Significant contrast dose-reduction with Digital Variance Angiography in carotid and cerebral X-ray angiography

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Disclosure

Speaker name: Viktor Orias MD

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I have the following potential conflicts of interest to report:

- ☐ Employment in industry: Kinepict Health Ltd.

Kinetic imaging (or DVA)

- New, patented x-ray image processing method
- Digital *Variance* Angiography (DVA) instead of *subtraction* (DSA)
- Significant image quality advantage over current reference-standard DSA in lower extremity arteriography with iodinated contrast media (1) and carbon-dioxide (2)
- First aim: DVA feasibility in carotid angio setting

1: Gyano M, Gog I, Orias VI, et al. Kinetic Imaging in Lower Extremity Arteriography: Comparison to Digital Subtraction Angiography. Radiology. 2019;290(1):246-53

2: Orias VI, Gyano M, Szollosi D, et al. Digital Variance Angiography as a Paradigm Shift in Carbon-Dioxide Angiography, Investigative Radiology (forthcoming 2019)

Carotid and cerebral X-ray angiography

- Contrast medium
  - Nephrotoxicity
  - „Selective injections of hyperosmolar contrast material into the common and internal carotid arteries may...
    - Cause pain, resulting in patient movement
    - Decreased image quality
    - Increased patient discomfort
    - “May produce transient disruption of the blood-brain barrier with associated neurologic deficit or seizure” (3)
  - Second aim: to reduce contrast dose without image quality loss

3: Bird et al, Am J of Neuroradiology, 1984

Materials and methods

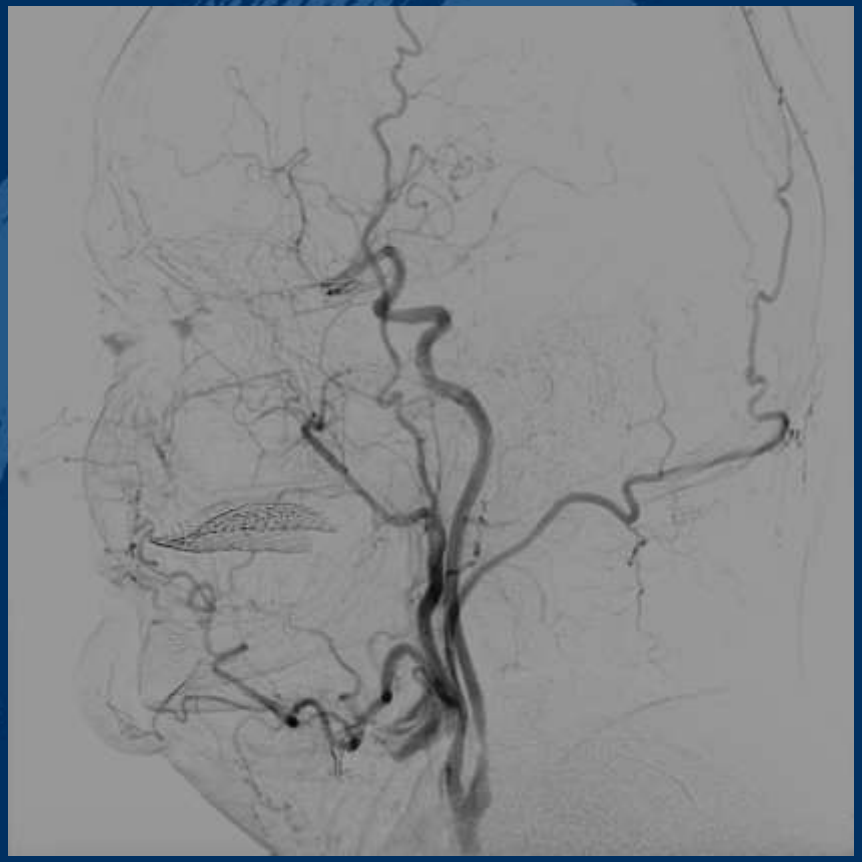
- Bács-Kiskun County Hospital Kecskemét, GE Innova IGS530 (4 fps, low X-ray dose setting)
- Iobitridol (Xenetix 350) 350 mg I / ml, 5fr Simmons 2 catheter
- 26 patients undergoing carotid PTA, GFR over 60 ml/min/1,73 m^2
- Standard protocol: 6 ml ICM with 0,5 s rise time, 3 ml/sec flow angiography before and after carotid intervention (DSA of both commin carotid arteries selectively, AP and lateral view, 105 image pairs)
- Low-dose protocol: 1 run with 50% ICM dose (3 ml) with 0,2 s rise time and same flow (19 image pairs)
- No patient received more than 100 ml of ICM

Materials and methods

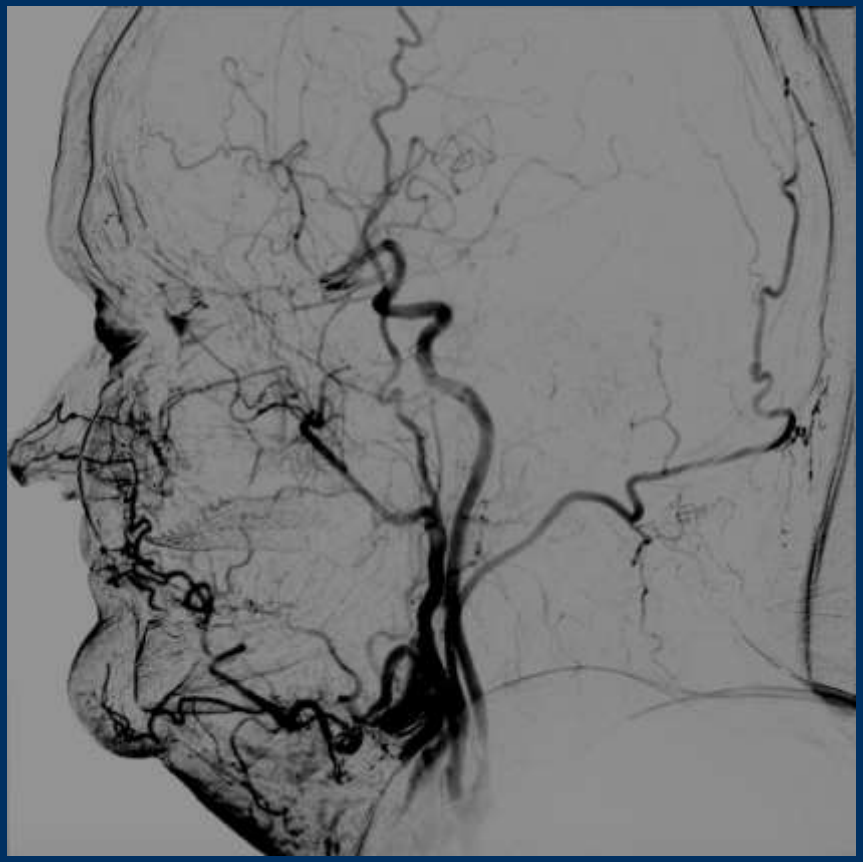
- Comparison of DVA and DSA
  by signal-to-noise ratio (SNR) and visual image quality evaluation

  - SNR measurement and comparison:
    intravascular and extravascular (background) ROIs selected and compared
  - Visual evaluation of single images
    on a scale from 1 (no diagnostic value) to 5 (outstanding image quality) by 6 raters

Images



GE postprocessed DSA



Postprocessed DVA

Results – SNR comparison

	DVA (100%)	DSA (100%)	DVA (50%)	DSA (50%)
SNR mean	14.65	**7.09**	**11.66**	4.91
SNR median	10.95	**5.41**	**9.13**	4.00

	DVA(100%) to DSA(100%)	DVA(50%) to DSA(100%)
Mean SNR(R)	**2.89**	**1.64**
Median SNR(R)	**2.09**	**1.69**

SNR(R): SNR(DVA) / SNR(DSA)

Results – visual evaluation scores

	DSA		DVA		
	Mean	SEM	Mean	SEM	
standard protocol	3.49	0.08	**3.53**	0.04	n=1260
low-dose protocol	3.00	0.11	**3.51**	0.10	n=168

No significant image quality loss with low-dose protocol DVA

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	DSA		DVA		
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Low-dose protocol DVA has same image quality
as standard protocol DSA

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	Mean	SEM	Mean	SEM	
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Notable image quality loss with low-dose protocol DSA

Conclusions

- DVA has an *obvious quality advantage* over DSA in carotid and cerebral X-ray angiography setting

- 50% ICM dose reduction *does not cause noticable loss* of image quality while using DVA
- Low-dose protocol DVA still *outperforms* standard-dose protocol DSA
- Further investigation needed to safely *decrease X-ray dose* as well

Thank you for your attention!

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