

# Fastest detection of ischemic penumbra using ASAP-ASL with secure and comprehensive 10min-MRI Protocol including Chest MRA

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## Background and Aim

In acute cerebral ischemia with large vessel occlusion, the brain imaging is extremely important in making decision whether to apply a mechanical thrombectomy. However, MRI protocol including a complicated technique may delay the start of the therapy. We have established an optimized and quick MRI protocol including "Acute Stroke Assessment using rapid Pseudo-continuous Arterial Spin Labeling: ASAP-ASL) and chest-MRA.

## Method

Our MRI protocol is shown in table2. This MRI protocol is completed within 10min. We retrospectively analyzed the cases with acute onset of neurological symptoms. ASAP-ASL is characterized by shortened label distance and limited scan area which makes the test quick (Fig. 1, Table 1). Chest coronal MRA was performed to diagnose major vessel disease such as aortic dissection.

## Result

169 consecutive patients were performed this MRI protocol after the onset. 54 patients were diagnosed as intracranial hemorrhage at the stage of survey scan and DWI. 44 patients were performed all the sequence, and undergone mechanical thrombectomy (Fig. 2). DWI and ASL perfusion imaging clearly revealed irreversible cerebral infarction and ischemic penumbra in all of these patients within 3min from the start of the examination. In addition, 2 patients with type A aortic dissection were detected by chest MRA (Fig. 3).

## Conclusion

All the patients were precisely diagnosed using this optimized MRI protocol. Especially, we could decide to apply mechanical thrombectomy with DWI-ASL mismatch within 3min in the first stage of protocol. This MRI protocol is the best tool in diagnosing patients with acute phase cerebral ischemia. In the best of our knowledge, this is a first report referred to the comprehensive MRI protocol including perfusion imaging and chest MRA without a contrast media.

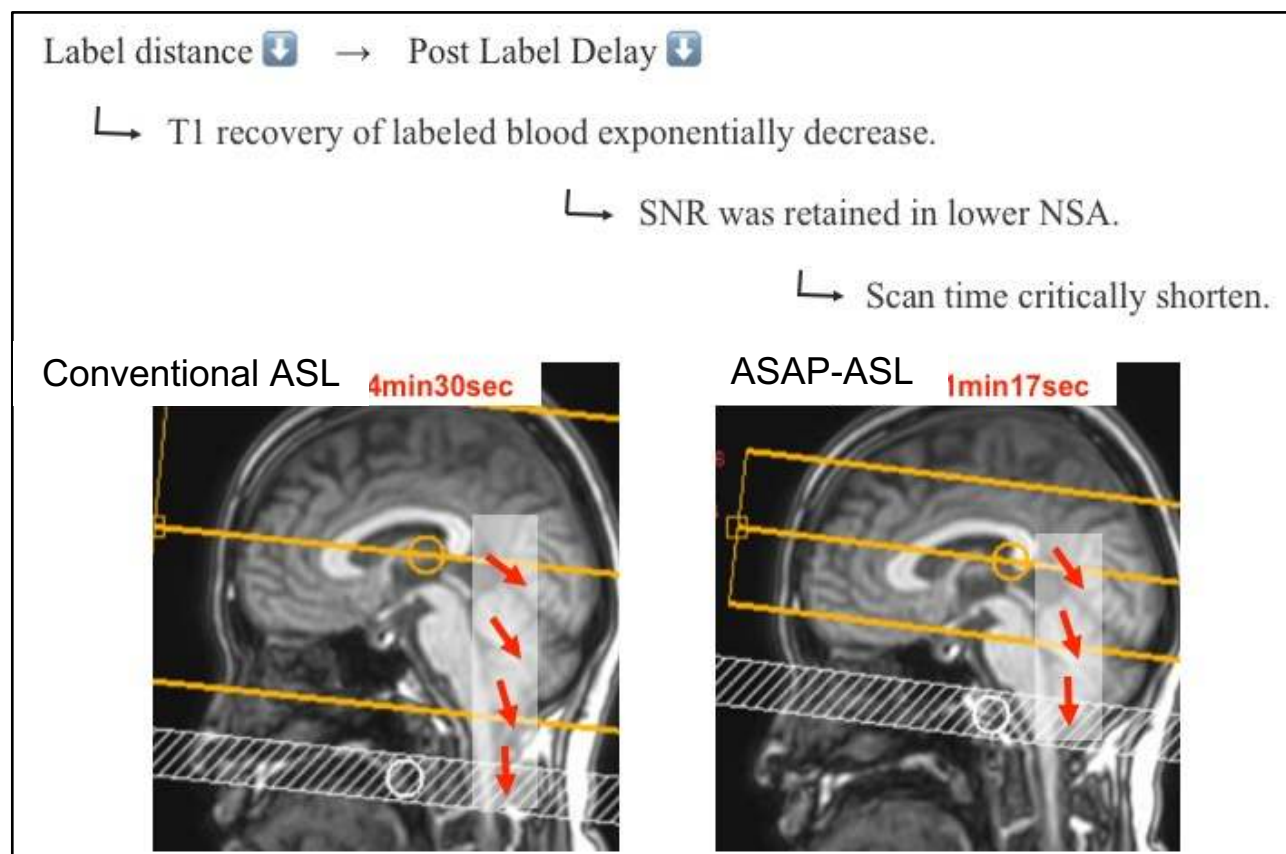


Fig. 1: Conventional whole brain ASL and ASAP-ASL: Basal-ganglia pCASL

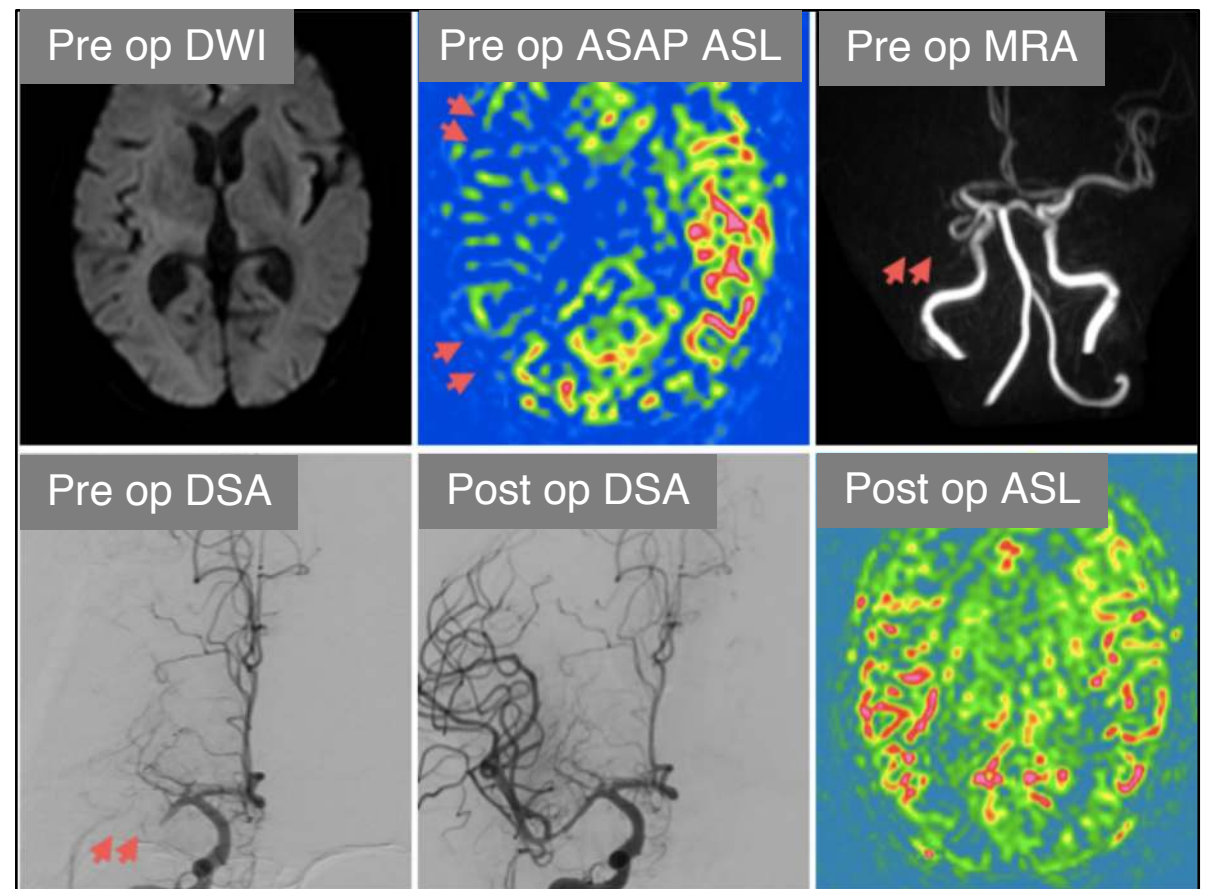


Fig. 2: A representative case, 74y male with rt. M1 occlusion. The patient was undergone endovascular treatment successfully.

Sequence	FOV	Scan time	TR / TE (ms)	label distance (mm)	post Label delay (ms)	label duration (ms)	slice thickness (mm)	slice number	matrix size (mm)	NEX
Conventional		<b>4:30</b>	4356 / 16	95	1800	1600	5	22	2.75	30
2D TFE-EPI	240x240									
ASAP-ASL		<b>0:21 - 1:45</b>	3949 / 7.8	65	1300	2000	10	6	3.33	2-14

Table1: Parameters of conventional whole brain ASL and ASAP-ASL: Basal-ganglia pCASL

Sequence	TR / TE, ms	FOV, mm	Matrix size, mm	Slice th and number	SENSE	Scan time
DWI	2283 / 79	230 × 230	1.8 × 2.34	5 mm × 22 slice	3	0 min 14 sec
<b>ASAP-ASL</b>	<b>3510 / 9.2</b>	<b>240 × 240</b>	<b>3.33 × 3.33</b>	<b>10 mm × 6 slice</b>	<b>3</b>	<b>1 min 17 sec</b>
Head MRA	17 / 3.5	200 × 200	0.7 × 1	1 mm × 90 slice	3	1 min 14 sec
FLAIR	8000 / 120	230 × 186	1.11 × 1.56	5 mm × 22 slice	2.5	0 min 48 sec
T2*WI	428 / 16	220 × 187	1.2 × 1.2	5 mm × 22 slice	3	0 min 22 sec
Neck MRA	18 / 3.5	200 × 200	1 × 1	1 mm × 120 slice	3	1 min 44 sec
Chest Coronal	6.6 / 3.9	430 × 430	2.5 × 2.5	3mm × 70 slice	2	1min 10 sec
<b>Total time</b>						<b>6 min 49 sec</b>

Table 2: Our MRI protocol for fastest detection of ischemic penumbra using ASAP-ASL including Chest MRA

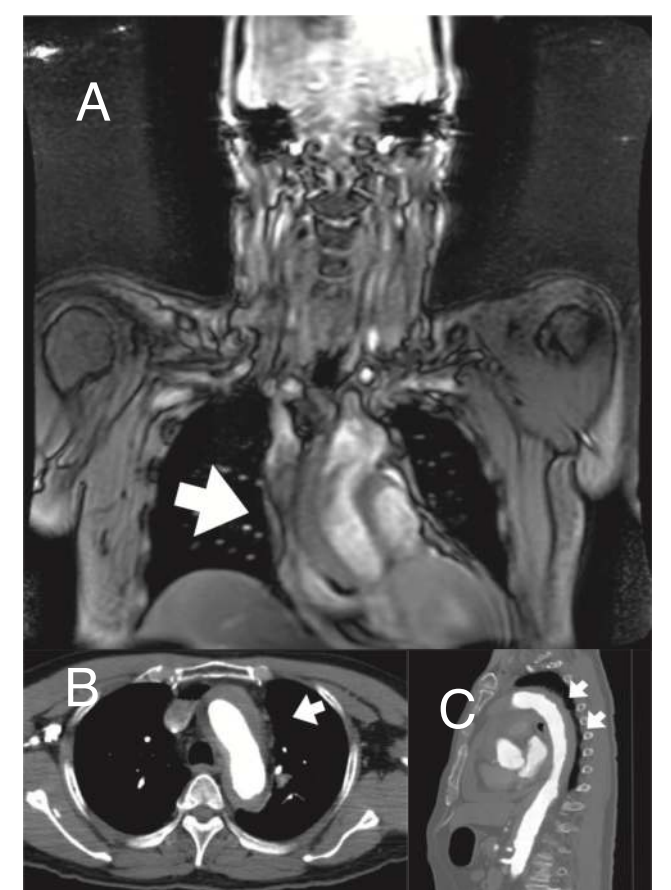


Fig. 3: A representative case with cerebral ischemia caused by aortic dissection which was diagnosed by chest MRA (A). B, C: Enhanced chest CT.