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Case Report

Spinal canal meningioma mimicking posterior fossa ischemia on CT perfusion: A CT perfusion pitfall

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ABSTRACT

The recent approach to treat acute stroke is to extend treatment window in patients with salvageable peri-infarct ischemia which increases the application of the perfusion imaging, specifically computed tomography perfusion (CTP). In this paper, I am presenting a case of left middle cerebral artery infarction which was evaluated by CTP under "code stroke." The patient had an incidental spinal canal meningioma which was out of field of view in CTP but mimicked right cerebellar ischemia on CTP. Although ischemia has been previously reported within the peripheral parenchymal edema surrounding a meningioma, in this patient there was no evidence of edema in the right cerebellum on magnetic resonance imaging. I believe the CTP findings are secondary to steal phenomena at right vertebral artery or compression upon the venous plexus. Recently, by using modern computed tomography scanners, it is common to cover the entire brain in CTP. The emergency radiologist should be aware of this pitfall that spinal canal pathologies which are out of field of view can mimic posterior fossa ischemia.

1. Case report

The patient is a 49-year-old man with history of hypertension who was presented to the emergency department with sudden onset right upper extremity weakness and numbness. On physical examination, he had right facial droop and right upper extremity weakness. He received a dose of Tissue plasminogen activator (tPA) in another institution before presenting to emergency department. The non–contrast head computed tomography (CT) was performed upon activating stroke code which was negative for intracranial hemorrhage or typical presentation of acute infarct. Subsequently, CT perfusion (CTP) (Fig. 1) was performed with wide field of view, which demonstrated no definite evidence of acute lobar infarct or ischemia in left middle cerebral artery (MCA), but it showed a small area of increased mean transit time (MTT) and time to peak (TTP) in right inferior cerebellum without abnormal cerebral blood volume (CBV) or cerebral blood flow (CBF). This area was considered as ischemia by the automated CTP software. The computed tomography angiogram (CTA) revealed no evidence of flow-limiting stenosis in neck and intracranial arteries. Upon evaluation of neck CTA, a calcified intrathecal extramedullary mass was noted in right aspect of the spinal

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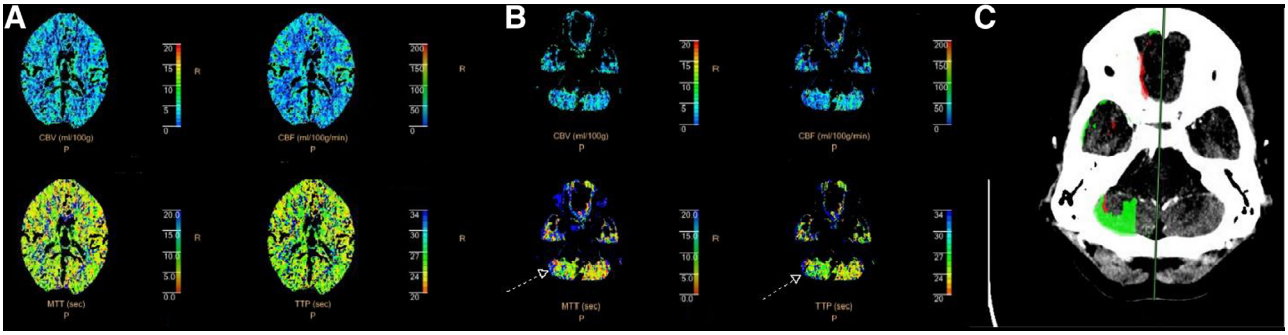

Fig. 1 – – Computed tomography perfusion shows no abnormal cerebral blood volume, cerebral blood flow, mean transit time, or TTP at left MCA territory to suggest ischemia or infarct (A). There is increased mean transit time and TTP in right inferior cerebellum at the territory of right inferior cerebellar artery (arrows B) which was considered as ischemia by the software (green color C). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

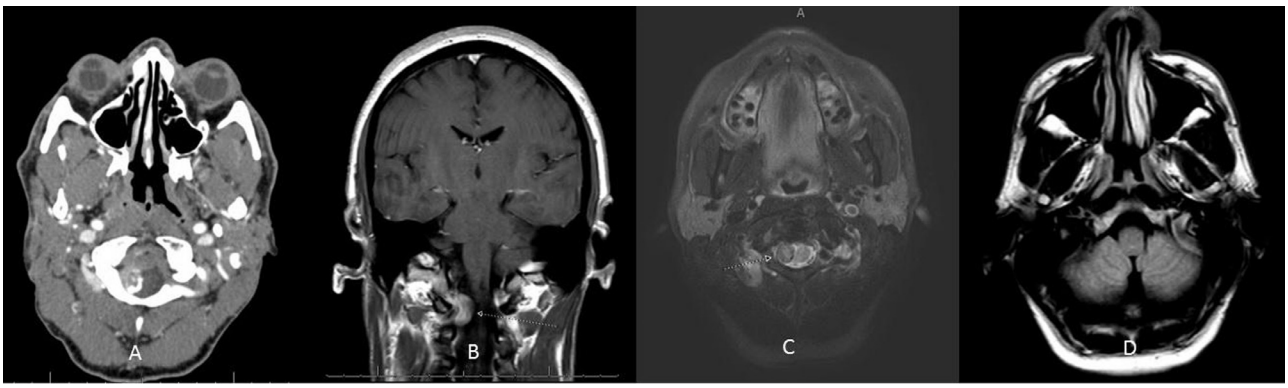

Fig. 2 – – Neck computed tomography angiogram shows a calcified intrathecal mass at the level of C1-C2 with mass effect upon the adjacent cord (A). Magnetic resonance imaging shows the mass to be intrathecal, extramedullary, dural based, and enhancing suggestive for meningioma on coronal post contrast T1 sequence (B) and axial T2 sequence (C). No evidence of edema or infarction in right cerebellum on axial Fluid attenuation inversion recovery (FLAIR) sequence (D).

canal at C1-C2 level with compression upon the right aspect of cord consistent with a meningioma (Fig. 2A). The V4 segment of vertebral artery was noted to pass above the mass without evidence of encasement or narrowing and no obvious feeding artery was noted for the presumed meningioma. The clinical presentation was not consistent with posterior fossa ischemia and CTP findings were attributed to the steal phenomena by a hyper vascular meningioma or compression over venous plexus. The patient was admitted in intensive care unit and right upper extremity weakness and facial droop resolved after few minutes. Subsequent brain magnetic resonance imaging performed 4 hours later revealed a relatively small cortical infarction in left frontal lobe in precentral gyrus, which was beyond the resolution of CTP and a spinal canal meningioma (Figs. 2B and C) but without evidence of infarction or edema in right cerebellum (Fig. 2D).

2. Discussion

Ischemic stroke is a leading cause of death which is caused by occlusion of the brain arteries. Currently, the main focus of stroke treatment is reducing the time of treatment and differentiation between the “core infarction” and “pre-infarction ischemic penumbra.” The patients with large area of perifraction ischemia benefit most from the thrombolysis and intra-arterial thrombectomy [1]. The recent approaches are

to extend the treatment window for any salvageable areas of ischemia which are revealed by imaging [2]. This approach relies on state-of-the-art imaging methods such as CTP. Although magnetic resonance perfusion has been widely used in the past; in many stroke centers, the main imaging technique for detection of salvageable ischemia is CTP due to logistical issues and availability. The application of CTP has been increased in recent years for evaluation of acute ischemia and differentiation between the core infarction and peri-infarction ischemia, but there are controversies about standard protocol and its effect on patients' prognosis. Traditionally, a small area of brain was covered by CTP which was mostly at the level of basal ganglia and other parts such as vertex and posterior fossa were excluded from CTP. By using modern multi-slice CT scanners, it is now common to cover a large area or even entire brain for CTP, so it is not uncommon to detect abnormal perfusion in brain stem and posterior fossa. Newer scanners (eg, 320 row detector) can cover 160 mm isotropic volume data of the entire brain [3]. The main physiologic parameters evaluated by CTP are CBF, CBV, and MTT. Basically, the area with significantly decreased CBV and CBF is considered as infarction and the area with elevated MTT and relatively preserved CBV or even slightly increased CBV is considered to be "peri-infarction ischemic penumbra" [4]. The patients with large and salvageable pre-infarction ischemia may benefit from the thrombolysis and intra-arterial thrombectomy. The patients with small ischemic penumbra do not benefit from thrombolysis and thrombectomy but they are at risk of treatment complications.

The basic concept of CTP is to acquire multiple CT images after injection of contrast. The increased parenchymal attenuation is proportional to contrast and arterial blood flow. Generally, 35-50 mL of iodine contrast is injected via the antecubital vein followed by 20 cm^3 of saline. The CT acquisition starts 5-7 seconds after contrast injection and it continues up to 75-90 seconds. The normal values of the mentioned CTP parameters depend on the scanners and protocols. Generally, CBF less than 25 mL × 100/g/min and CBV less than 2 mL × 100/g are considered as core infarction and relative MTT more than 145% of normal is considered as "ischemic penumbra" [5, 6].

I am presenting a case of spinal canal meningioma mimicking posterior fossa ischemia on CTP. Abnormal CTP findings are common in intracranial masses and peripheral parenchymal edema. Generally, the CBF and CBV are increased in the solid part of the tumor and decreased in the necrotic parts. Prior studies showed significantly increased CBF and CBV with prolonged TTP and MTT in meningioma itself [3]. In one prior study, ischemia at parenchymal edema around the meningioma has been reported [7]. In the case presented here, there was no edema in right inferior cerebellum. In addition, no visible feeding artery or draining vein was noted in the meningioma. The CTP presentation is likely due to steal phenomena involving the right vertebral artery or compression over the draining venous plexus which are beyond the resolution of CTA. The case presented here has unusual imaging finding with abnormal intracranial CTP due to spinal canal pathology. Diagnosis would be more complicated given the fact that the tumor itself is out of brain and field of view.

The application of CTP in emergent situation is increasing with new stroke protocols and extended treatment window. Using the newer scanners, the entire brain can be covered for CTP. Radiologists are familiar with CTP findings at the level of basal ganglia. They should be aware of pitfalls in other parts of brain especially the posterior fossa which is traditionally a CT weak point and artifact prone area. The radiologist should be aware that the abnormal CTP in posterior fossa can be secondary to pathology in spinal canal (eg, meningioma) which is out of field of view. This fact emphasizes the need for a neck CTA as part of a code stroke protocol. In addition, the referring physician should provide the radiologist with information about suspicious ischemic territory.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2018.04.020.

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