Parametric Color Coding of Digital Subtraction Angiography: A Feasibility Study in Patients with Intracranial Steno- Occlusive Arterial Disease

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Introduction

DSA has evolved from a two-dimensional, low-resolution static imaging-system to a three-dimensional real-time system with high spatial-resolution. Recently, the use of parametric-color-coded-DSA has come to the fore, especially in evaluation of aneurysms and AVM embolisation. There is good evidence to demonstrate that time to maximum-opacification(Tmax) and time-intensity-curves(TIC) reliably represent blood-flow characteristics inside intracranial-vessels. Also, varied scores(TIMI,TICI,AOL) have been used in the evaluation of the radiological outcomes but they lack uniformity and reproducibility .We presents ,University at Buffalo experience with parametric imaging. To the best of our knowledge this is the first-instance of use of parametric imaging in the treatment of steno-occlusive intracranial arterial disease.

Results

Ten vascular territories and 39 regions of interests (ROI's) were evaluated in 6 patients. Analysis of time density curve showed that, subsequent to intervention there was a decrease in parameters such as TTP and TTA. However, MTP did not show consistency with the radiological outcome. Area under curve increased following intervention in all six cases.

Methods

Two-dimensional DSA images were acquired in 6 patients (3 cases each of intracranial stenosis(Figure-1) and acute-large vessel occlusion. Approximately 10ml of contrast media, iohexol-300/ iodixanol-320 was injected during the DSA-acquisition. The images were acquired using transfemoral approach while maintaining similar injection conditions. TIC analysis was performed for each image pixels using prototype software (Toshiba Medical Systems, Tochigi, Japan). Once the DSA data was loaded on the prototype software, TIC analysis is automatically performed and Time To Arrival (TTA), Time To Peak (TTP), Mean Transit Time(MTT) and Area Under the Curve(AUC) are calculated for each TIC(Figure 1 and 2)

Figure 1A

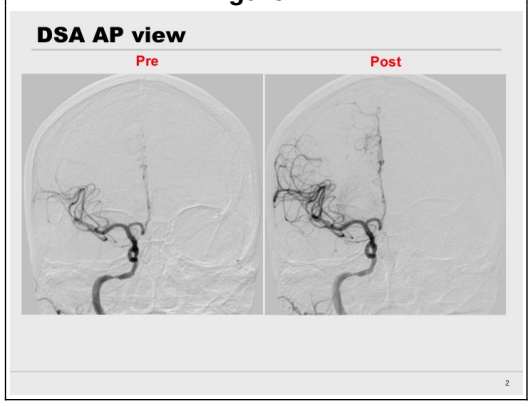


Figure 1B

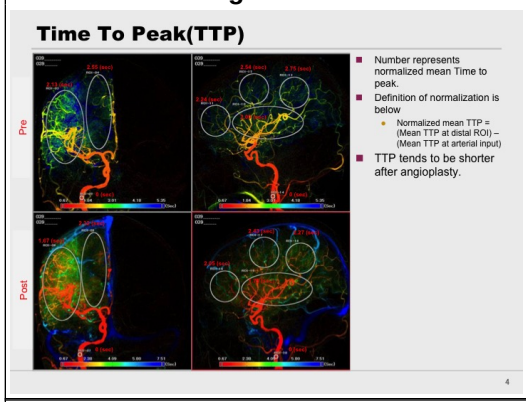


Fig 1C

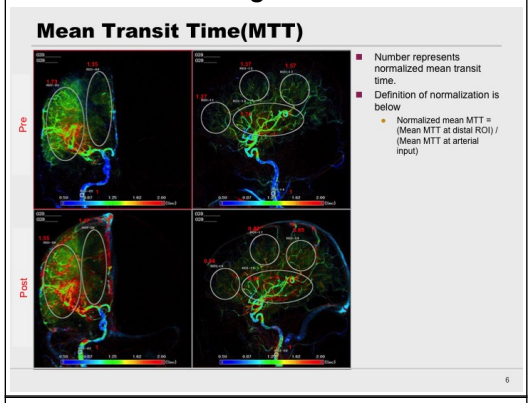
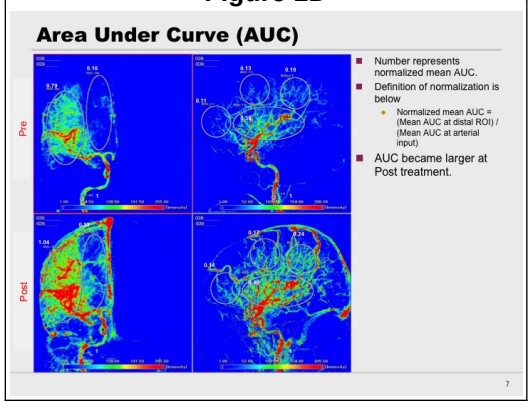


Figure 1D



Conclusions

Our experience shows that color coded parametric imaging can be used successfully to assess the radiological outcomes of interventions for acute arterial occlusion and intracranial angioplasty. It is a step to make a standard angiogram into a "functional angiogram".

FIGURE 1

DSA and Parametric perfusion maps, before and after submaximal angioplasty for symptomatic intracranial angioplasty. DSA (1A)demonstrates Right Petrous ICA stenosis which was measured as 85% and the improvement in stenosis(45%) following angioplasty . The Parametric perfusion map shows mean values in each region of interest in ACA and MCA territory, before and after treatment. If relative TTP(images 1B), MTT(Images 1C) is analyzed , there is a decreases in TTP in the ROI following angioplasty. Compared to pre-angioplsty , there was an increase in AUC following angioplasty(Fig 1D)

Learning Objectives

By the conclusion of this session, participants should be able to:

1) Describe the importance of parametric imaging in the setting of Neuro-endovascular intervention for intracranial stenosis and large vessel