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Digital subtraction angiography laboratory with inbuilt CT (DynaCT): Application during intracranial aneurysm embolization

Sir,

It is known that early recognition and management that occur during a neuroendovascular procedure complications can improve clinical outcome.[1,2] A new combined angiography/CT suite has been developed that uses flat-panel detector (FD) technology for higher-resolution angiography that is also capable of producing CT-like images.[3]

A 32-year-old female patient presented with subarachnoid hemorrhage. Digital subtraction angiography with 3-D angiography revealed an internal carotid artery bifurcation aneurysm along with spasm in the adjacent vessels [Figure 1A]. The option of endovascular coil embolization was decided upon and was performed in the same session. Under roadmap guidance, microcatheter (Excelsior SL 10, Boston Scientific Corporation, USA) was carefully guided over a microguidewire (Agility 10, Cordis, Johnson and Johnson, USA) into the aneurysm. During microcatheter placement, wire was seen to cross the margin of the aneurysm and immediate angiogram revealed rupture of the aneurysm with extravasation of contrast into subarachnoid space [Figure 1B]. Heparin was immediately reversed with protamine and a coil (GDC soft 3x8, Boston Scientific, USA) was placed into the dome of the aneurysm. Repeat angiogram did not reveal any more extravasation of the contrast [Figure 1C]. Further embolization was performed with GDC soft 2 × 4 and 2 × 2 coils with almost complete occlusion of the aneurysm [Figure 1D]. Thereafter, DynaCT was performed in the angiography room without shifting the patient and the images [Figure 1E and F] revealed minimal contrast in the subarachnoid space with no obvious hematoma, mass effect or change in ventricular size. Intra-arterial vasodilatation was performed with 0.5 mg of nimodipine with decrease in arterial vasospasm. Patient was extubated with no change in neurological status and was discharged after a few days with intact neurological status.

Intraoperative rupture of aneurysm is a known complication of aneurysm embolization and is reported in 2-3% of patients. Such patients may need an immediate external ventricular drain (EVD) or hematoma evacuation. In our case, there was a dilemma.

Figure 1: A 32-year-old female presented with subarachnoid hemorrhage due to an internal carotid artery bifurcation aneurysm (A). During embolization, aneurysm ruptured with extravasation of contrast (Arrow, B). Heparin reversal and coil placement stopped the bleeding (C). Further coil placement resulted in almost complete occlusion of the aneurysm (D). DynaCT (E and F) was immediately performed in the angiography suite which revealed minimal hyperdensity in subarachnoid space (Arrow, F) with no hematoma formation or ventricular dilatation. Arrow in Figure. E indicates coil artifacts.
whether to continue with the procedure, do an EVD or to shift to CT scan to assess the intracranial status. Shifting the patient to regular CT scan would have meant stopping the interventional procedure as well as loss of time while the patient was shifted to the CT scanner. It would also have resulted in moving the patient out of the relatively sterile environment to a relatively open/unsterile atmosphere of the CT scanner. DynaCT technology enabled us to do the intracranial assessment within a few minutes in the angiography lab while the intervention was continued. It helped us in accurate and immediate assessment of the situation and helped in avoiding any unnecessary surgical procedure such as EVD. We were able to complete the endovascular procedure including the intra-arterial vasodilatation as was needed in the case.

The images produced by DynaCT are not of the quality of conventional CT. However, as our case demonstrates, current DynaCT image quality is sufficient to make a diagnosis when a complication is suspected, particularly to detect hemorrhage. This technology is likely to be useful in other intracranial endovascular procedures. In the management of acute stroke, DynaCT can be performed to exclude intracranial hemorrhage before planning intra-arterial thrombolysis. This technique can also be useful to detect intracranial hemorrhage during embolization of intracranial arteriovenous malformations. This technology is also being used for clear visualization of stents in both intracranial and extra-cranial arteries and helps in visualizing both the stent struts and their relationship to the arterial walls and the aneurysmal lumen. This helps in accurate placement of stents as well as in some cases in assessment of wall pathology such as presence of calcification. In head and neck embolization procedures using direct percutaneous access, in combination with fluoroscopy, DynaCT can be used for more precise needle placement. The radiation exposure during DynaCT was approximately 49 mGy, which is less than that during head scan using conventional CT scanner (recommended dose of 60 mGy).

Capability of performing CT scan-like images in the angiographic suite is likely to help in early detection of complications during neuroendovascular procedures and will help in proper decision-making and is likely to play a crucial role in the coming years.

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