AS10-001

CLINICAL UTILITY OF 320-DETECTOR ROW COMPUTED TOMOGRAPHY IN THE EVALUATION OF MOYAMOYA DISEASE

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☑ The author has no conflict of interest to disclose with respect to this presentation.

A. Hashimoto[1], H. Tajiri[1], K. Mizokami[2], T. Mizuno[1], M. Endo[3], O. Seiki[3].
[1]Ofuna Chuo Hospital, Diagnostic Radiology, Kamakura, Japan.
[2]Shonan Fujisawa Tokushukai Hospital, Neuroendovascular Surgery, Fujisawa, Japan.
[3]Shonan Fujisawa Tokushukai Hospital, Neurosurgery, Fujisawa, Japan.

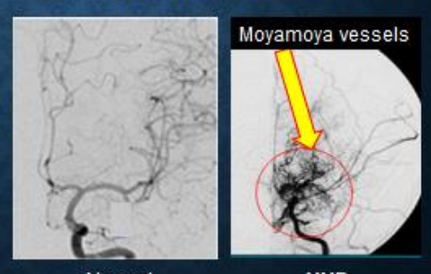
Background and Purpose

The present study aimed to determine the ability of 320-detector row computed tomography angiography (CTA) to evaluate moyamoya disease.

What is moyamoya disease (MMD)?

- Chronic progressive cerebrovascular disorder, particularly affecting Asian persons
- **Bilateral stenoses or occlusions of the supraclinoid ICA** and its major branches
- Arterial collateral circulation, so-called **"moyamoya vessels (MMVs)**

"moyamoya" means
Puffy, Obscure, or Hazy,
like a *puff of smoke* in the air



Digital subtraction angiography (DSA)

Diagnostic criteria

● *DSA (Gold Standard since 1957)*

- **Bilateral stenoses or occlusions of the supraclinoid ICA** that extend to the proximal portions of the ACA, MCA, and PCA.
- Presence of parenchymal **collateral vessels (MMVs)**

● *MRI・MRA (since 1994)*

Adding to DSA…

- At least **two flow voids** in the basal ganglia (T2WI)

● *Should be excluded*

Atherosclerosis, Cranial irradiation, Autoimmune disease, Neoplasms, Trauma, Meningitis, Neurofibromatosis, etc.

The role of CT?⇒ Not determined !

Materials and Methods

- Retrospective study
- April 2013 - March 2018
- Clinically diagnosed MMD and underwent all three examinations
  - ● Contras-enhanced **CTA** using 320-detector row CT (3D/4D CTA, VR, MIP)
  - ● TOF-**MRA** using 3T MRI
  - ● **DSA**
- Gold standard: DSA
- Two specialists evaluated independently (Final diagnosis: consensus)

Evaluation Items

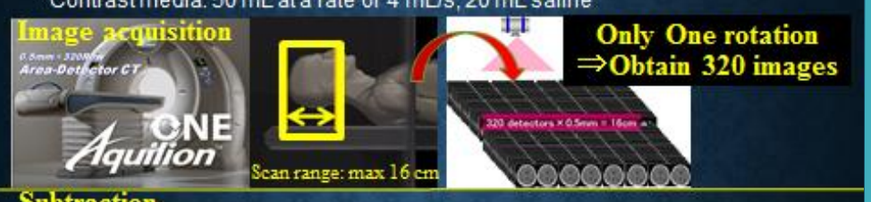
① Correlations between CTA, MRA, and DSA scores (Houkin score)
② Inter-observer difference of CTA scores and MRA scores
③ Visualization of basal MMVs

● **Statistical analysis (SPSS for Windows 15.0J)**
① **Multiple comparisons (Tukey's honestly significant difference test)**
Pearson's product moment correlation coefficient
② **Kappa statistic**
③ **Fisher's exact test**
P < 0.05: statistically significant

Equipment: Aquilion ONE™, 320-detector row CT

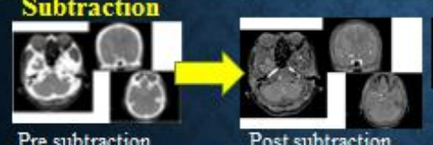
Manufactured by CANON Medical Systems, Japan
*Contrast media: 50 mL at a rate of 4 mL/s, 20 mL saline

Image acquisition



Only One rotation ⇒Obtain 320 images

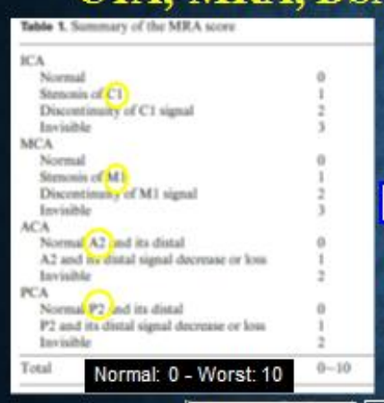
Subtraction

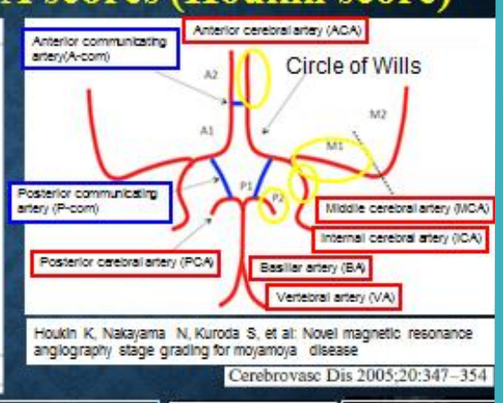


⇒Visualize vascular component only

Image reconstruction

CTA, MRA, DSA scores (Houkin score)





Houkin K, Nakayama N, Kuroda S, et al: Novel magnetic resonance angiography stage grading for moyamoya disease
Cerebrovasc Dis 2005;20:347–354

Representative case

A 50-y.o. woman
Chief complaint: disturbance of consciousness
NCCT showed large amount of intraventricular hematoma.

Comparison CTA, MRA, and DSA

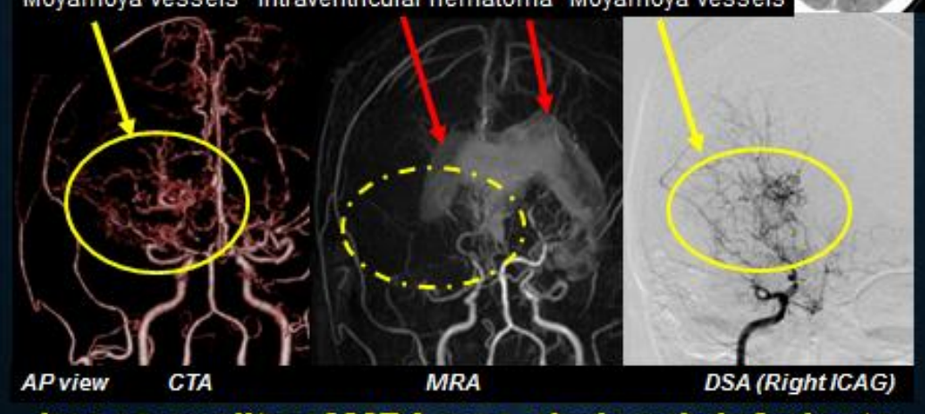


Image quality of MRA was obviously inferior to that of CTA and DSA.

4D-CTA, AP view (from arterial to venous phase)

Results

● Patients' Characteristics

- **25 consecutive patients (50 cerebral hemispheres)**
  Males: n = 15 (60%); Females: n = 10
- Mean age: 48 years
- Age range: 23-71 years (No children)
  Stroke subtype
  - Ischemic Stroke or TIA: n = 20
  - Hemorrhagic stroke: n = 5

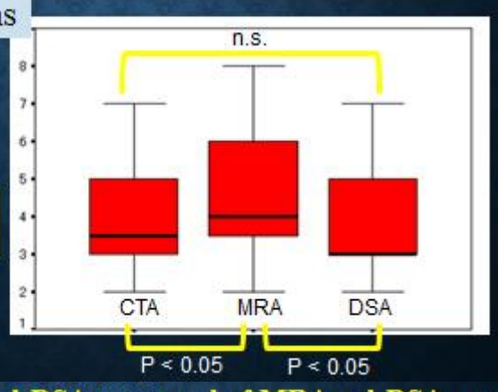
  Unilateral moyamoya disease: n=5

① ● Comparisons between CTA, MRA, and DSA scores (Houkin score)

Scores (Mean ± SD)	CTA	MRA	DSA
	3.82 ± 1.53	4.76 ± 1.80	3.69 ± 1.73

・Multiple comparisons

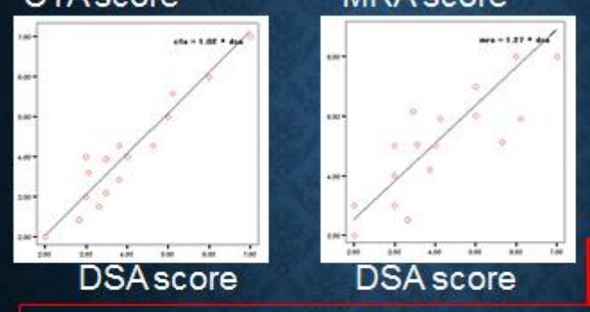
CTA/MRA/DSA scores



Vascular stenosis/occlusion: MRA tends to overestimate

CTA > MRA

● Correlations of CTA and DSA scores and of MRA and DSA scores (Houkin score)



CTA > MRA

Correlation coefficient
0.85 (P < 0.05) **0.68** (P < 0.05)

② Inter-observer agreement for CTA scores and MRA scores

K value
0.83 (P < 0.05) **0.65** (P < 0.05)

CTA > MRA

③ Comparison of Evaluation of MMVs with CTA, MRA, and DSA

All (50 cerebral hemispheres) / Hemorrhage (10 cerebral hemispheres)

	DSA			DSA		
	Moyamoya vessels			Moyamoya vessels		
	Absent (n=5)	Present (n=45)		Absent (n=2)	Present (n=8)	
CTA						
Absent	5	4		2	0	
Present	0	41		0	8	
MRA	Moyamoya vessels: MRA tends to underestimate					
Absent	5	10		2	5	
Present	0	35		0	3	
	CTA	MRA	P value	CTA	MRA	P value
Sensitivity	41/45 91%	35/45 78%	P < 0.05	8/8 100%	3/8 38%	P < 0.01
Specificity	5/5 100%	5/5 100%	n.s.	2/2 100%	2/2 100%	n.s.
Accuracy	46/50 92%	40/50 80%	P < 0.05	10/10 100%	5/10 50%	P < 0.01

CTA > MRA

Discussion

- Steno-occlusive lesions: MRA tended to overestimate
- Visualization of MMVs: MRA tended to underestimate

  CTA ≒ DSA > MRA
- Inter-observer agreement: CTA > MRA

Comparison between CTA and MRA
Advantages and Disadvantages of CTA

Advantages of CTA
・Accurate evaluation of steno-occlusive lesions
・Good visualization of slow-flow vessels (e.g. moyamoya vessels, collateral vessels)
・Easy access, short scan time
・Subtraction: Visualize vascular components only
・*Whole-brain dynamic scan:* *whole-brain CT perfusion* *whole-brain CT angiography: 4D-CTA* * Only 320-detector row CT can evaluate
Disadvantages of CTA
・Radiation exposure
・Use of iodine contrast media (risk of allergy)

Conclusions

・Steno-occlusive changes were evaluated more accurately, and basal moyamoya vessels were visualized with greater sensitivity by CTA using 320-detector row CT than by MRA.

・CTA should be incorporated into the diagnostic criteria for moyamoya disease.