VALUE OF CONE BEAM COMPUTED TOMOGRAPHY TO EVALUATE COMPLICATION OF INTRACRANIAL HAEMORRHAGE IN ENDOVASCULAR TREATMENT (EVT): A CASE REPORT

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Abstract
In this article, we evaluate the effectiveness of Cone Beam Computed Tomography, through a case study, in assessing the complication of intracranial bleeding during an endovascular treatment of brain arteriovenous malformation when compared to Multislice-Detector Computed Tomography performed immediately after the procedure. The image quality of Cone Beam Computed Tomography has enough diagnostic value in differentiating between haemorrhage, embolic materials and the arteriovenous malformation nidus to facilitate physicians to decide for further management of the patient.

Keywords; Cone beam computed tomography (CBCT): Brain arteriovenous malformation (AVM): Intracranial haemorrhage: Endovascular treatment BAVM: VasoCT

1. INTRODUCTION

Computed tomography (CT) is a well-established modality to diagnose intracranial diseases. As of late, CT-like imaging or Cone Beam Computed Tomography (CBCT) has been widely introduced into the angiography framework as a result of advancements in the flat detector technology and 3D reconstruction techniques.[1,2] The innovation has revolutionised interventional procedures in facilitating the on-table evaluation, and decision making in real-time.[3,4] We have been using CBCT application in the FD20/10 Philips angiography machine (VasoCT, Philips Healthcare, Best, The Netherlands) at our centre for a number of endovascular procedures, as well as for diagnostic purposes. This case report is to show the utility of CBCT as a tool to assess the complication of intracranial bleeding during an endovascular treatment of a brain arteriovenous malformation (AVM)

2. CASE

A 38-year-old gentleman presented with intracranial haemorrhage from a ruptured frontal lobe AVM. He was planned for staged embolisation, followed by surgical resection. The first embolization was uneventful, with approximately 25% of nidal occlusion achieved. Unfortunately, whilst the second embolisation session was being carried out, the microwire had accidentally torn the tortuous feeder artery upon cannulation, causing an extravasation of contrast. High-resolution peri-operative imaging was acquired using VasoCT protocol without iodinated contrast injection (VasoCT, Philips Healthcare, Best, The Netherlands).

The cross-sectional images showed brain parenchyma with evidence of a small haematoma. We were able to appreciate the distinct differences between the glue cast, nidus, and haemorrhage.

Based on these findings, decision to abandon the procedure was taken, and the patient was managed conservatively. He was extubated in the angiography suite with no evidence of neurological deficits. The gentleman was later scheduled for MDCT (Somatom Sensation 64, Siemens, Germany) and the results from VasoCT images and MDCT were compared. He was discharged from the hospital, in good condition, 4 days after the procedure.

3. DISCUSSION

CBCT images acquired by rotational angiography in the angiography suite has a promising new application that allows real-time image acquisition and visualisation of 3D anatomical structures. Previously, a conventional CT or MRI following the procedure needed to be performed, necessitating patient transfer to the CT or MRI scanner. CBCT enables access to cross-sectional imaging instantaneously during or after the procedure, without moving the patient from the angiography table.[2] The quality of these images is comparable to conventional MDCT.

In the illustrated case, the endovascular procedure performed was unfortunately complicated by intracranial haemorrhage. CBCT was performed immediately, which showed a distinct haematoma. The image quality was sufficient enough to provide a diagnostic value in differentiating the lesion, the high contrast embolic material artefacts, and the enhancement of the nidus. The glue cast seemed to give fewer artefacts when compared to conventional MDCT. Using the capability offered by CBCT, we were able to decide immediately whether the haemorrhage was significantly severe to warrant an urgent surgical evacuation of the haematoma, or otherwise.

CBCT image acquisition is also capable of generating a volumetric visualisation, which enables the user to reconstruct and evaluate more accurately the location of the haematoma with respect to the whole lesion. This will help surgeons plan their operative approach, should surgical or bail-out intervention is needed. We found the application of CBCT very useful for endovascular treatment of neurovascular diseases.

Good quality cross-sectional images can be obtained immediately for evaluation without the need for patient transfer. It also allows peri-procedural decision making to take place in complicated cases, as well as a supportive tool in dealing with procedural complications

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FIGURES

Figure 1: Digital substraction angiography of right internal carotid artery (ICA) showing the frontal lobe brain AVM nidus with early abnormal venous drainage (a), with fluoro-capture image showing contrast extravasation during check microcatheter run. Subsequent fluoro-capture image shows further extravasation of contrast (c), and single shot image during the procedure after NBCA (N-butyl cyanoacrylate) injection to secure the bleeder, showing NBCA cast at the bleeding point and feeder with residual contrast extravasation (d).

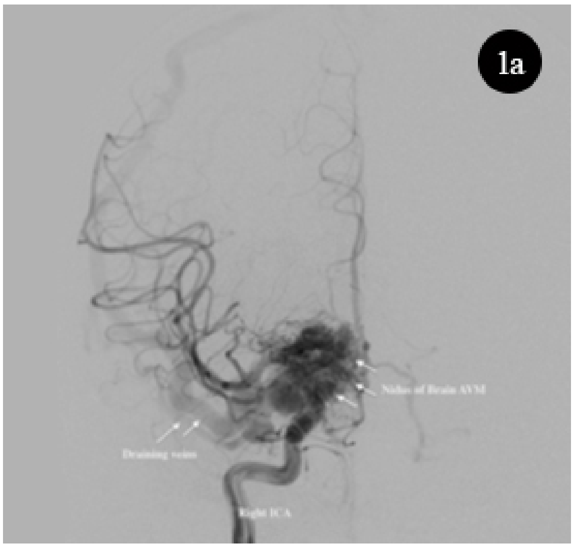

Figure 1a*: Digital subtraction angiography of the right internal carotid artery (ICA) showing the frontal lobe brain AVM nidus with early abnormal venous drainage*

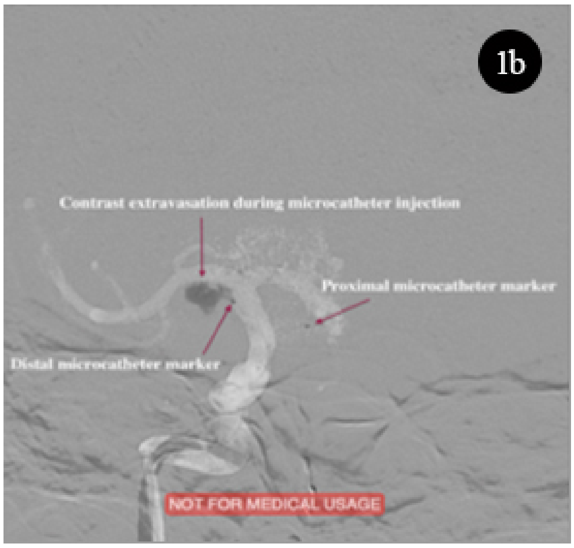

Figure 1b*: Capture fluoroscopy image showing contrast extravasation during check microcatheter run*

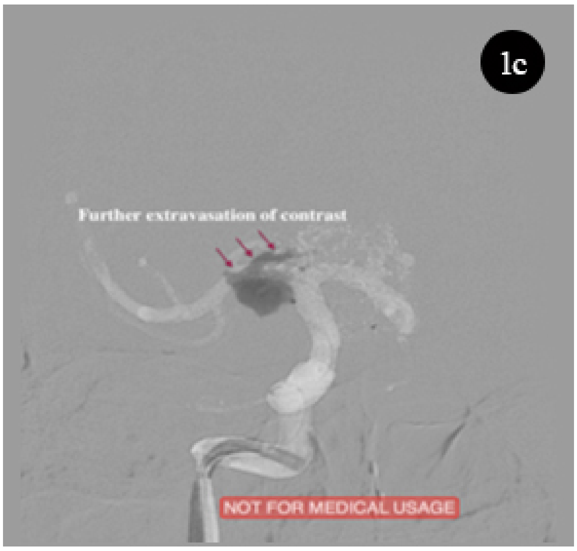

Figure 1c: *Subsequent capture fluoroscopy image showing further extravasation of contrast*

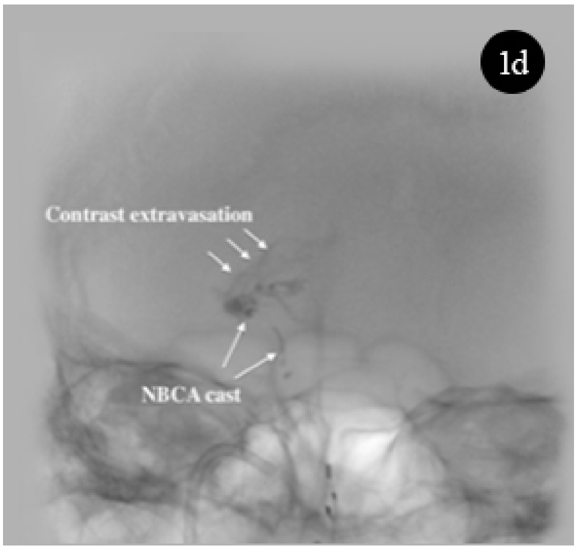

Figure 1d: *Single shot image post NBCA (N-butyl cyanoacrylate) injection (to secure the bleeder), showing*

Figure 2: Reconstructed non-contrast, enhanced CBCT (VasoCT without contrast) shows different intensity between glue cast and contrast in nidus compared to haemorrhage (a), and the corresponding plain MDCT done immediately after the procedure, showing NBCA cast and haemorrage well differentiated and comparable to CBCT (b). The nidus not well depicted in this section

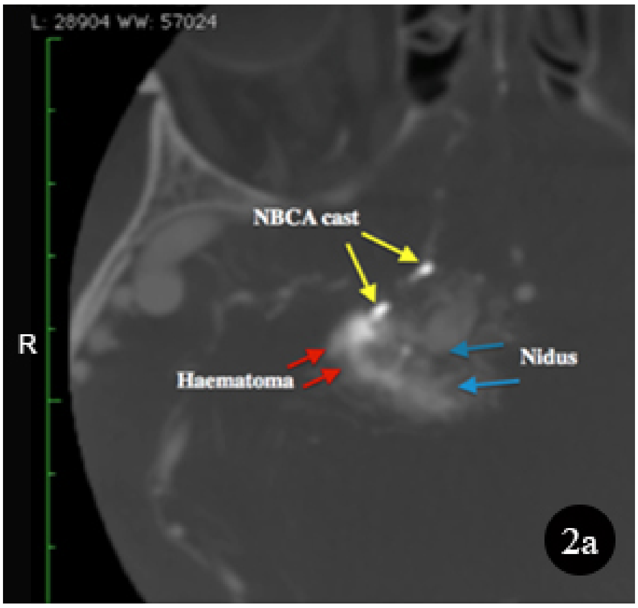

Figure 2a: *Reconstructed non-contrast enhanced CBCT (VasoCT without contrast) shows different intensities between glue cast and contrast in the nidus, compared to haemorrhage.*

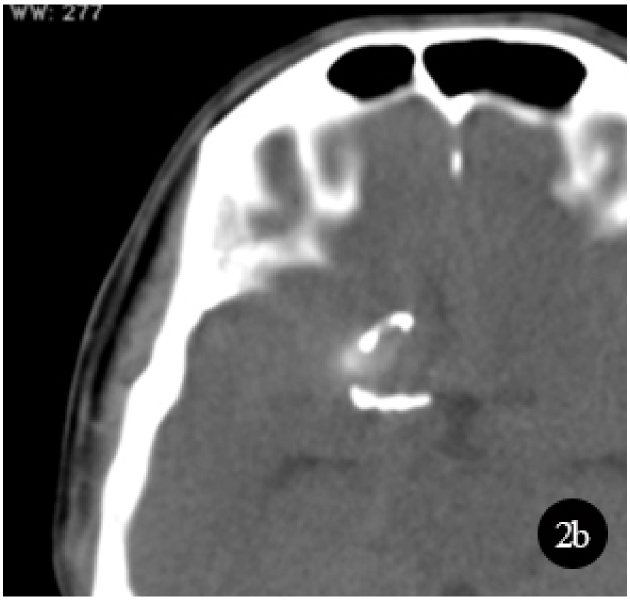

Figure 2b: *NBCA cast and haemorrage in the corresponding MDCT section. Nidus is not well depicted in this section.*

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