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Visualization of aneurysmal neck and dome after coiling and clipping treatment for cerebral aneurysms with 3D multifusion imaging of silent MRA and FSE-MR cisternography

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Starting Now

Lecturers report no conflict of interest concerning the materials or methods used in this study.



Objectives

- 1) In the follow-up after treatment of cerebral aneurysms, the visualization of the neck and dome configuration after coiling or clipping is necessary.
- 2) We have developed 3D multifusion imaging of silent MRA and FSE-MR cisternography (MRC) to depict the neck and dome after coiling and clipping for cerebral aneurysms.



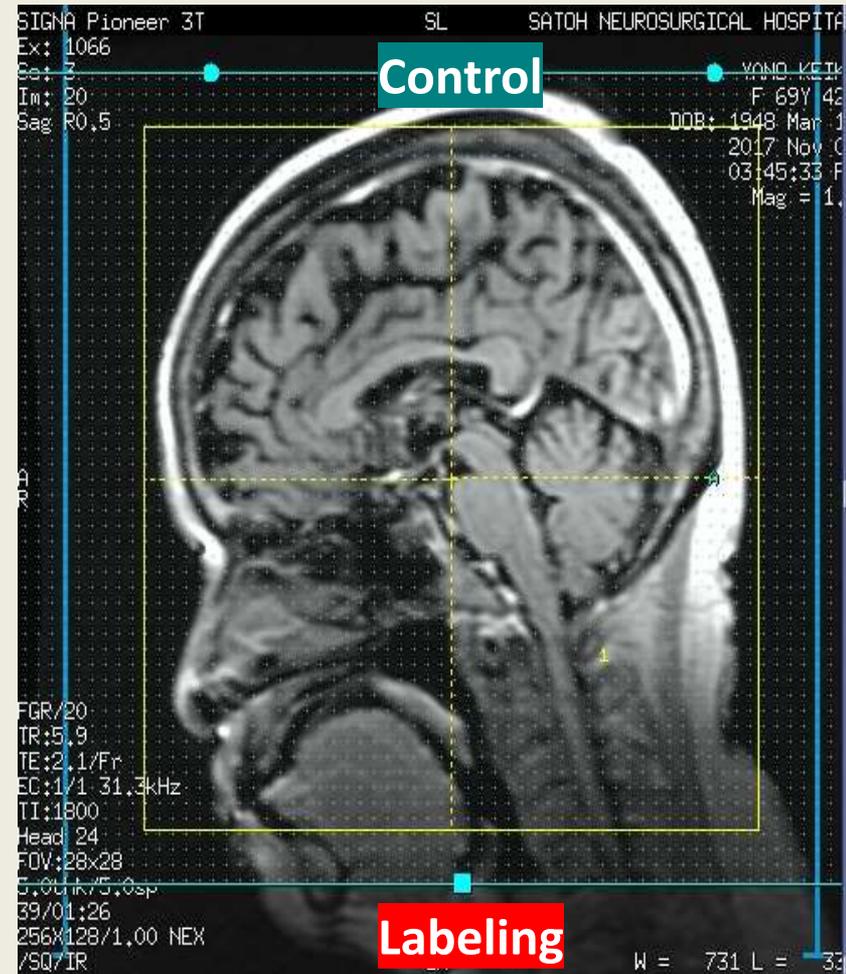
Methods

- 1) 34 aneurysms (15 treated by coiling and 19 by clipping) were examined with 3D multifusion imaging by composing 3D images reconstructed from TOF-MRA, silent (Zero TE) MRA, and heavily T2-weighted 3D FSE-MRC.
- 2) The influence of magnetic susceptibility artifacts caused by metal materials affecting the configuration of the aneurysmal complex with coil or clip, in combination with coiled dome and the surrounding brain structures, was assessed in a single 3D image.



Arterial Spin Labeling (ASL) for Silent MRA

- 1) Long RF inversion pulse tagged at the carotid arteries (**Labeling**).
- 2) Tagged blood is flowing into the vasculature and captured by the Silenz acquisition.
- 3) Followed by the reverse labeling pulse corrected at the top of the head (**Control**).
- 4) Subtract **Labeling** from **Control** datasets to eliminate the background, leaving a depiction of the entire vascular tree (T1WI).



Silent MRA (GE SIGNA Pioneer: 3.0T)

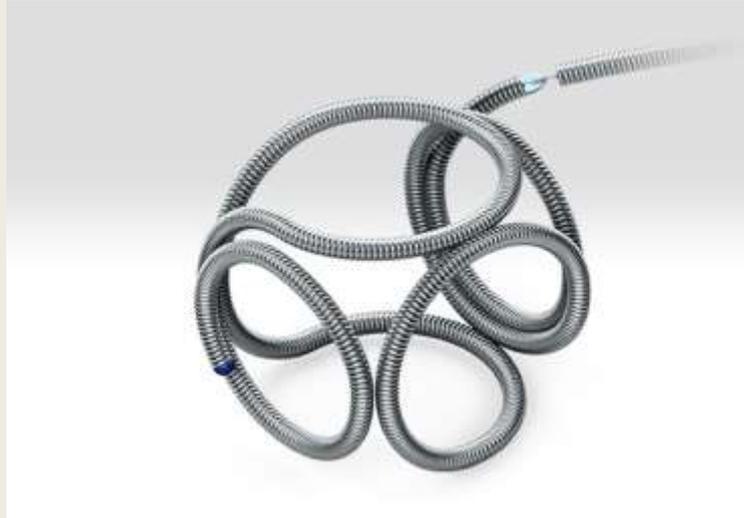


Scan Parameters of TOF vs Silent MRAs

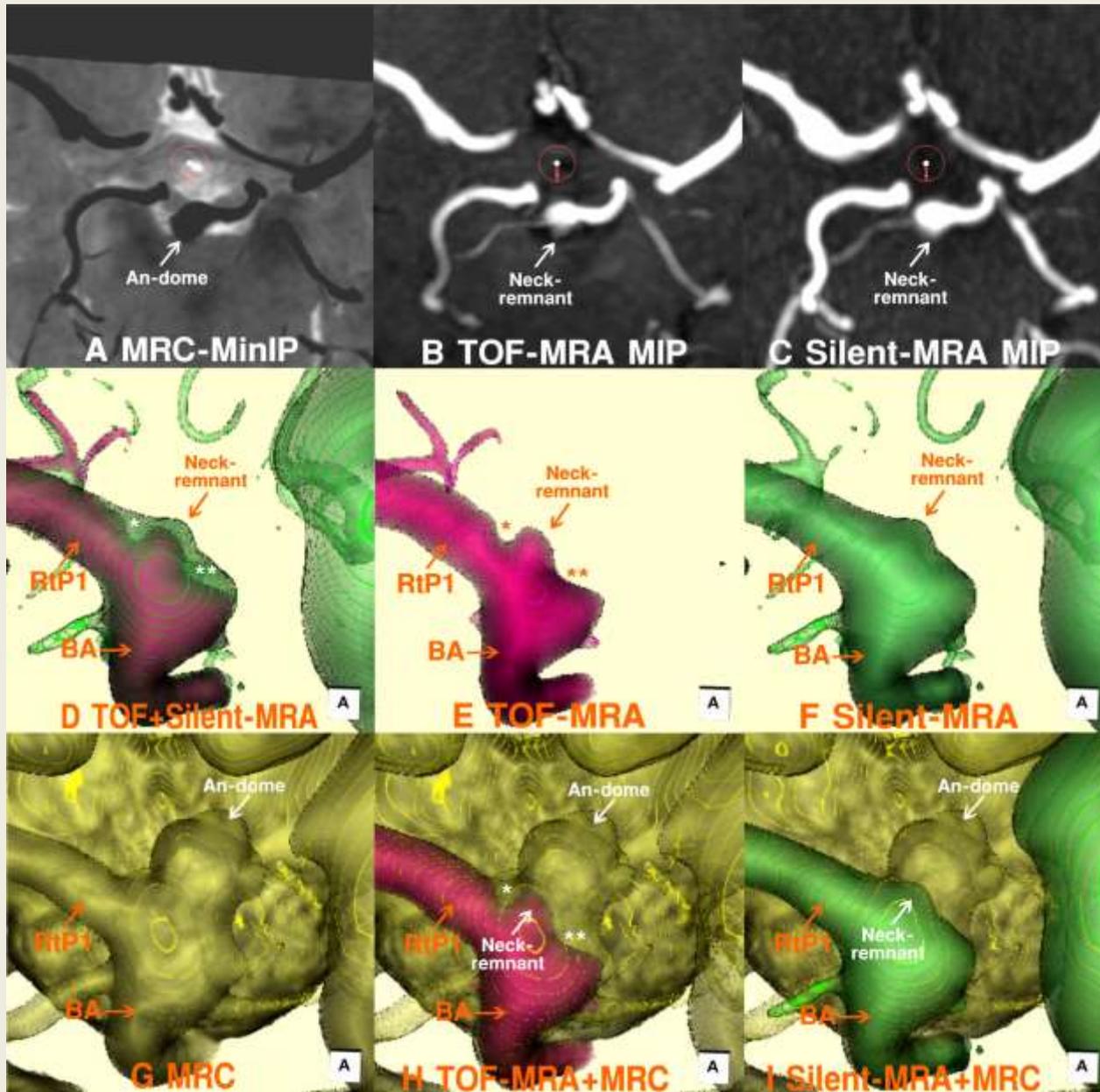
	TOF-MRA	Silent MRA
Technique	in-flow effect	ASL+Ultra short TE+ T1WI subtraction
Noise	Noisy: >100 dB	Silent: < 3dB
Saturation effect	Difficult: slow flow Signal loss : fast, whirlpool, turbulence flow, parallel running flow	Easy: slow flow Depict: slow, whirlpool, turbulence flow, multi-directional flow
TR/TE	25/3.4	880/0.016
FOV	200 x 200 mm	200 x 200 mm
Matrix	288 x 192	-
Spokes	-	320
Slice thick	1.2 mm	1.0 mm
NEX	0.85	1
Scan time	4 min 59s	12 min 48s
Band width	35.71 kHz	31.3 kHz
Flip angle	20	5



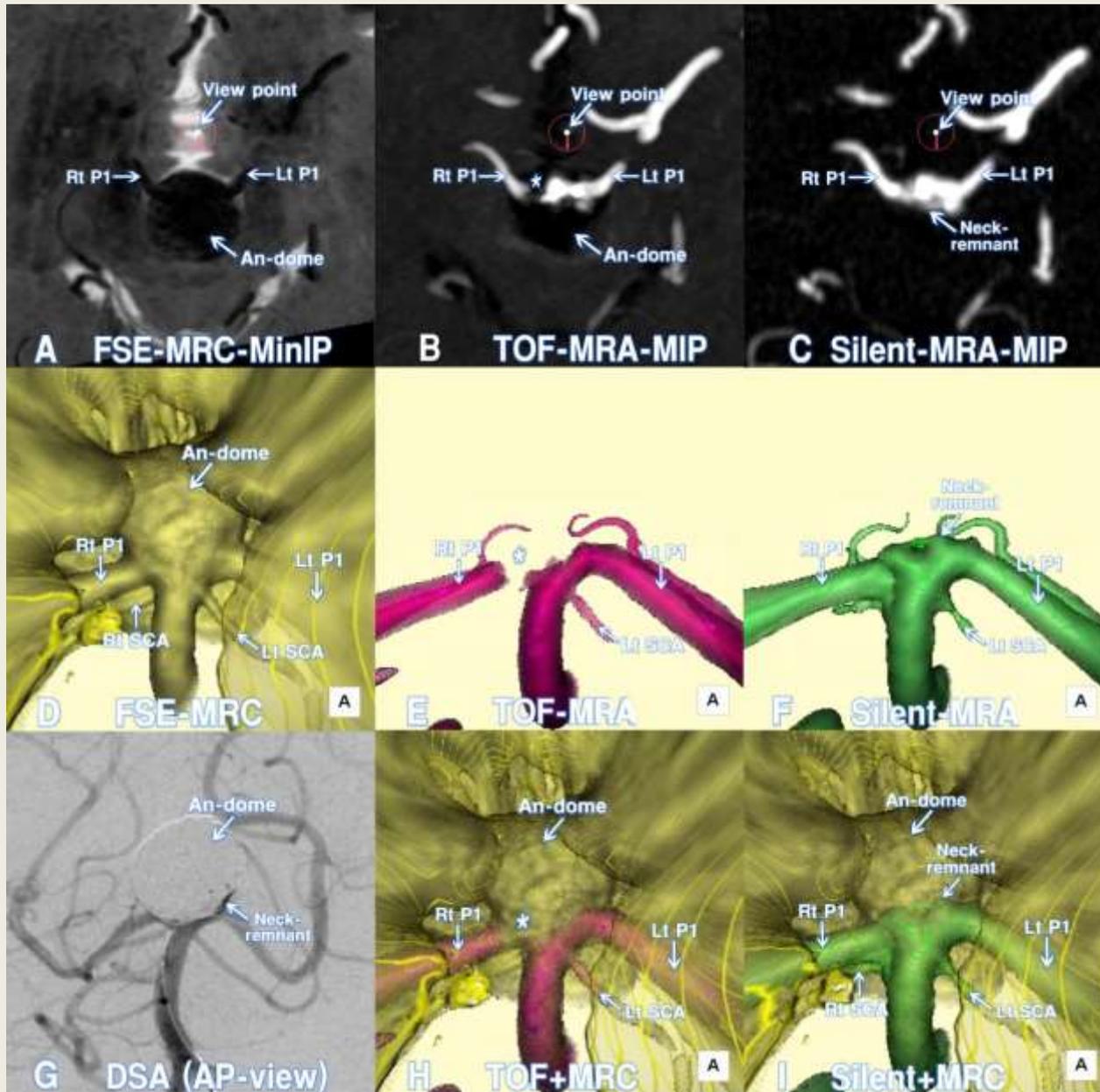
Coiled Aneurysms



BA-tip Aneurysm-Coiled (Remnant)



BA-tip Aneurysm-Coiled (Remnant)



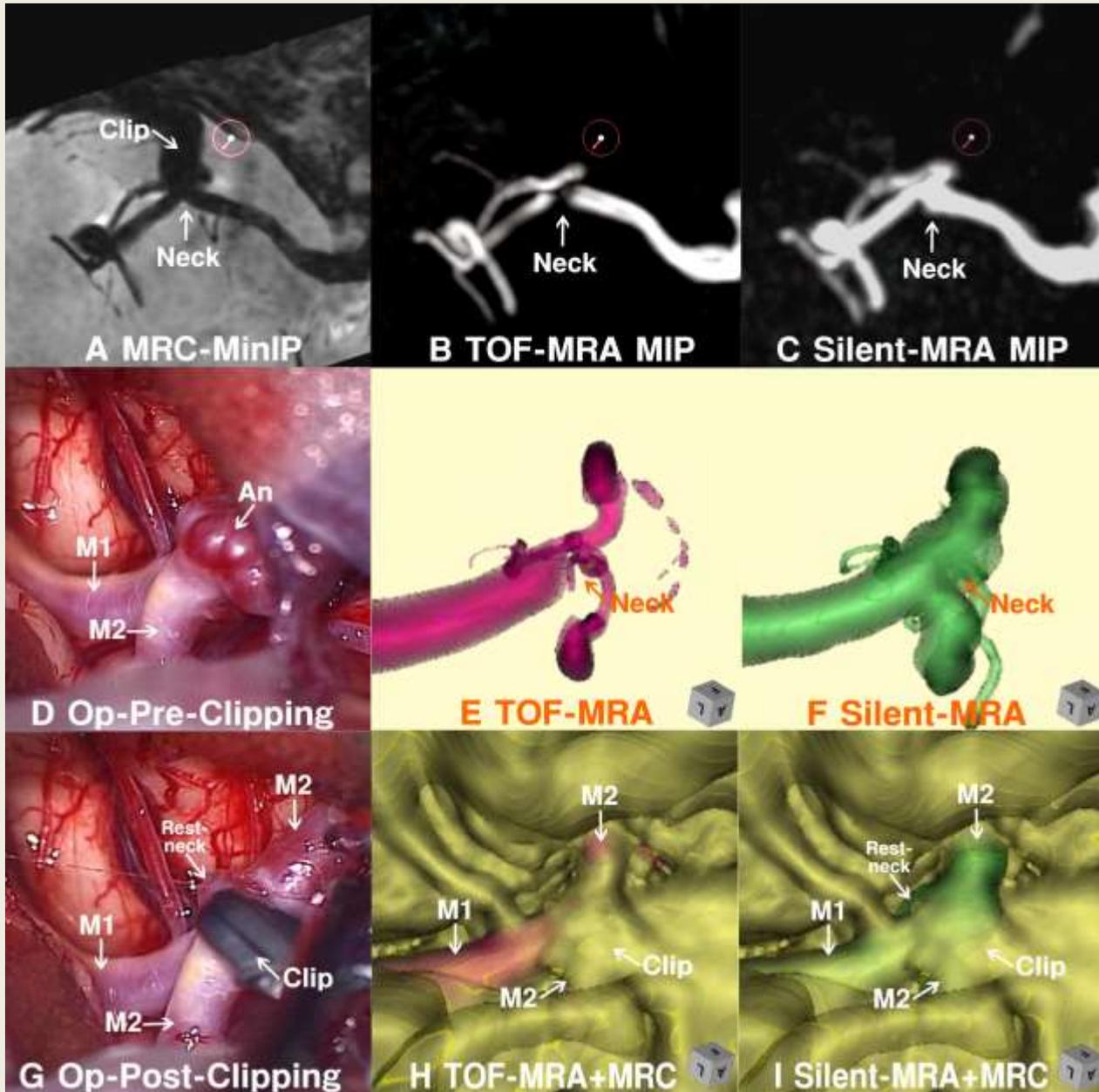
Size & Volume of Remnant/Dome: Coiled Aneurysms

Case	Age/Sex	Location	Symptoms	Remnant size (mm) silent MRA	Remnant volume (mm ³)	Dome size (mm) FSE-MRC	Dome volume (mm ³)	Remnant/Dome (%)	Results
1	63/F	ACoMA	Unrup'd	0	0.0	4.5 × 3.6 × 4.0	33.9	0.0	Complete
2	67/M	ACoMA	Unrup'd	2.0 × 2.0 × 1.8	3.8	4.8 × 3.9 × 4.8	47.1	8.0	Follow-up
3	58/M	ACoMA	Unrup'd	3.3 × 2.1 × 3.4	12.3	5.6 × 10.9 × 7.4	236.5	5.2	Follow-up
4	62/F	ACoMA	Unrup'd	5.6 × 5.5 × 5.7	91.9	13.9 × 14.0 × 17.8	1813.7	5.1	Follow-up
5	53/M	ACoMA	Unrup'd	1.0 × 1.9 × 2.3	2.3	2.8 × 3.0 × 2.7	11.9	19.3	Follow-up
6	82/F	ACoMA	Unrup'd	13.3 × 11.2 × 17.4	1.5	17.6 × 18.29 × 22.1	5.0	30.0	Follow-up
7	78/F	A2-A3	Unrup'd	0	0.0	3.7 × 4.1 × 4.5	35.7	0.0	Complete
8	75/F	Lt ICPC	Unrup'd	3.5 × 2.5 × 3.9	17.9	6.1 × 5.8 × 6.5	120.4	14.8	Retreat
9	51/M	IC AChor	Unrup'd	3.4 × 2.2 × 2.8	11.0	4.3 × 3.4 × 3.9	29.9	36.7	Follow-up
10	56/F	Lt MCA	SAH	3.2 × 2.8 × 3.1	14.5	19.9 × 2.8 × 11.4	332.6	4.4	Follow-up
11	70/F	RtIC3	Unrup'd	0	0.0	11.1 × 7.9 × 5.0	3.0	0.0	Complete
12	65/F	LtIC-Opht	Unrup'd	0	0.0	3.5 × 3.3 × 4.4	81	0.0	Complete
13	69/F	BA-tip	Unrup'd	5.0 × 4.9 × 4.0	52.4	16.2 × 15.5 × 17.3	2274.5	2.3	Follow-up
14	69/F	BA-tip	SAH	4.0 × 3.0 × 1.3	8.2	4.5 × 5.2 × 7.9	80.2	6.9	Follow-up
15	53/F	BA-tip	Unrup'd	10.5 × 7.4 × 7.0	284.8	11.9 × 12.2 × 10.9	828.6	34.4	Retreat

Clipped Aneurysms



Rt. MCA Aneurysm-Clipped (Rest-neck)



Size of Dome & Rest-neck: Clipped Aneurysms

Case	Age/ Sex	Location	Symptoms	Dome size (mm) FSE-MRC	Rest-neck size (mm) Silent MRA	Result
16	74/F	ACoMA	Unrup'd	NA	2.5 × 1.2 × 2.4	Follow-up
17	75/F	ACoMA	Unrup'd	NA	none	Complete
18	55/F	Rt IC-PC	Unrup'd	NA	none	Complete
19	67/F	ACoMA	Unrup'd	NA	none	Complete
20	76/F	Lt IC-PC	Unrup'd	NA	none	Complete
21	72/F	ACoMA	Unrup'd	NA	none	Complete
22	52/F	Rt IC-OphA	Unrup'd	NA	2.6 × 3.6 × 2.9	Follow-up
23	43/F	Lt IC-OphA	Unrup'd	NA	none	Complete
24	71/F	Lt MCA	Unrup'd	NA	none	Complete
25	61/F	Rt MCA	Unrup'd	NA	none	Complete
26	34/F	ACoMA	Unrup'd	NA	none	Complete
27	67/F	Rt MCA	Unrup'd	NA	none	Complete
28	82/M	Rt MCA	Unrup'd	NA	0.4 × 0.6 × 0.4	Follow-up
29	64/F	Lt IC-AChoA	Unrup'd	NA	none	Complete
30	77/M	ACoMA	Unrup'd	NA	none	Complete
31	53/M	Rt IC-AChoA	SAH	NA	none	Complete
32	62/M	Rt IC-OphA	Unrup'd	NA	none	Complete
33	60/F	Rt MCA	Unrup'd	NA	none	Complete
34	78/F	Lt IC-PC	Unrup'd	NA	2.2 × 2.8 × 3.3	Follow-up



Conclusions

- 1) With TOF MRA, the neck of coiled or clipped aneurysms were not shown precisely due to metal artifacts.
- 2) Silent MRA is a non-contrast-enhanced form of MRA, and it depicted the neck of coiled or clipped aneurysms without serious metal artifacts.
- 3) FSE-MRC depicted the shape of the neck and dome of coiled aneurysms and the neck of clipped aneurysms with the surrounding brain structures.
- 4) 3D multifusion imaging of silent MRA and FSE-MRC can clearly delineate the neck and dome of coiled or clipped aneurysms with the brain. This imaging method may be useful for follow-up evaluation after treatment of coiling or clipping for cerebral aneurysms.





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Thank you for your kind attention!

