Clinical Case Review

Assessment of Large Right MCA Infarct and Aneurysm Using Vitrea® Software

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INTRODUCTION

The patient is a 65-year-old white female with acute onset of slurred speech and left-sided weakness. She was brought to the West Virginia University (WVU) Hospital Emergency Department (ED) approximately two hours after onset of symptoms. She was noted to have a left hemiplegia, right gaze preference and dysarthria on presentation. Her initial National Institute of Health Stroke Scale (NIHSS) was 14.

Dr. Jeffrey Carpenter imaged and evaluated the patient.

METHOD

A Computed Tomography (CT) stroke protocol was ordered to evaluate whether the patient was a candidate for treatment.

FINDINGS

Images were processed with a Vitrea® system using the Head CT protocol. Relatively narrow windows were used to maximize the difference between gray matter and white matter in order to exclude the presence of hemorrhage (which would preclude further treatment). The patient had appropriate brain volume for a 65-year-old. Some blurring of the right putamen as compared to the left putamen (an early sign of acute stroke) was observed, as well as basil ganglia involvement on the right (*see Figure 1*). Increased attenuation within the right Sylvian fissure was appreciated, indicating clot rather than flowing blood. Therefore, stroke localization on the right was suspected.

The first of two sets of perfusion volumes were processed using Vitrea's Brain Perfusion CT protocol. Gross motion was visualized throughout the study (*see Figure 2*). (This is a common problem with acute stroke patients who may not understand the need to be still. By acquiring two data sets, the second often has less motion than the first.)

Figure 1: Localization of Stroke on the Right

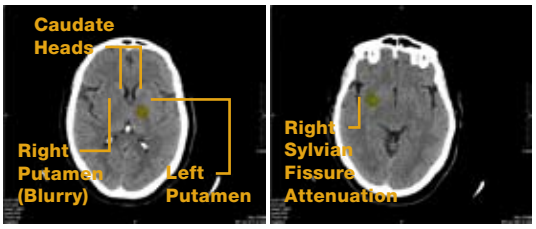


Figure 2: Observation of Gross Motion

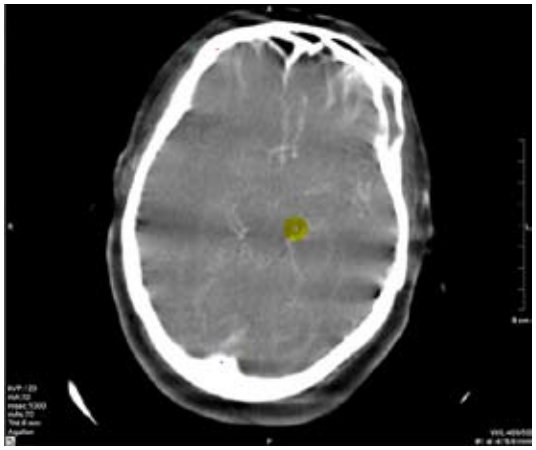
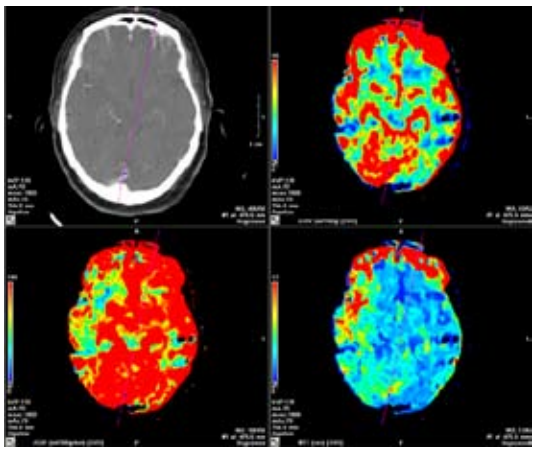


Figure 3: Computation of Perfusion Analysis



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After running Motion Correction to clean up as much motion artifact as possible, an acceptable amount of motion remained and the study had diagnostic quality. Vessel segmentation was performed after which the system computed Perfusion Analysis. The midline was adjusted (*see Figure 3*). Scrolling up through the images, good qualitative information was visualized with an extremely noisy study.

The Cerebral Blood Flow (CBF) map confirmed a right middle cerebral artery (MCA) stroke in evolution. CBF was decreased throughout the MCA division, markedly so in the area where the blurred right basil ganglia was observed on non-contrast head CT (*see Figure 4*). These areas of the brain were irreversibly injured. The rest of the brain looked salvageable at this time.

The cerebral blood volume (CBV) labels were activated (*see Figure 5*). Through motion distortion, the study remained qualitatively valid and an MCA stroke was confirmed even with the original noisy data set.

The second set of perfusion volumes were processed using the Brain CT Perfusion protocol in Vitrea. The data set was very good and no motion was observed. After verifying vessel segmentation and computing Perfusion Analysis, an abnormal mean transit time throughout the MCA (*see Figure 6*) was observed along with a small amount of processing technique artifact in areas of very low CBV. The abnormality was isolated to the right basil ganglia. Based on CBV in the cortex itself, his impression was that this area was still viable.

Scrolling up to visualize the next level, a large perfusion abnormality was observed but maintained viability per CBV all the way up to the top (*see Figure 7*).

Figure 4: Confirmation of Right MCA Stroke and Decreased CBV

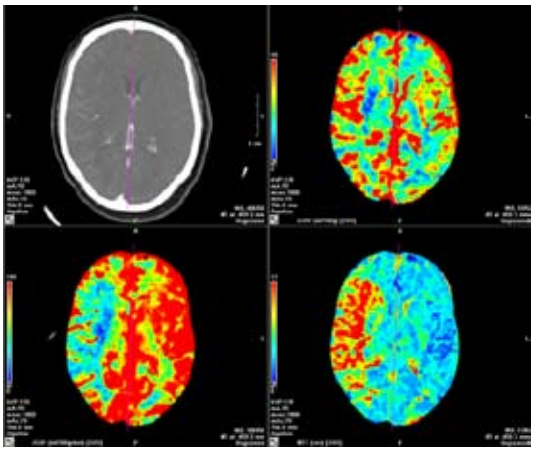


Figure 5: CBV Labeling

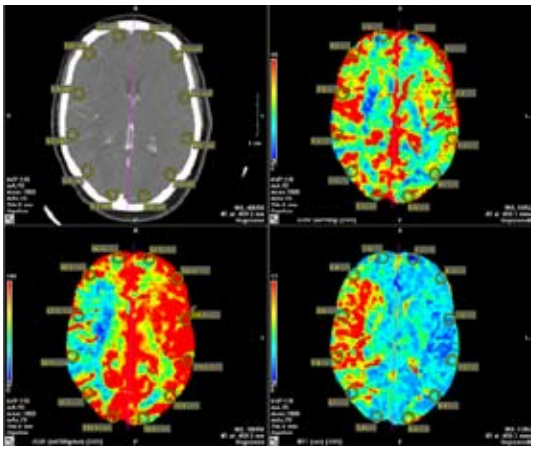
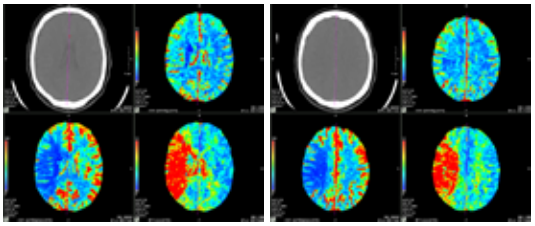


Figure 6: Observation of Flow Deficit in the MCA

Figure 7: Continued Observation of Right Perfusion Abnormality



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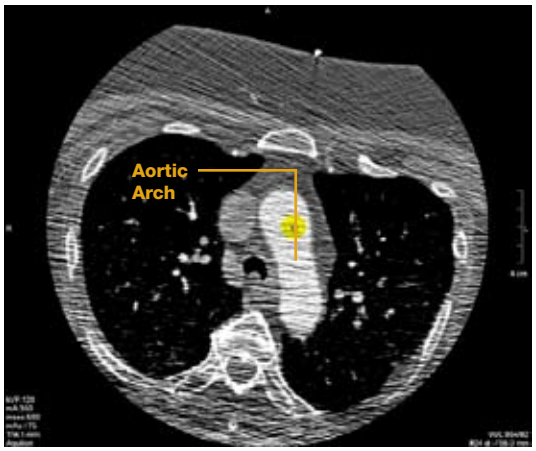
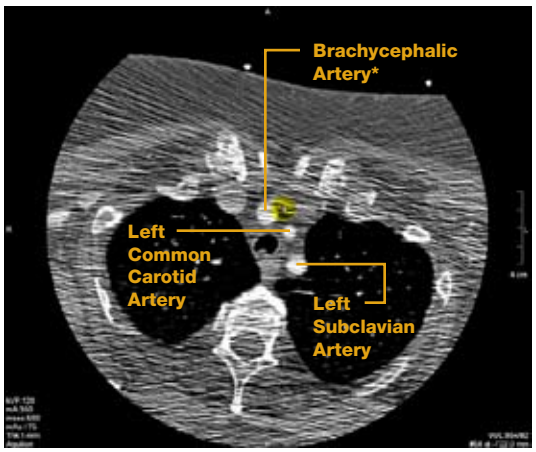
Based on all available information, the stroke evolution was clocked at less than two hours from symptom onset. It was caught early enough that the core infarct was relatively small and the patient was a great candidate for lysis.

Intravenous (IV) tissue plasminogen activator (TPA) may be less effectual for large clot burden. Therefore, a CT angiography (CTA) was ordered to assess the need for intra-arterial (IA) thrombolysis. The CTA data was loaded in Vitrea to visualize the clot and identify possible origination sites. Starting in the upper thorax, 2D imaging was utilized to follow the vessels all the way up (*see Figure 8*), paying particular attention to the right common carotid artery.

Significant amounts of arthritis were noted in the neck, including a very large anterior osteophyte in the cervical spine (*see Figure 9*).

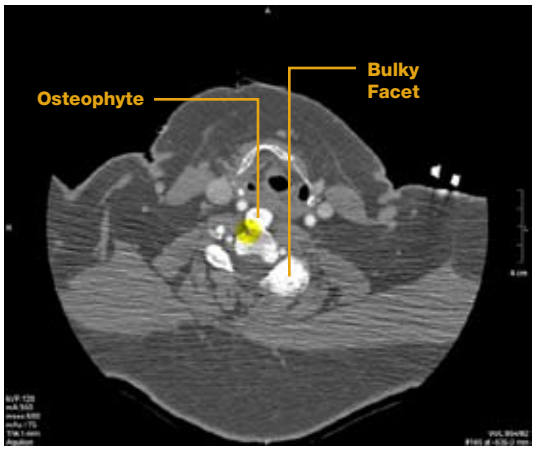
Figure 8: Identification of Vasculature in CTA





* The right common carotid artery is a branch of the brachiocephalic artery.

Figure 9: Visualization of Spinal Arthritis



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At the carotid bifurcation (*see Figure 10*), no potential sources for the blood clot were observed. The medial course of the internal carotid artery (*see Figure 11*) was visualized. (While not a potential lesion source, ENT surgery can be problematic without this anatomical knowledge if later required.)

Some calcifications in the cavernous ICA were noted. The windows were widened to improve visualization of this finding (*see Figure 12*).

At the mid-M1 segment of the MCA, an abrupt occlusion (*see Figure 13*) and appreciated significant clot size was noted. Based on persistence of the patient's symptoms and the amount of the tissue at risk, an intravascular intervention was attempted. The patient was taken to the interventional radiology lab to undergo cerebral angiogram.

The stroke thrombolysis portion of the CTA was opened in Softread. The initial portion of the angiogram showing injection of the right common carotid artery to evaluate blood flow was reviewed. The right MCA was occluded, the right anterior cerebral artery was patent and the pial collaterals were filling the MCA in retrograde fashion (*see Figure 14*). Observation of the pial arteries' late phase revealed good collateral flow. The MCA territory was kept alive with the exception of the basal ganglia.

Figure 10: Evaluation of Carotid Bifurcation

Figure 11: Observation of Medial Course

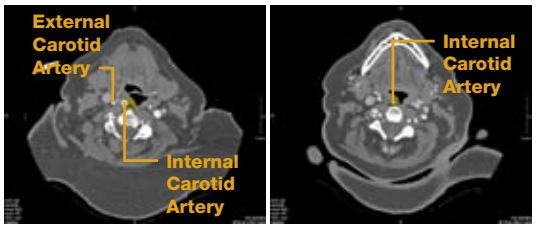


Figure 12: Calcifications in Cavernous ICA

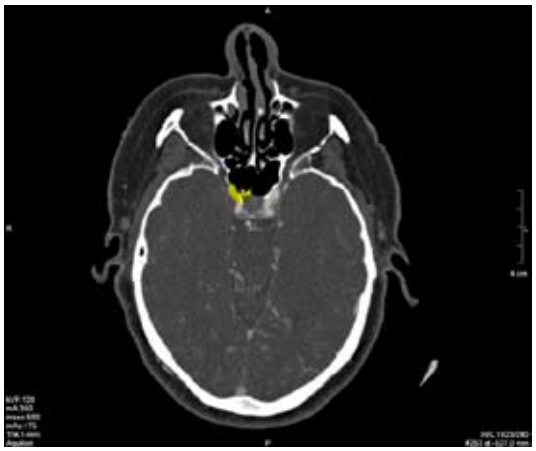
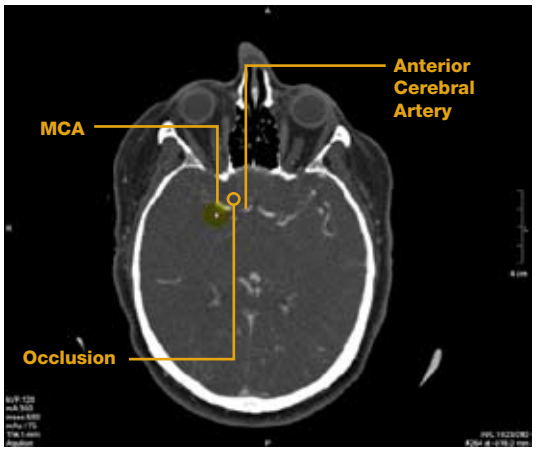


Figure 13: Identification of Clot at M1 Segment of MCA



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The patient had fibromuscular dysplasia, which causes vessel wall weakness and renders a beaded appearance on CTA (*see Figure 15*).

The patient received 8 MG of IA TPA over the ensuing half hour. A follow-up angiogram was captured and contrasted with initial image. A medium-sized aneurysm was visualized at the bifurcation of the MCA, but restored antegrade flow through all the MCAs (*see Figure 16*).

In the lateral view, haziness in the parenchymogram (capillary) phase of the angiogram was visualized everywhere except in a small wedge (*see Figure 17*), indicating the presence of a small distal thrombus. The patient had good results following administration of another milligram of TPA, and her post-therapy NIHSS was 10.

The post-CT of the brain was then loaded into Vitrea. The CBV map showed questionable basil ganglia staining (*see Figure 18*). If this finding persisted for a couple of days, it would indicate hemorrhage. Some swelling and mass effect was visualized, but the hemisphere continued to have normal gray/white differentiation.

Figure 14: Initial Angiographic View of Contrast Injection

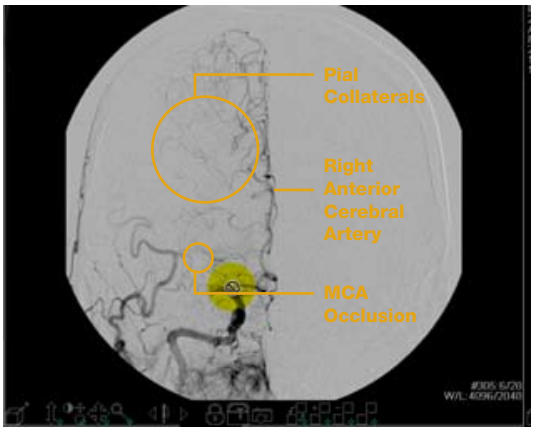
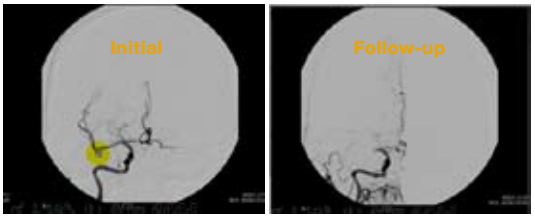


Figure 15: Beaded Appearance from Fibromuscular Dysplasia

Figure 16: Comparison of Initial and Follow-up Angiograms



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The follow-up MR volumes were loaded into Vitrea using the Head MR protocol. Having found an ideal window setting for visualization, it was noted that most of the tissue at risk in the right hemisphere had been salvaged (*see Figure 19*). There was some swelling around the basil ganglia and the area of original involvement, and a few distal areas of the cortex had small regions of infarction. The patient probably had some non-symptomatic hemorrhagic conversion, which is fairly common. However, considering the patient's original NIHSS of 14 and her extensive blood clot burden, it was a very good outcome imaging wise.

CONCLUSION

A right M1/M2 MCA infarct with large clot volume was identified, which resolved following both IV and IA TPA administration. The patient was also noted to have a possible 4 mm aneurysm. She was hospitalized for five days before being transferred to a rehabilitation center. Her NIHSS at discharge was 3, and she had returned to baseline with the exception of residual left hemisensory changes, a left facial droop and altered orientation (i.e., answered her age incorrectly).

Figure 17: Appreciation of Hazy Parenchymogram Phase

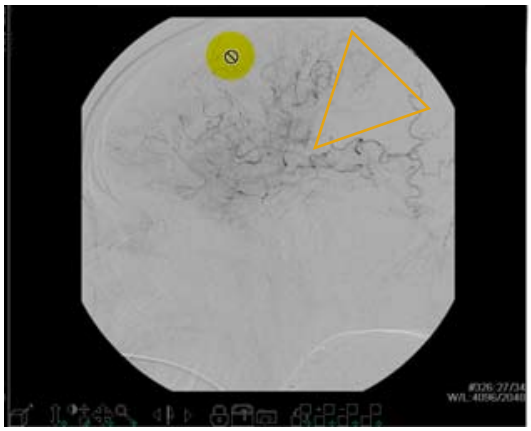


Figure 18: Questionable Basil Ganglia Staining

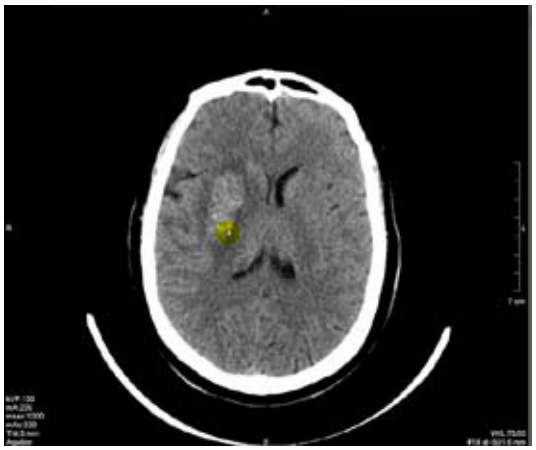
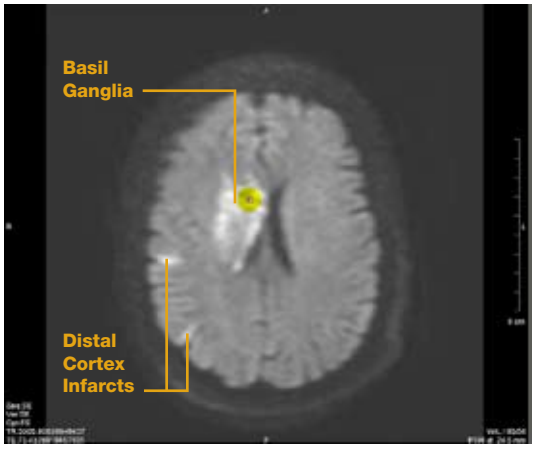


Figure 19: Evaluation of Right Hemisphere in Follow-Up MR



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