

Canon

画論

29th

The Best Image

Best Image Awards Compilation

MRI Category

Judging Panel

Osamu Abe (Professor and Chairman, Graduate School of Medicine, Radiology and Biomedical Engineering, Board-Certified Diagnostic Radiologist, The University of Tokyo)
Katsuyoshi Ito (Professor and Chairman, Department of Radiological, Yamaguchi University Graduate School of Medicine)
Kenichi Yokoyama (Professor and Chairman, Department of Radiological, Kyorin University, School of Medicine)
Kuninori Kobayashi (Professor, Department of Medical Radiological Technology, Faculty of Health Science, Kyorin University)
Atsushi Ono (Professor, Department of Radiological Technology, Faculty of Health Science and Technology, Kawasaki University of Medical Welfare)
Hirofumi Wada (General Manager, Radiological Technologist, Center for Preventive Medicine, Saiseikai Kumamoto Hospital)

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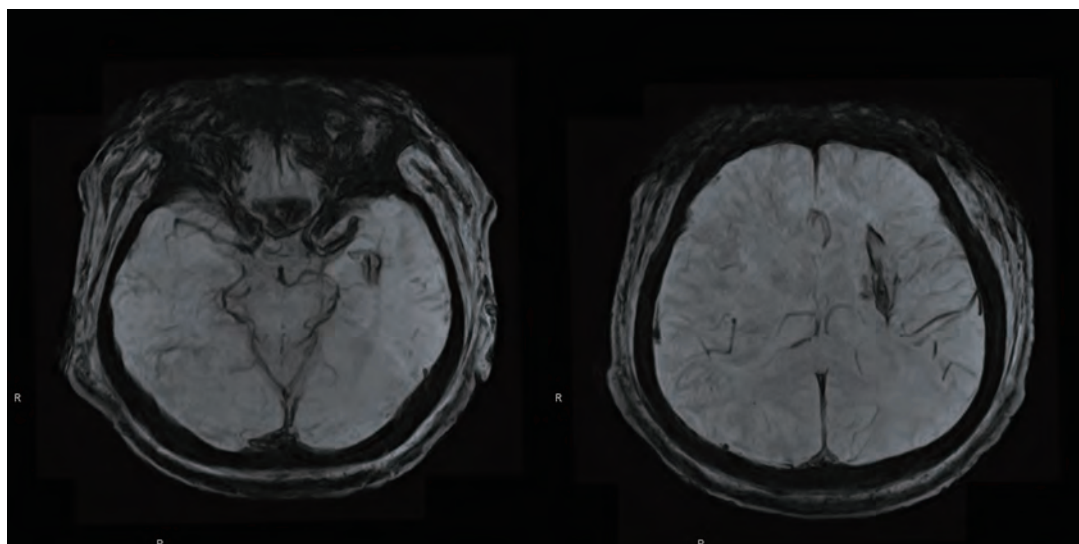
[Technical Award]

Aneurysm of the left renal artery

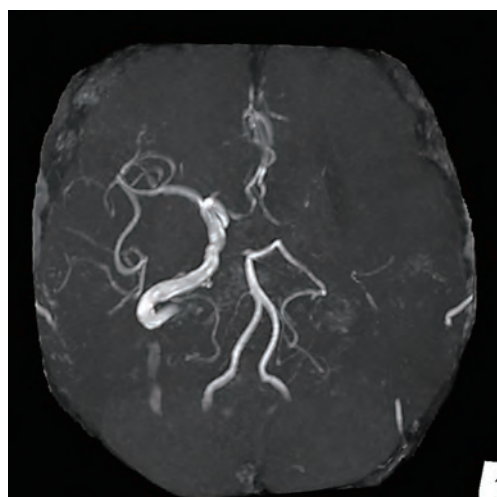
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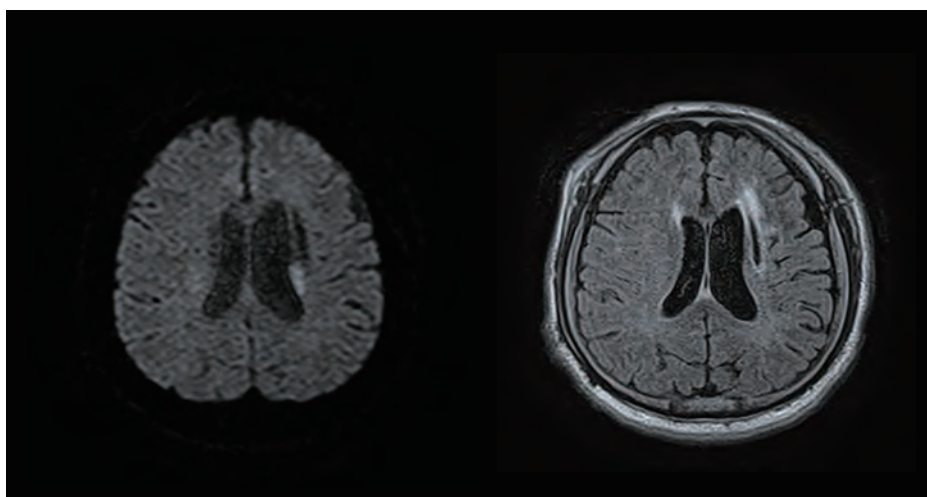
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(a) FSBB



(b) TOF-MRA



(c) DWI

(d) FLAIR

Neurosurgery

Suspected acute cerebral infarction

Kawachi General Hospital, Osaka, Japan
Toshihiko Maeda

System used: EXCELART Vantage Powered by Atlas series

Reason for examination: This patient had a past medical history of left putaminal hemorrhage with incomplete hemiplegia on the right side. After waking up during the night to go to the bathroom, the patient noticed numbness on the right side of his body and slurred speech. He called an ambulance and was brought to the hospital. A head MRI examination was performed for suspected acute cerebral infarction.

Clinical comments: MRA can detect occlusion of the major cerebral arteries, which is an indication for mechanical thrombectomy. FSBB scanning can be used to evaluate not only the thrombus in the affected vessel but also the status of the collateral circulation, allowing the cause of the infarction to be assessed in greater detail. This provides extremely useful information for determining whether the patient is a good candidate for mechanical thrombectomy.

Technical comments: At our hospital, FSBB scanning is routinely performed for patients in whom occlusion of a major cerebral artery is seen in an emergency MRI examination. Many of these patients have impaired consciousness, so it is essential to set the optimal scan conditions in order to minimize the total examination time. The scan conditions are selected to provide the highest possible SNR with the shortest possible TE.

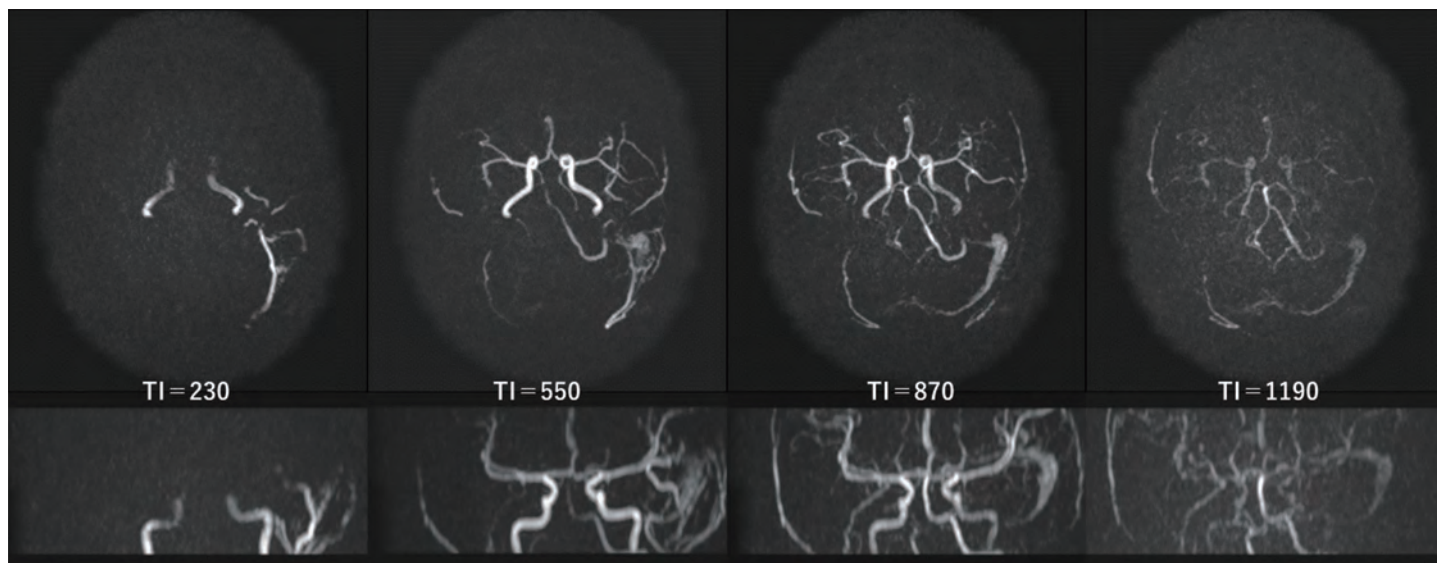
Comments on images: (a) These images show thrombus extending from the end of the left internal carotid artery to the middle cerebral artery. A black blood image is ob-

served distal to the M2 bifurcation of the middle cerebral artery, indicating the presence of arterial blood flow. It is assumed that this blood flow is from the collateral vessels arising from the vertebral artery. (b) The left internal carotid artery is not visualized, indicating occlusion. Blood flow signals to the left middle cerebral artery from the right anterior cerebral artery via the anterior communicating artery are observed. (c) The DWI image shows high-intensity areas in the range from the posterior limb of the internal capsule to the corona radiata, indicating the presence of acute cerebral infarction. (d) Changes in signals are not observed in the FLAIR image of the same region. Old hemorrhage in the left putamen is also noted.

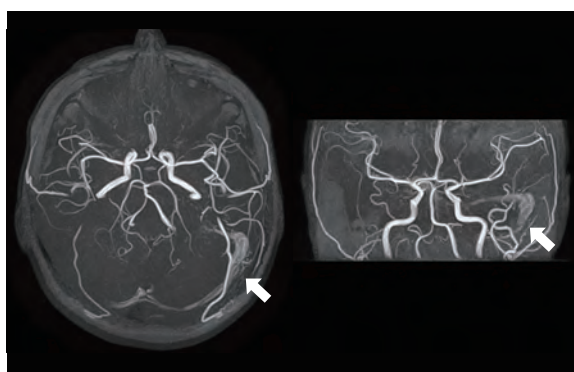
Comments of judges: The location of the thrombus and the status of the collateral vessels can be accurately evaluated using the FSBB method. This method allows examinations to be performed in less time and provides valuable information for treatment planning in patients with acute cerebral infarction.

Sex	Age	Weight	Software version	Fasting	Contrast medium
Male	60-70 years	60-70 kg	V9.20	No	
Dose	Injection rate	Administration method	Workstation		

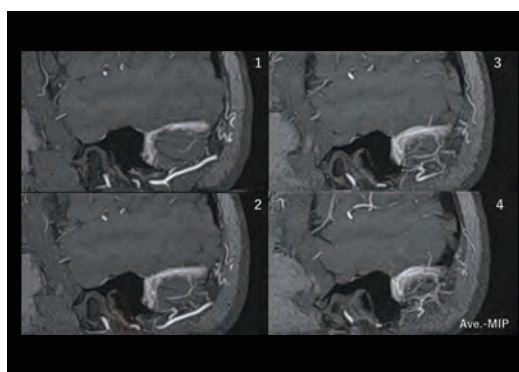
Acquisition conditions for (a)	FE 3D FSBB, TR: 29, TE: 15, FA: 7, b-factor: 0.3, SPEEDER factor: 2.0, FOV / No Wrap: 20×20 / 1.0×1.0, PE matrix × RO matrix: 256×256, slice thickness / number of slices: 2.0 mm / 30, number of acquisitions: 1.0, scan time: 1:59
Acquisition conditions for (b)	MRA 3D 6.8 fc slt, TR: 32, TE: 6.8, FA: 20, SPEEDER factor: 2.0, FOV / No Wrap: 20×20 / 1.0×1.0, PE matrix × RO matrix: 192×256, slice thickness / number of slices: 1.4 mm / 80, number of acquisitions: 1.0, scan time: 5:08
Acquisition conditions for (c)	SE EPI 95 +0.9, TR: 5751, TE: 95, FA: 90, SPEEDER factor: 2.0, FOV / No Wrap: 22×22 / 1.0×1.0, PE matrix × RO matrix: 144×144, slice thickness / number of slices: 5.0 mm / 23, number of acquisitions: 1.0, scan time: 0:35
Acquisition conditions for (d)	FSE+15 nBw slt(13), TR: 10000, TE: 105, FA: 90, T1: 2500, SPEEDER factor: 2.0, FOV / No Wrap: 22×22 / 1.0×1.0, PE matrix × RO matrix: 192×288, slice thickness / number of slices: 5.0 mm / 23, number of acquisitions: 1.0, scan time: 1:30
Coil used	Atlas SPEEDER Head



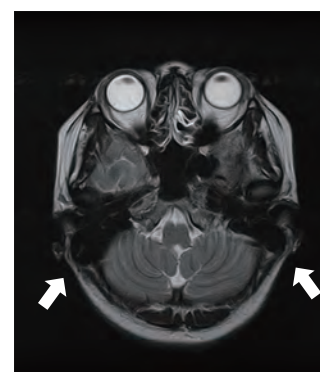
(a) mASTAR images



(b) TOF-MRA MIP images



(c) TOF-MRA Averaging MIP images



(d) T2WI

Neurosurgery

Dural arteriovenous fistula

Hakodate Western Neurological Clinic, Hokkaido, Japan
Takeshi Makabe

System used: Vantage Elan

Reason for examination: The patient visited the hospital complaining of tinnitus. She had no other associated symptoms and underwent MRI and MRA of the head for detailed intracranial examination.

Clinical comments: This is a case of dural arteriovenous fistula (dAVF), which is a very common abnormality. The

left sigmoid sinus was visualized in TOF-MRA images. In T2WI images, abnormal signals were not observed in the ipsilateral proximal jugular vein or sigmoid sinus, and the presence of a dAVF was therefore suspected in the original MRA images. Early visualization of the left external carotid artery and veins using the 4D method led to a diagnosis of dAVF. The area in which fine arterial branches of the external carotid artery flow into the venous sinus was also depicted in sagittal MIP images.

Technical comments: Scanning was performed using mASTAR with TI values of 230, 550, 870, 1190, and 1510 ms in an acquisition time of 3:30. In head MRA, a presaturation pulse is applied to suppress signals from venous blood flow in order to selectively visualize arterial blood flow. When this scanning technique is employed, the visualization of signals from the veins indicates the presence of a shunt, such as a dAVF. However, signals from the veins may

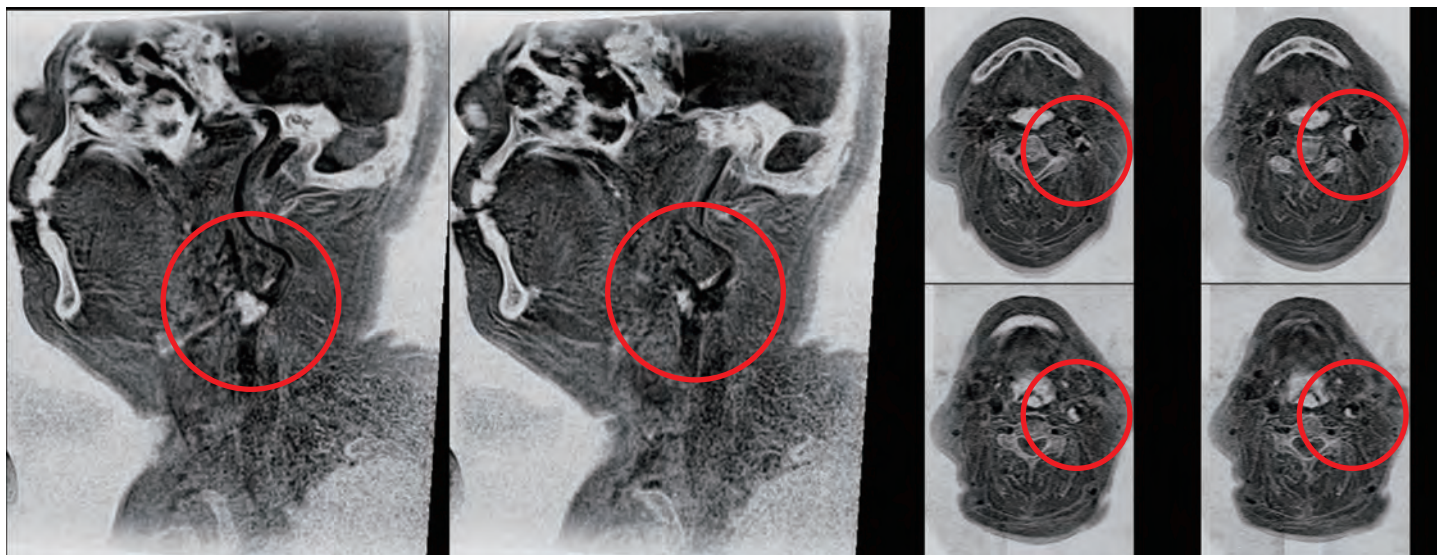
sometimes be observed even when a dAVF is not present, possibly arising from the cavernous sinus or the sigmoid sinus. In addition, the original MRA images were found to be effective in this case thanks to the use of Ave. MIP.

Comments on images: (a) Early visualization of the left external carotid artery and shunt flow to the vein are observed at a TI of 550 ms. (b) The left sigmoid sinus is clearly depicted. (c) The images are displayed with a ROI thickness of 6 mm and overlap of 2 mm. Images with excellent reproducibility can be generated in a short processing time. (d) Abnormal signals are not observed in the left and right sinuses. Flow voids are seen.

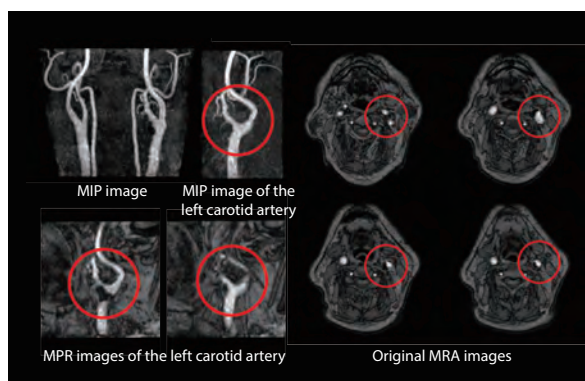
Comments of judges: Contrast-enhanced scanning is usually required in such patients, but in this patient, the use of mASTAR allowed hemodynamics to be evaluated without the use of contrast medium. Shunt flow to the vein via the dAVF could be clearly depicted.

Sex	Age	Weight	Software version	Fasting	Contrast medium
Female	40-50 years		V4.0		
Dose	Injection rate	Administration method	Workstation		

Acquisition conditions for (a)	FFE3D:ASTR, TR: 5.7, TE: 1.9, FA/Flop: 8, TI: 230, 550, 870, 1190, 1510, fat suppression: none, gating: none, SPEEDER factor: 1.6, FOV / No Wrap: 23×23 / 1.0×1.0, PE matrix × RO matrix: 176×176, slice thickness / number of slices: 1.5 mm / 46, number of segments: 2, number of acquisitions: 2.0, scan time: 3:30
Acquisition conditions for (b)	MRA3D:fc, TR: 21, TE: 6.8, FA/Flop: 18, fat suppression: none, gating: none, SPEEDER factor: 1.8, FOV / No Wrap: 20×20 / 1.0×1.0, PE matrix × RO matrix: 192×256, slice thickness / number of slices: 0.5 mm / 160, number of segments / number of acquisitions: 1.0, scan time: 5:20
Acquisition conditions for (d)	FSE2D+12.5, TR: 4800, TE: 112.5, FA/Flop: 90/160, fat suppression: none, gating: none, FOV / No Wrap: 23×23 / 1.3×1.0, PE matrix × RO matrix: 256×512, slice thickness / number of slices: 6 mm / 20, number of acquisitions: 1.0, scan time: 1:41
Coil used	Octave SPEEDER Head



(a) MR Bone-like images



(b) TOF-MRA images of the carotid artery



(c) Fusion images of the TOF-MRA images and VR images of calcified plaque



(d) Fusion images of the TOF-MRA images and VR images of calcified plaque (left carotid artery)

Neck

Stenosis of the left carotid artery Visualization of calcified plaque in Bone-like images obtained using the 3D M-Echo method

Kanenaka Neurosurgery Clinic, Tokyo, Japan
Tsuyoshi Kataoka

System used: Vantage Elan

Reason for examination: Routine head examination and neck MRA (from the bifurcation) were requested for evaluation of a patient with suspected cerebral infarction.

Clinical comments: Stenosis and surrounding areas of extremely low-intensity were observed in MRA of the left carotid artery in the range from the bifurcation to the ICA. This was determined to be stenosis due to calcified plaque. In the Bone-like images, calcified lesions, which were depicted as low-intensity areas in the conventional MRI images, were depicted as high-intensity areas. The excellent contrast against background areas allowed the positional relationships with the vessels to be clearly visualized, including in the volume rendered images.

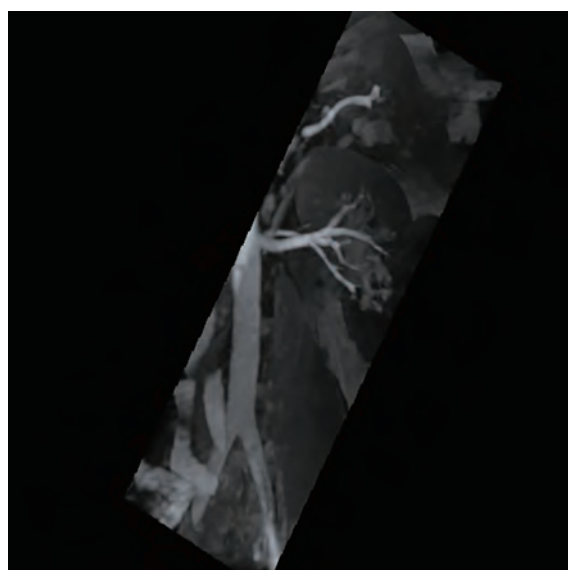
Technical comments: Visualization of calcified plaque was attempted using the 3D M-Echo method. After applying positive/negative reversal as performed in conventional Bone-like imaging, the lesions were extracted at the workstation and fusion images were then generated from the MRA images. Due to the basic principles of TOF-MRA imaging, it can be difficult to obtain good contrast between calcified plaque and the background, but in the Bone-like images, the parameters were adjusted for the positive/negative reversed images so that the calcified lesions were depicted as low-intensity areas, the background was displayed with slightly higher intensity, and the vessels were depicted as high-intensity areas. This made it possible to obtain images with good contrast.

Comments on images: (a) Calcified plaque is clearly visualized using 3D M-Echo. The areas of calcified plaque (red circles) are depicted as high-intensity areas in the positive/negative reversed images. (b) TOF-MRA images of the carotid artery. Stenosis is observed in the range from the left bifurcation to the ICA. The stenotic lesions are depicted as low-intensity areas, indicating the presence of calcified plaque. (c) VR image in MRA (left) and fusion image of VR images with calcified plaque (right). The vessels are shown in red and calcification is shown in white. (d) Fusion images of MRA images and calcified plaque of only the left carotid artery. The images in the lower row show the calcified plaque with greater transparency.

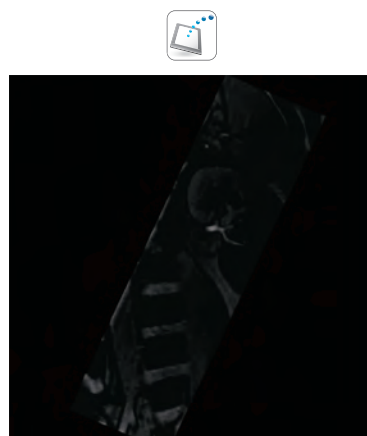
Comments of judges: The accurate evaluation of plaque characteristics is important in formulating the optimal treatment strategy. The presence of calcification, which usually means that CT scanning must be performed, could be qualitatively evaluated using MRI alone. This is considered to be of great clinical value.

Sex	Age	Weight	Software version	Fasting	Contrast medium
Male	70+ years		V4.0	No	
Dose	Injection rate	Administration method	Workstation		
			VINCENT		

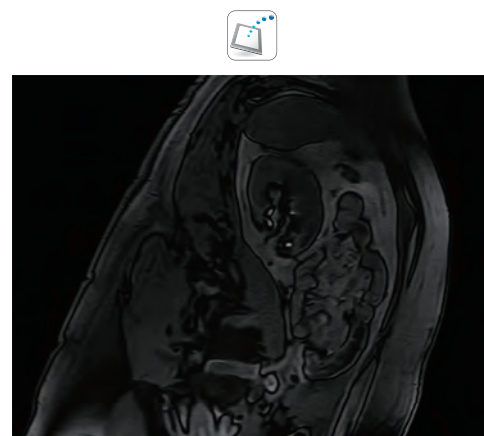
Acquisition conditions for (a)	FE3D:M-echo:tc, TR: 17.9, TE: 9.2, FA: 7, SPEEDER factor: 2.0, FOV: 25.0×25.0, PE matrix × RO matrix: 256×256, slice thickness: 2 mm, number of acquisitions: 1.0, scan time: 3:22
Acquisition conditions for (b)	MRA3D:tc, TR: 25, TE: 6.9, FA: 15, SPEEDER factor: 2.0, FOV: 21.0×21.0, PE matrix × RO matrix: 160×256, slice thickness: 1.5 mm, number of acquisitions: 1.0, scan time: 3:24
Coil used	Octave SPEEDER Head



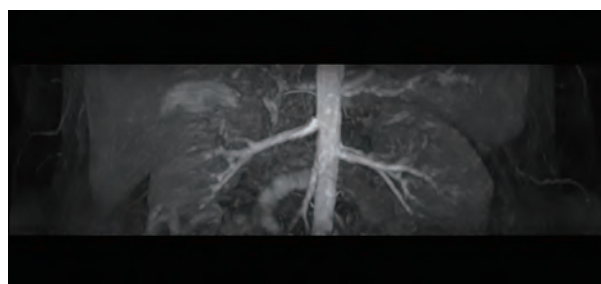
(a) TOF-MRA MIP image



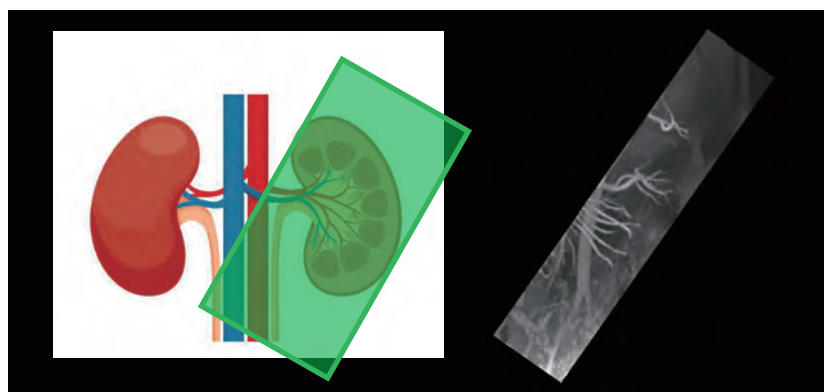
(b) TOF-MRA MPR image



(c) TOF-MRA original image



(d) Time-SLIP method (irregular breathing)



(e) Scan plan

Upper abdomen

Anomalous left renal artery

Hasuda Hospital, Saitama, Japan
Takashi Yamada

System used: Vantage Orian

Reason for examination: Detailed evaluation of the course of the left renal artery was requested.

Clinical comments: The renal arteries were examined using the conventional method, Time-SLIP, but the quality of the acquired images was poor due to the patient's irregular breathing. Because the patient's breath-hold time was judged to be insufficient, a breath-hold scanning technique was selected rather than attempting to perform Time-SLIP scanning again. Using the 3D-TOF method, non-gated

scanning (no ECG or respiratory gating) was performed with a 19-s breath-hold in a single acquisition. Higher quality images could be obtained without the need to extend the examination time, permitting the peripheral branches of the vessels to be accurately evaluated.

Technical comments: The renal arteries could be clearly visualized by breath-hold scanning using the 3D-TOF method. Taking into account the effects of the excitation pulse on the inflow side from the aorta and the inflow effects in the renal artery, scanning was performed with the ROI set obliquely. By employing the TOF method together with Fast3D, the scan time was significantly reduced, and AiCE was also used to increase the SNR. By employing scan sequences originally developed for cerebrovascular scanning and also taking advantage of the benefits of Fast3D and AiCE, a new type of non-contrast MRA was used to scan vessels in the abdomen.

Comments on images: (a) An anomalous left renal artery, with two arteries crossing each other, can be identified.

Fine ventral vessels arising from a proximal segment of the aorta supply blood to the lower part of the kidney, while most of the kidney is supplied by dorsal vessels arising from a distal segment of the aorta. (b) This is the only imaging method that is able to depict the extremely fine branches supplying the upper pole which arise from the proximal part of the dorsal vessels. (c) When this method is employed, the arteries can be clearly visualized out to fourth-degree branches in the renal medulla. When the Time-SLIP method is used, as in the original image, arteries smaller than second-degree branches in the hilum cannot be visualized.

Comments of judges: The TOF method provides higher spatial resolution, but it requires a long scan time and is therefore unsuitable for breath-hold scanning. By setting an oblique ROI in the scan plan or by using Fast3D or AiCE in combination, the vascular branches within the kidney can be clearly depicted in breath-hold scanning. The advantages of the TOF method can be fully exploited.

Sex	Age	Weight	Software version	Fasting	Contrast medium
			V7.0		
Dose	Injection rate	Administration method	Workstation		

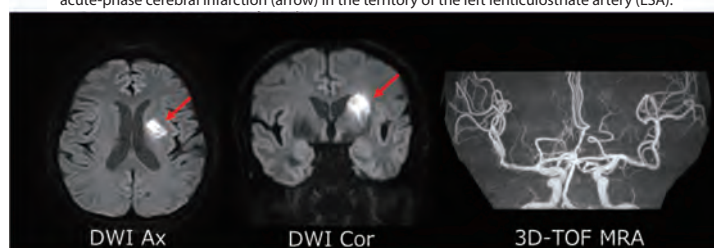
Acquisition conditions for (a)	MRA3D, TR: 9, TE: 2.6, FA: 18, fat suppression: WET, gating: none, SPEEDER factor: 2.5, FOV: 40×30.3, matrix: 192×288, slice thickness / number of slices: 2 mm / 84, number of segments: 4, number of acquisitions: 1.0, AiCE: used, scan time: 0:19
Acquisition conditions for (b) and (c)	MRA3D, TR: 9, TE: 2.6, FA: 18, fat suppression: WET, gating: none, SPEEDER factor: 2.5, FOV / No Wrap: 40×30.3 / 1, matrix: 192×288, slice thickness / number of slices: 2 mm / 84, number of segments: 4, number of acquisitions: 1.0, AiCE: used, scan time: 0:19
Acquisition conditions for (d)	SSFP3D, TR: 4.2, TE: 2.1, FA: 120, T1: 180, BBT1: 1400, fat suppression: STIR, gating: respiratory gated, SPEEDER factor: 2, FOV / No Wrap: 40×30 / 1.0×1.0, matrix: 256×208, slice thickness / number of slices: 2 mm / 50, number of segments: 1, number of acquisitions: 1.0, AiCE: not used, scan time: 6:20
Coils used	Atlas SPEEDER Body and Atlas SPEEDER Spine

* Advanced intelligent Clear-IQ Engine (AiCE)



Videos related to these images can be viewed by scanning the entire page using our medicalAR app.

➤ This is a patient who experienced the sudden onset of sensory aphasia. Head MRI shows an acute-phase cerebral infarction (arrow) in the territory of the left lenticulostriate artery (LSA).



➤ 3D-TOF MRA images do not show occlusion or stenosis of the middle cerebral artery. The cause of the left LSA infarction was considered to be lacunar infarctions or branch atheromatous disease (BAD).

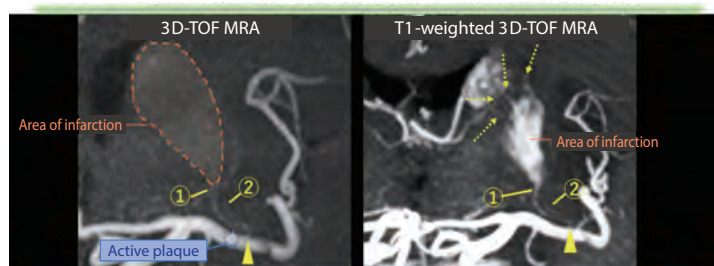
(a) DWI and 3D-TOF MRA

◆ Active plaque in left M1



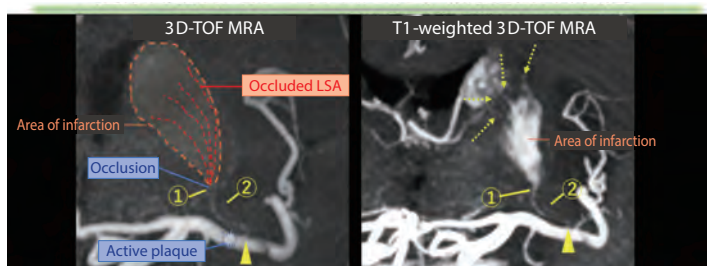
➤ In cross-sectional vessel wall images of M1, plaque showing strong contrast enhancement (which is considered to be active plaque) is observed in the posterior wall of the proximal segment (arrow).

(b) Vessel wall imaging



➤ The LSA arises from M1 distal to the segment containing active plaque (arrowhead) and divides into two branches, <1> and <2>.
➤ 3D-TOF MRA shows occlusion of the branch located on the inner side <1> in the area of infarction.
➤ T1-weighted 3D-TOF MRA shows multiple peripheral LSA branches arising from the branch located on the inner side and running through the area of infarction (arrow).

(c) Comparison between 3D-TOF MRA and contrast-enhanced T1-weighted 3D-TOF MRA



➤ A large infarction, as seen in BAD, is observed. However, in this patient, the infarction is considered to be due to occlusion of a distal segment of the branch located on the inner-side <1>.
⇒ The images are suggestive of a BAD-type infarction, which can be broadly classified as a lacunar infarction.

(d) Identification of LSA occlusion using contrast-enhanced T1-weighted 3D-TOF MRA

Neurosurgery

Acute-stage cerebral infarction in the territory of the left lenticulostriate artery

Kyorin University Hospital, Tokyo, Japan
Sanae Takahashi

System used: Vantage Centurian

Reason for examination: A man in his 70s suddenly developed sensory aphasia. Emergency head MRI showed signs of an acute stroke in the region from the left basal ganglia to the corona radiata corresponding to the territory of the lenticulostriate artery (LSA). Detailed head MRI was then performed to investigate the cause of the stroke.

Clinical comments: Contrast-enhanced T1-weighted 3D-TOF MRA is a useful method for examining the LSA, even when the vessel is occluded. It is expected that this method will lead to higher diagnostic accuracy thanks to its

ability to depict occluded vessels, although further research involving larger numbers of patients is needed to assess its usefulness in visualizing various stages and types of cerebral infarction.

Technical comments: 3D-TOF MRA as employed in routine MRI examinations was modified in order to perform contrast-enhanced imaging. A phantom for improving T1 contrast was fabricated and used to develop a new sequence by determining the optimal flip angle without extending the scan time.

Comments on images: (a) An acute-phase cerebral infarction in the territory of the left LSA is seen in a man in his 70s who developed sudden sensory aphasia. 3D-TOF MRA images do not show occlusion or stenosis of the left MCA, and lacunar occlusions or branch atheromatous disease (BAD) is therefore suspected. (b) Cross-sectional vessel wall imaging of left M1 demonstrates the presence of plaque with strong contrast enhancement (which is considered to be active plaque) in the posterior wall of the proximal segment (arrow). (c) The left LSA arises from M1 distal to the segment containing active plaque (arrowhead) and divides

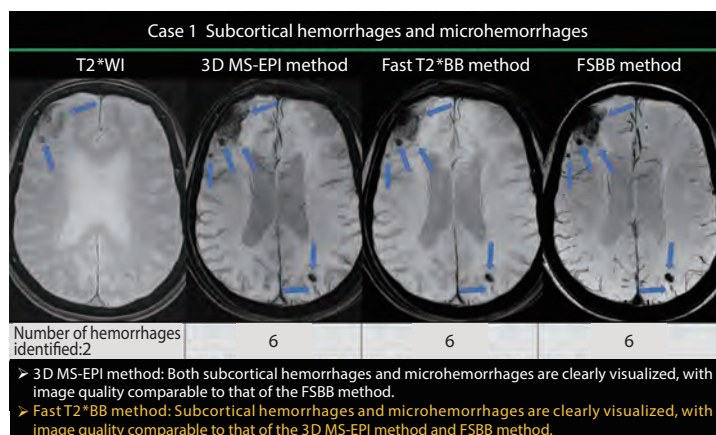
into two branches. The branch located on the inner side is occluded in the area of infarction observed in 3D-TOF MRA. T1-weighted 3D-TOF MRA shows multiple peripheral LSA branches in areas distal to the occluded segment, indicating spread of the area of infarction corresponding to the territories supplied by the occluded branches. (d) These images show diagrammatic representations of the occluded LSA running inside the area of infarction. A large infarction, as seen in BAD, is observed, but this patient is not thought to have BAD caused by active plaque in M1. Instead, an infarction caused by occlusion of a distal segment of the branch located on the inner side of the LSA is suspected. This type of infarction is broadly classified as a lacunar infarction, as is often seen in BAD.

Comments of judges: This method is highly evaluated because it has been carefully verified by conducting basic research and has already shown very promising results. The ability to identify the locations of occlusions is expected to lead to more accurate diagnosis and improved patient outcomes.

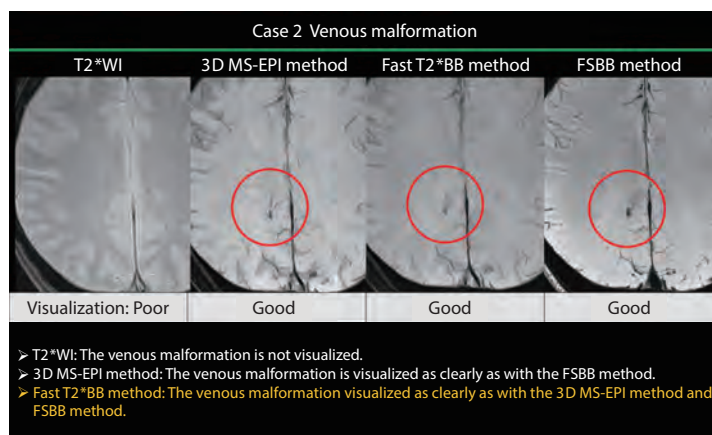
Sex	Age	Weight	Software version	Fasting	Contrast medium
Male	70+ years		V6.0		
Dose	Injection rate	Administration method	Workstation		

Acquisition conditions for (a)	DWI, TR: 4400, TE: 65, FA/Flop: 90/180, fat suppression: FatSAT, gating: none, b-factor: 1000, SPEEDER factor: 3, FOV / No Wrap: 22×22 / 1.0×1.0, matrix: 192×160, slice thickness / number of slices: 5 mm / 24, number of shots: 1, number of acquisitions: 4.0, AiCE: not used, scan time: 1:46
Acquisition conditions for (b)	3D T1 MPV, TR: 500, TE: 16.5, FA/Flop: 90/70, fat suppression: FatSAT, gating: none, FOV / No Wrap: 13×15.9 / 2, matrix: 114×176, slice thickness / number of slices: 0.9 mm / 80, number of shots: 6, number of acquisitions: 1, AiCE: not used, scan time: 5:42
Acquisition conditions for (c) and (d)	T1WI 3D-TOF MRA, TR: 21, TE: 3.4, FA: 25, fat suppression: none, gating: none, SPEEDER factor: 2, FOV / No Wrap: 20×20.3 / 1.0×1.0, matrix: 224×288, slice thickness / number of slices: 0.8 mm / 170, number of acquisitions: 1.0, AiCE: not used, scan time: 7:18
Coil used	32ch head SPEEDER

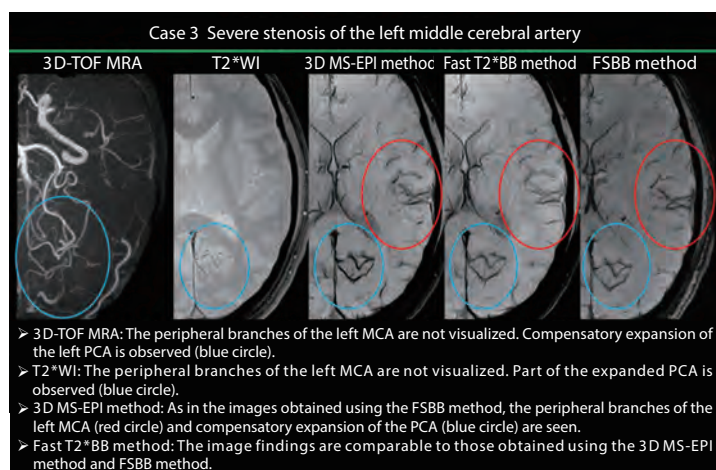
* Advanced intelligent Clear-IQ Engine (AiCE)



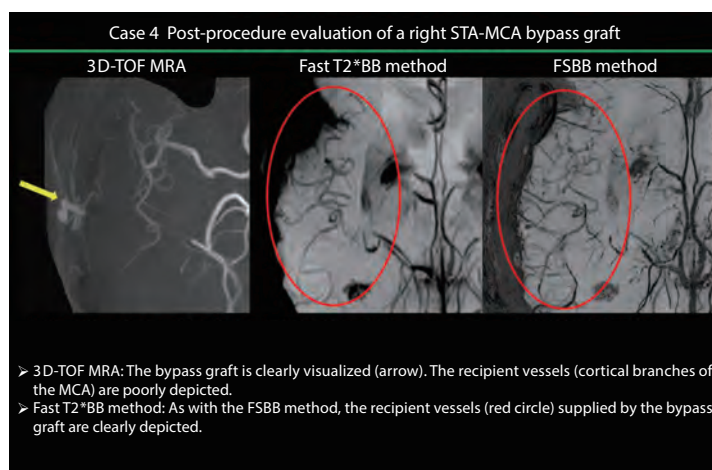
(a) Case 1 Subcortical hemorrhages and microhemorrhages



(b) Case 2 Venous malformation



(c) Case 3 Severe stenosis of the left middle cerebral artery



(d) Case 4 Post-procedure evaluation of a right STA-MCA bypass graft

Neurosurgery

Clinical usefulness of the Fast T2*BB method

Kyorin University Hospital, Tokyo, Japan
Kosuke Sakaguchi

System used: Vantage Centurian

Reason for examination: The flow sensitive black blood (FSBB) method is a scan sequence which is commonly used to visualize intracranial microhemorrhages and blood vessels, but in this case, a long scan time of 13 minutes and 37 seconds was required for a whole-brain examination. An FSBB-like sequence known as the FE-type multi-shot 3D EPI (3D MS-EPI) method, which was officially released in 2018, allowed a whole-brain examination to be performed in a scan time of only 2 minutes and 35 seconds. To achieve even shorter scan times in emergency examinations, the optimal scan conditions for the 3D MS-EPI method were investigated and the usefulness of the

method was validated.

Clinical comments: The use of 3D MS-EPI allowed a shorter scan time of only 2 minutes and 35 seconds for a whole-brain examination. It was confirmed that the microhemorrhages and blood vessels could be visualized as clearly as with the FSBB method. Moreover, visualization comparable to that of the FSBB method was also confirmed for the FAST T2*BB method. This method allows a whole-brain examination to be performed in only 52 seconds and is therefore considered to be extremely useful for examining emergency patients.

Technical comments: A volunteer was scanned using the FE-type 3D MS-EPI method, which is a scan sequence similar to the FSBB method, in order to determine the optimal FA and TE for achieving a high BB effect. It was confirmed that microhemorrhages could be visualized as clearly as with the FSBB method in actual clinical imaging. In addition, the new Fast T2*BB method was developed by changing the slice thickness of the 3D MS-EPI method, resulting in a high-speed scanning method allowing a whole-brain examination to be performed in only 52 seconds, and it was confirmed that microhemorrhages and

vessels could be visualized as clearly as with the FSBB method.

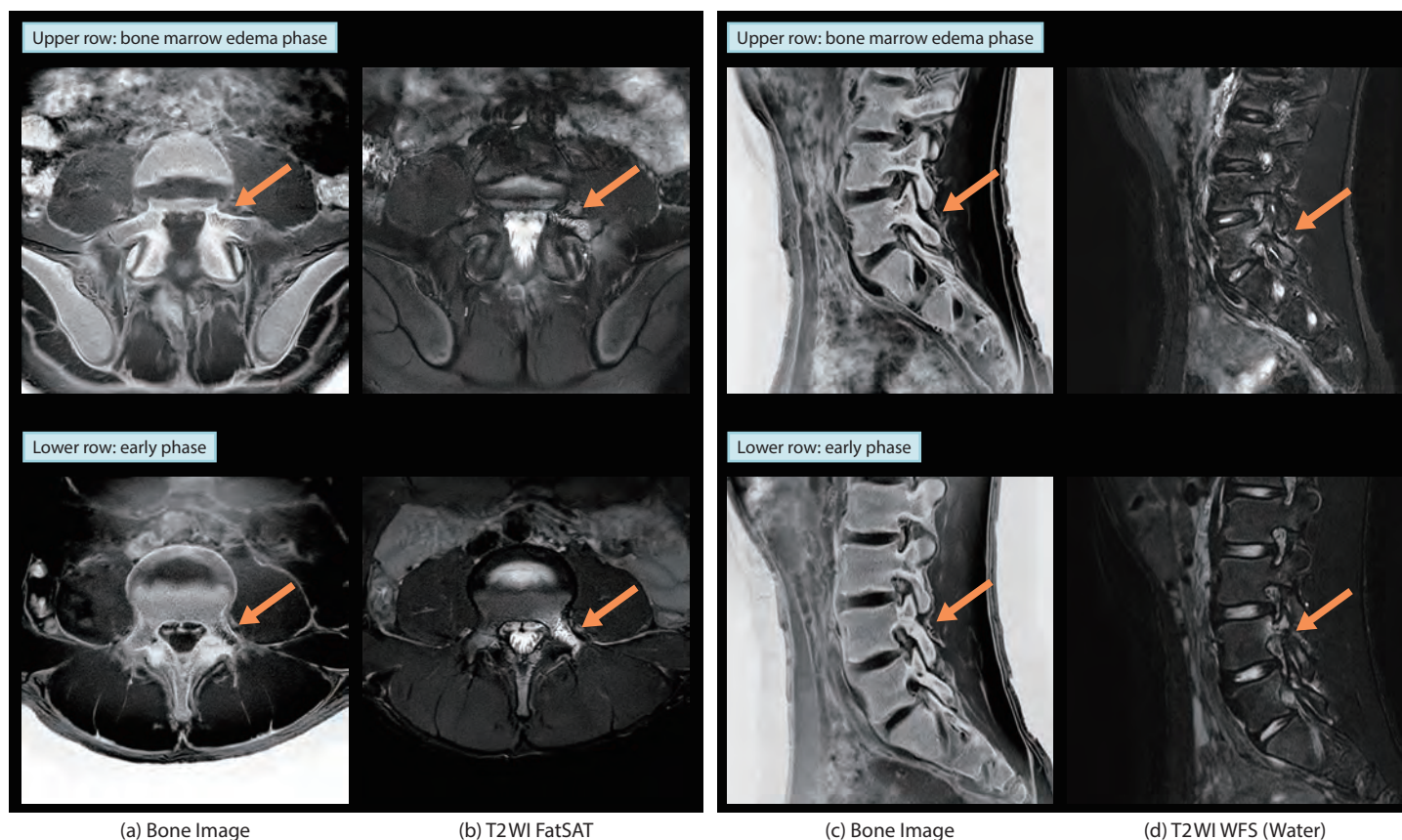
Comments on images: (a) It was confirmed that the Fast T2*BB method is able to detect subcortical hemorrhages and microhemorrhages as well as the 3D MS-EPI method or FSBB method. (b) It was also confirmed that the T2*BB method is able to depict fine venous malformations as clearly as the FSBB method or 3D MS-EPI method. (c) The T2*BB method was also found to provide image quality comparable to that of the FSBB method or 3D MS-EPI method for evaluation of the peripheral branches of the MCA and compensatory expansion of the PCA in a patient with severe stenosis of the MCA. (d) The recipient vessels, which were difficult to visualize in 3D-TOF MRA images, were clearly depicted using the Fast T2*BB method, with image quality comparable to that of the FSBB method.

Comments of judges: The use of multi-shot FEPI3D allows whole-brain examinations to be performed in a shorter scan time with excellent visualization of microhemorrhages and vascular structures.

Sex	Age	Weight	Software version	Fasting	Contrast medium
			V6.0		
Dose	Injection rate	Administration method	Workstation		

Acquisition conditions for (a), (b), and (c) (3D MS-EPI method)	FEPI3D, TR: 44, TE: 16, FA/Flop: 20/70, fat suppression: Standard, gating: none, SPEEDER factor: 2, FOV / No Wrap: 23×23 / 1.0×1.0, matrix: 320×256, slice thickness / number of slices: 1 mm / 160, number of shots: 18, number of acquisitions: 1.0, AiCE: not used, scan time: 2:35
Acquisition conditions for (a), (b), (c) and (d) (Fast T2*BB method)	FEPI3D, TR: 44, TE: 16, FA/Flop: 20/70, fat suppression: Standard, gating: none, SPEEDER factor: 2, FOV / No Wrap: 23×23 / 1.0×1.0, matrix: 320×256, slice thickness / number of slices: 2.8 mm / 55, number of shots: 18, number of acquisitions: 1.0, AiCE: not used, scan time: 0:52
Coil used	32ch head SPEEDER

* Advanced intelligent Clear-IQ Engine (AiCE)



Joint, bone, soft tissue

MR Bone Image of lumbar spondylolysis in a young patient

Tokuyama Medical Association Hospital, Yamaguchi, Japan
Yuta Kobayashi

System used: Vantage Galan 3T

Reason for examination: Detailed examination was performed to identify the cause of this patient's back pain, focusing on the differential diagnosis of lumbar disc herniation and spondylolysis.

Clinical comments: This is a patient with lumbar spondylolysis who was scanned in the bone marrow edema phase and in the early phase. In the bone marrow edema phase, although high signal intensity is noted in the T2WI FatSAT image, no fractures are observed in the MR Bone Image. In the early phase, extremely small fracture lines are visible in

the MR Bone Image. When this method is employed, both bone marrow edema and the bone itself can be evaluated by MRI alone, allowing early diagnosis, precise staging, and accurate treatment planning while avoiding the X-ray exposure associated with CT scanning.

Technical comments: The MR Bone Images were obtained by signal averaging and conversion of multiple TEs (2.4/4.8/7.2/9.6/12 ms) acquired with In Phase using FE2D, FE2D:M-echo. Because multiple TEs needed to be acquired in a short period of time, AiCE was used to compensate for the reduction in SNR. After image acquisition, SlabMIP images with a thickness of 1 mm were generated. Because image quality is adversely affected by motion of the abdomen and the iliopsoas muscle, an abdominal strap was used to minimize motion effects and thus ensure acceptable image quality while minimizing the burden on the patient.

Comments on images: (a), (b) Bone Images of a patient with lumbar spondylolysis (bone marrow edema phase and early phase). These images were obtained by signal-

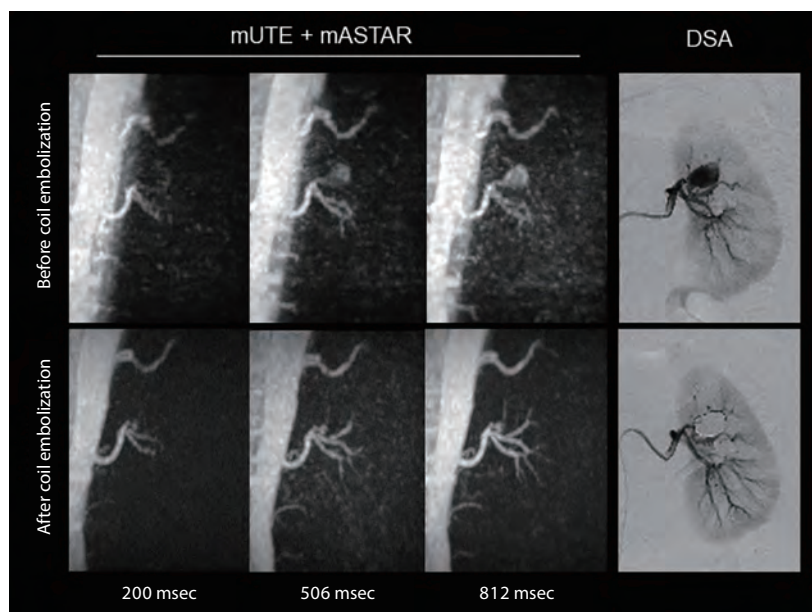
averaging and conversion of multiple TEs acquired with In Phase using FE2D, FE2D:M-echo. Because multiple TEs needed to be acquired in a short period of time, AiCE was used to compensate for the reduction in SNR. After image acquisition, SlabMIP images with a thickness of 1 mm were generated. (c), (d) In the bone marrow edema phase, although high signal intensity is observed in the T2WI WFS (Water) image, no fractures are seen in the MR Bone Image. In the early phase, extremely small fracture lines are visible in the MR Bone Image. Both bone marrow edema and the bone itself could be evaluated by MRI alone, allowing early diagnosis while avoiding the X-ray exposure associated with CT scanning.

Comments of judges: High-definition Bone Images with a high SNR could be obtained in a short scan time. The technique used in this patient is expected to be useful for the early diagnosis of lumbar spondylolysis in the bone marrow edema phase and in the early phase. A novel patient immobilization method using a custom-made abdominal strap was also employed in this case.

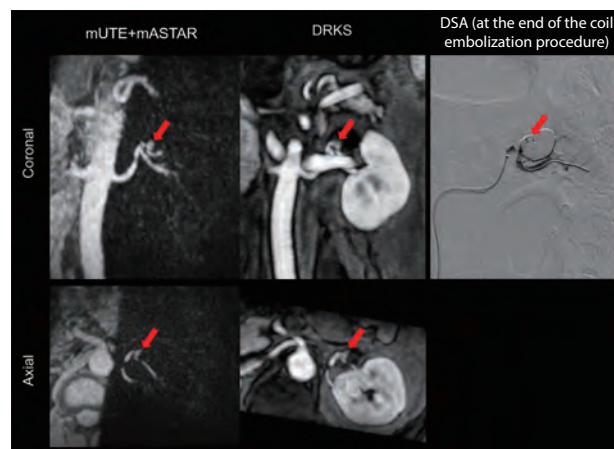
Sex	Age	Weight	Software version	Fasting	Contrast medium
Male	10-20 years	40-50 kg	V6.0	No	
Dose	Injection rate	Administration method	Workstation		

Acquisition conditions for (a)	FE2D, FE2D:M-Echo, TR: 400.8, TE FE2D: 2.4, M-Echo: 4.8/7.2/9.6/12, FA: 25, SPEEDER factor: 2.0, FOV / No Wrap: 16.5×16.5 / 1.8×1.0, PE matrix × RO matrix: 352×304, slice thickness / number of slices: 3.0 mm / 20 (MPR: 1 mm), number of acquisitions: 1.0, AiCE: used/d03e2.5, scan time: 6:27 (2:09×3)
Acquisition conditions for (b)	FSE2D+12:MPV_HL, TR: 4779, TE: 60, FA/Flop: 90/140, fat suppression: SPAIR, SPEEDER factor: 1.8, FOV / No Wrap: 16.5×16.5 / 1.8×1.0, PE matrix × RO matrix: 416×416, slice thickness / number of slices: 3.0 mm / 20, number of acquisitions: 1.0, AiCE: used/d03e1.7 scan time: 2:58
Acquisition conditions for (c)	FE2D, FE2D:M-Echo, TR: 400.8, TE FE2D: 2.4, M-Echo: 4.8/7.2/9.6/12, FA: 25, SPEEDER factor: 2.0, FOV / No Wrap: 28×28 / 1.7×1.0, PE matrix × RO matrix: 336×416, slice thickness / number of slices: 3.0 mm / 20 (MPR: 1 mm), number of acquisitions: 1.0, AiCE: used/d03e2.5, scan time: 5:48 (1:56×3)
Acquisition conditions for (d)	FSE2D+12:WFS:MPV_HL, TR: 4083, TE: 120, FA/Flop: 90/140, fat suppression: WFS, SPEEDER factor: 1.8, FOV / No Wrap: 28×28 / 1.7×1.0, PE matrix × RO matrix: 288×416, slice thickness / number of slices: 3.0 mm / 20, number of acquisitions: 1.0, AiCE: used/d03e1.3, scan time: 3:08
Coils used	16ch Flex SPEEDER L and 16ch Flex SPEEDER M

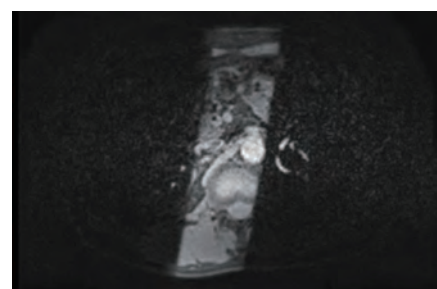
* Advanced intelligent Clear-IQ Engine (AiCE)



(a) Comparison of the renal artery before and after coil embolization



(b) Evaluation after coil embolization



(c) mUTE+mASTAR original image

Upper abdomen

Aneurysm of the left renal artery

Jichi Medical University Saitama Medical Center, Saitama, Japan
Yoshimasa Ikeda

System used: Vantage Titan 3T

Reason for examination: An aneurysm of the left renal artery was seen as an incidental finding in an abdominal ultrasound screening examination. MRA was used to evaluate the renal artery before and after coil embolization of the aneurysm.

Clinical comments: The combined use of mUTE* (to minimize loss of image quality due to metal artifacts) and mASTAR (to evaluate hemodynamics) is extremely useful for evaluation following coil embolization because it can detect the presence of residual blood flow. The fact that scanning can be performed using only respiratory gating with-

out the need for ECG gating is another advantage of this method in examinations of the trunk. Further improvements in SNR and image resolution are anticipated when it becomes possible to use DLR in combination, and it is expected that the range of applications of this method will continue to expand.

Technical comments: The mASTAR method (which permits dynamic evaluation) was selected for labeling, and the mUTE method (which minimizes the effects of susceptibility artifacts and reduces noise) was selected as the acquisition sequence. Because the blood flow velocity in the renal arteries is extremely high, scanning was performed in multiple time phases with the number of trajectories set to 9600 and the number of segments set to 100 to ensure a good balance between the TI step and the scan time. The SNR tends to increase when the respiratory cycle is longer due to greater longitudinal magnetization recovery, so scanning was performed using prerecorded breathing instruction voice messages from the console.

Comments on images: (a) Comparison of the renal artery before and after coil embolization. mUTE+mASTAR before embolization clearly shows the aneurysm in a superior

segmental branch. In addition, hemodynamic assessment can be performed using continuous images both before and after embolization, and these images show excellent agreement with the DSA images. (b) In an examination performed after coil embolization, patency of the mother vessel and residual blood flow in the neck of the aneurysm are demonstrated by mUTE+mASTAR (red arrow). These findings show good agreement with the DRKS and DSA images obtained immediately after embolization. (c) An original mUTE+mASTAR image acquired after coil embolization clearly depicts extremely small residual blood flow in the neck of aneurysm without susceptibility artifacts. A slice thickness of 2 mm / 1 mm allows observation from multiple directions in MPR and VR images.

Comments of judges: The advantages of mUTE and mASTAR were fully exploited in this case. When these sequences were used in combination in noncontrast 4D MRA, the status of the aneurysm before and after coil embolization could be clearly visualized because any adverse effects due to the presence of the coils were minimized, allowing the effectiveness of the embolization procedure to be accurately assessed.

Sex	Age	Weight	Software version	Fasting	Contrast medium
Male	60-70 years	60-70 kg	V4.0	Yes	Gadovist
Dose	Injection rate	Administration method		Workstation	
6.5 mL	2 mL/s	Using an injector, 6.5 mL of Gadovist was injected at a rate of 2 mL/s, followed by a 40-mL physiological saline solution flush also injected at 2 mL/s.		Ziostation2	

Acquisition conditions for (a), (b), and (c)	FFE3D:SILENT:ASTR2, TR: 3, TE: 0.1, FA: 5, TI: 200, 506, 812, fat suppression: none, gating: respiratory gating, SPEEDER factor: 1, FOV / No Wrap: 35×35 / 1.0×1.0, matrix: 256×256, slice thickness / number of slices: 2 mm / 80, number of segments: 100, number of acquisitions: 2.0, scan time: 13:14
Acquisition conditions for (b) (DRKS)	FFE3D:SKIP, TR: 3.6, TE: 1.3, FA: 10, fat suppression: none, gating: none, SPEEDER factor: 2.5, FOV / No Wrap: 38×28 / 1.0×1.0, matrix: 140×256, slice thickness / number of slices: 2.5 mm / 30, number of segments: 1, number of acquisitions: 1.0, scan time: 0:30
Coils used	Atlas SPEEDER Body and Atlas SPEEDER Spine

* mUTE: minimized acoustic noise utilizing UTE



Videos related to these images can be viewed by scanning the entire page using our medicalAR app.

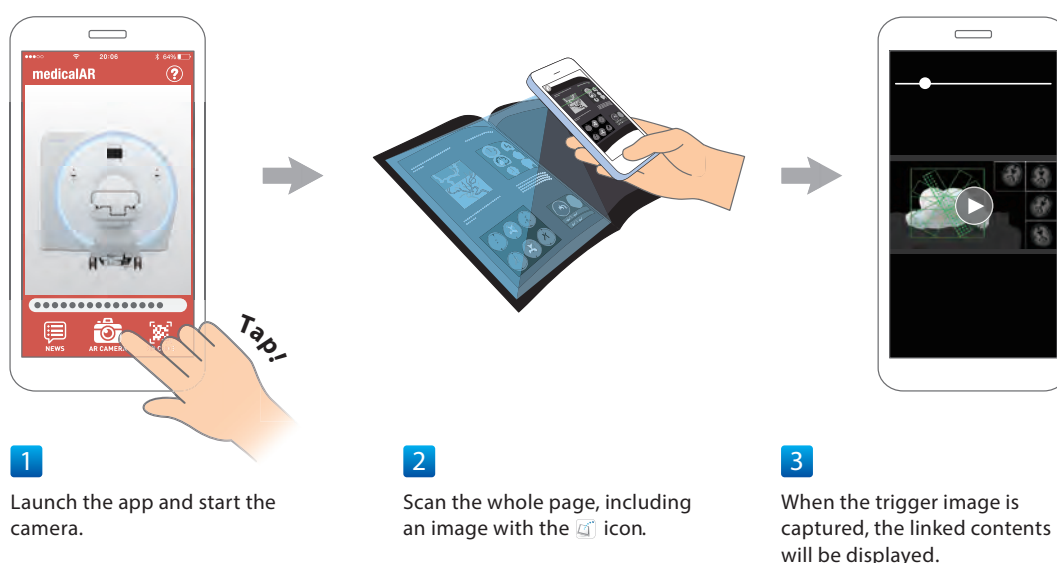
Memo

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