia. A fluid-fluid level is seen in the occipital horn of the right lateral ventricle, indicating intraventricular hemorrhage. Repeat scan two months later (not shown) showed a dramatic reduction in the hyperintensity, with two small residual foci of hyperintensity in the thalami.
(b) Follow-up scan at 18 months post-stroke showing further resolution of the lesions, with two small residual foci of low signal intensity in the thalami suggesting infarction.

thrombolysis was associated with improved survival – mortality was 13% vs. 48% for "untreated" patients, despite similar initial severity and time to treatment in both groups.[13] Most survivors had full recovery or only mild disability. Direct endovascular thrombolytic therapy is now being considered for patients who deteriorate despite adequate anticoagulation.[13,14] Patients should be investigated for the underlying etiology of thrombosis, including newly recognized hereditary prothrombotic conditions.[1,15,16]

This case emphasizes that DCVT can produce extensive venous congestion and vasogenic edema without early infarction[17] and demonstrates that excellent clinical recovery from DCVT is possible, even with a profound deficit persisting for several weeks.

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