Volume Cerebral Blood Flow (CBF) Measurement Using an Interventional Ceiling-Mounted C-arm Angiography System

Authors

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Purpose

Measuring CBF in the angiographic suite using a C-arm CT system may help optimize management of stroke patients during interventional therapy.

Methods and Materials

Our new scanning protocol uses multi-sweep acquisitions with a C-arm angiography system to calculate 3-D images (Axiom Artis dTA, DynaCT, Siemens). Each acquisition (6 consecutive bi-directional sweeps, 5.5s per sweep) has a different injection delay to increase temporal sampling (TS).

Our new interpolation algorithm reconstructs 4-D data which are then processed using deconvolution to compute the whole-brain CBF map.

We investigated different injection and acquisition protocols in 5 perfusion-normal pigs (injection location, injection rate 1.5-6 ml/s, contrast concentration 50%-100%, injection duration 4-8 s) with CT as the gold standard.

From a total number of 6 acquisitions additional subsets of 3 and 2 acquisitions were taken to investigate different TS options.

After registering the C-arm CT and CT data, the mean CBF was computed in six circular ROIs (radius 2 mm) per slice placed in corresponding areas in each hemisphere in three slices.

Results

Injection rate of 6ml/s, for 8s, 50% dilution with catheter just proximal to the right carotid provides the most uniform contrast enhancement. All three TS options showed good qualitative agreement of the CBF values compared to CT measurements. There was good correlation ($r > 0.79$, $p < 0.001$) between the C-arm and CT CBF values.

Conclusion

We have optimized acquisition parameters for perfusion measurement in the angio suite using a C-arm CT system, and demonstrated that two multi-sweep acquisitions can already provide adequate temporal sampling.