CASE REPORT

Pathologic validation of clot length determined using thin section non-contrast CT

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ABSTRACT

Background and purpose Recent studies have demonstrated that in acute ischemic stroke patients, thin section non-contrast CT (NCCT) can be used to determine the length of the hyperdense intracranial thrombus, and that clot length using this approach predicts the likelihood of vessel recanalization after intravenous tissue plasminogen activator.
Summary of case An acute ischemic stroke patient presented with a left middle cerebral artery occlusion and underwent emergent catheter based therapy. Clot length was determined using pretreatment thin section NCCT and was independently confirmed by the pathologist after whole clot extraction.
Conclusions The concordance between the NCCT measured clot length and the pathological examination in this case provides additional support for the accuracy of using thin section NCCT data to determine clot length in all patients.

INTRODUCTION

Recent studies have demonstrated that in acute ischemic stroke patients, thin section non-contrast CT (NCCT) can be used to accurately determine the length of the hyperdense intracranial thrombus, and that clot length using this approach predicts the likelihood of vessel recanalization after intravenous tissue plasminogen activator (tPA).[1 2] These findings may assist physicians in identifying intravenous tPA treated patients who may benefit from intra-arterial treatment.

In support of this NCCT approach to clot length measurement, we describe a case where an acute ischemic stroke patient underwent mechanical clot removal with pathologic confirmation of the NCCT determined clot length.

CASE REPORT

The patient was a 78-year-old woman with a history of transient ischemic attack and right carotid angioplasty and stenting in 2008. On the date of admission, she was last seen normal at 15:30, and was discovered 15 min later with right facial droop and right hemiplegia. She presented to our hospital at 16:27. Her National Institutes of Health Stroke Scale (NIHSS) score was 16, and after NCCT revealed no intracranial hemorrhage she received full dose intravenous tPA. CT angiography revealed a left mid M1 middle cerebral artery occlusion, and diffusion weighted imaging demonstrated minimal hyperacute infarction in the left corona radiata (figure 1). Given the mismatch between her clinical examination and the DWI findings, a decision was made to pursue intra-arterial treatment.

For clot length determination, the NCCT scan was reconstructed to 1.25 mm thick slices, which were then used to create coronal and axial maximum intensity projection images. Using the maximum intensity projection dataset, the hyperdense clot was identified and measured as 9.1 mm long (figure 2).

The patient underwent groin puncture at 18:26, with the first intracranial angiogram performed at 18:44, revealing persistent left M1 occlusion (figure 3). The Penumbra 054 reperfusion catheter (Penumbra Inc, Alameda, California, USA) was navigated to the clot face, and the aspiration pump was turned on. However, the 054 separator could not be advanced beyond the catheter tip and it was deemed that the clot was obstructing the distal catheter lumen. Thus the reperfusion catheter was removed under active suction and inspected. Confirming our suspicion, firm clot was lodged at the catheter tip, partially extending from the

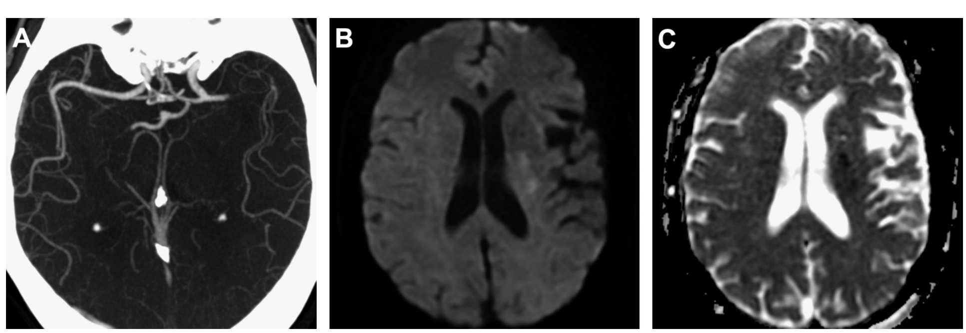

Figure 1 (A) Axial CT angiography maximum intensity projection image demonstrates a left mid M1 middle cerebral artery occlusion. (B, C) Diffusion weighted and apparent diffusion coefficient (ADC) images demonstrate a small hyperacute infarct within the left corona radiata.

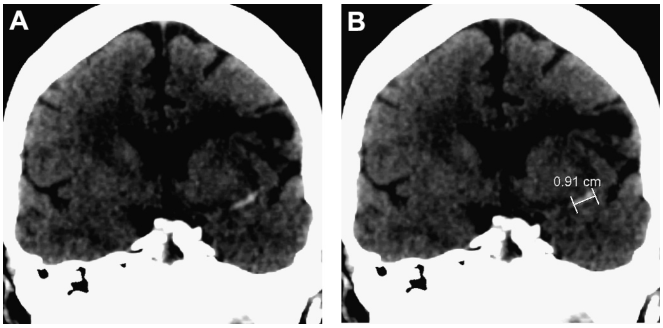

Figure 2 (A, B) Coronal non-contrast CT maximum intensity projection image demonstrates good visualization of the clot which measured 9.1 mm.

catheter. Repeat angiography at 19:10 revealed full Thrombolysis in Cerebral Infarction score 3 reperfusion with no evidence of distal embolization (figure 3). The clot was sent for pathologic examination, with the pathology report describing a '0.9×0.4×0.3 cm, firm, dark red blood clot'.

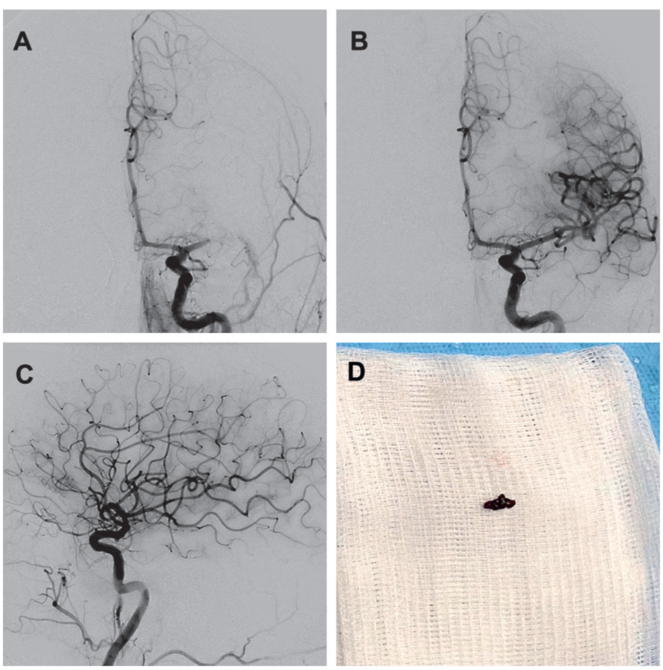

Figure 3 (A) Baseline angiogram (anteroposterior (AP) view) demonstrates persistent left M1 middle cerebral artery occlusion. (B, C) AP and lateral control angiograms demonstrate complete Thrombolysis in Cerebral Infarction score 3 reperfusion. (D) Photo of the extracted clot.

The patient demonstrated marked neurologic improvement with a 24 h NIHSS score of 5 and 7 day discharge NIHSS score of 2.

DISCUSSION

This case demonstrates independent pathologic confirmation of clot length measurement on thin section NCCT imaging. In this case, we were able to extract the entire clot because of its firm consistency and lack of significant separator manipulation. Furthermore, the control angiogram revealed no distal emboli to suggest clot fragmentation.

In their recent study, Riedel *et al* demonstrated that acute thrombus can be visualized reliably using NCCT data reconstructed to ≤2.5 mm slice width.[1] These thin section images prevent partial volume effects that may obscure the hyperdense clot. The authors utilized CT angiography as the reference standard for their clot length measurement. However, given individual differences in the adequacy of the pial collateral circulation, they could only study patients in whom the contrast was able to traverse the pial collaterals in a retrograde fashion to reach the distal end of the clot. This occurs in only 50% of patients.[3] In the remainder of patients, there will be a discrepancy between the two imaging techniques. Concordance between the NCCT measured clot length and the pathological examination in our case provides additional support for the accuracy of using thin section NCCT data to determine clot length in all patients.

Contributors All authors contributed to the conception and design, writing/editing of the article and final approval of the version to be published.

Competing interests None.

Patient consent Obtained.

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