

3.0T

PROPELLER

1

1,3

2

:(pneumatization)가
periodically rotated
overlapping parallel lines with enhanced reconstruction (PROPELLER)
. 3.0T

PROPELLER

60 (58 , 30)
50% type - 1, 50%
type - 2
, type - 1, 2 10 (53) PROPELLER
3.0 tesla
가 가
: Type - 1 2 (6.7%) , 28
. Type - 2 27 (90%)
, 3 (chi - square test)
(artifact)
($p=0.000$). PROPELLER
type - 1,2 ($n=20$)
type - 1 ($n=10$)
, type - 2 ($n=10$)
: Type - 2 가
가 PROPELLER

(diffusion - weighted imaging: DWI)

artifact: MSA)

(EPI - DWI)

planar imaging: EPI) DWI (echo MSA

(magnetic susceptibi - lity

가

가
MSA가

1
2
3

2006 5 28

2006 7 8

: 3.0T PROPELLER

MSA MSA가

3.0 tesla (1, 2). MSA 가 가

가 가 (3). 3.0 tesla 58 30) 60 (

가 가 Jang (3) T2 가

(tuberculum sellae) (dorsum sellae)

가 type - 1,

periodically rotated overlapping parallel lines with
enhanced reconstruction (PROPELLER) DWI가 MSA type - 2 . Type - 1, 2 30

가 (4, , type - 1 57 17 ,

5). EPI - DWI type - 2 58 가 17 .

MSA EPI - DWI , type MSA

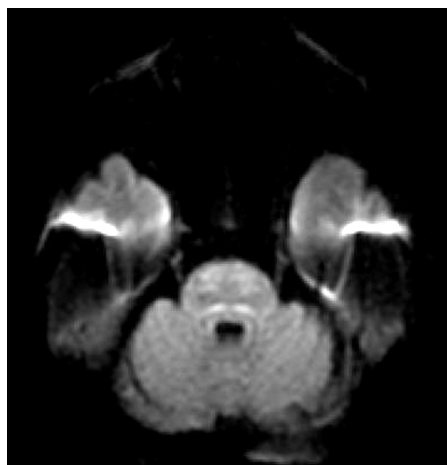
 , type - 1, 2 10

EPI - DWI PROPELLER - DWI MSA

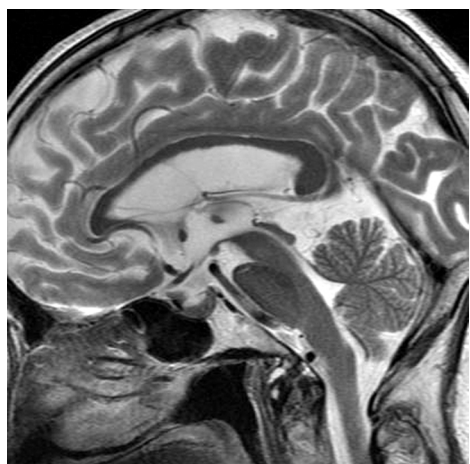
 가 . EPI - DWI



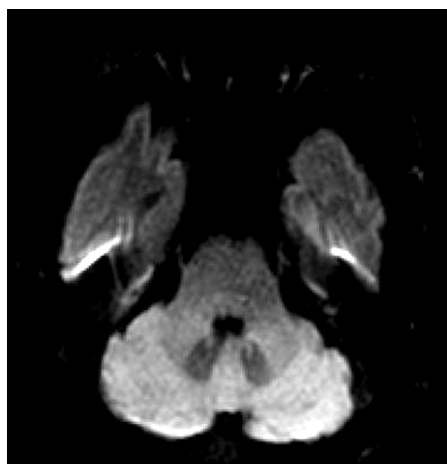
A



B



C



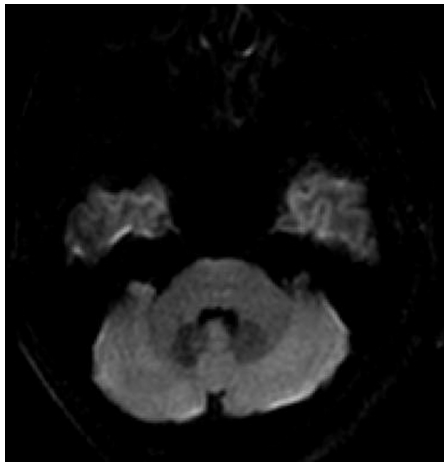
D

Fig. 1. Type-1 pneumatization of sphenoid sinus. Case 1; (A) midsagittal T2-weighted image shows less than 50% pneumatic sphenoid sinus, and (B) axial EPI diffusion-weighted image does not produce magnetic susceptibility artifact. Case 2; (C) midsagittal T2-weighted image also shows less than 50% pneumatic sphenoid sinus, but (D) axial EPI diffusion-weighted image appears mild anatomical distortion of basis pontis.

MSA PROPELLER - DWI
MSA 가
가 .
3.0 tesla (Signa VHi, GE Type - 1 2 (6.7%) MSA가
Medical system, MW, U.S.A.) , 28 (Fig. 1).
T2 TR 4000 msec, TE 106.2 msec, Type - 2 27 (90%) MSA가
5 mm, 23 cm , , 3 (Fig. 2). ,
PROPELLER 가 가 EPI - DWI
: , TR MSA (p < 0.001).
7000 msec, TE 74.5 msec, 5 mm, 24 PROPELLER - DWI
cm, NEX 2, 144 × 144, 56 ; PROPELLER type - 1,2 (n=20) MSA
, TR 3000 msec, TE 80 msec, 5 mm, , EPI - DWI type - 1 (n=10)
24 cm, NEX 4 , 256 × 144. 2 , type - 2 (n=10)
53 . (Fig. 3), PROPELLER - DWI가
EPI - DWI type - 1, 2 MSA EPI - DWI (p < 0.001).
Chi - square , SPSS
(version 11.0; SPSS Inc. Chicago, IL) .
PROPELLER (> 1.5 tesla)



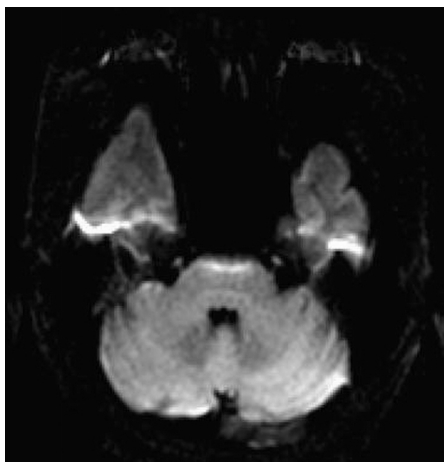
A



B

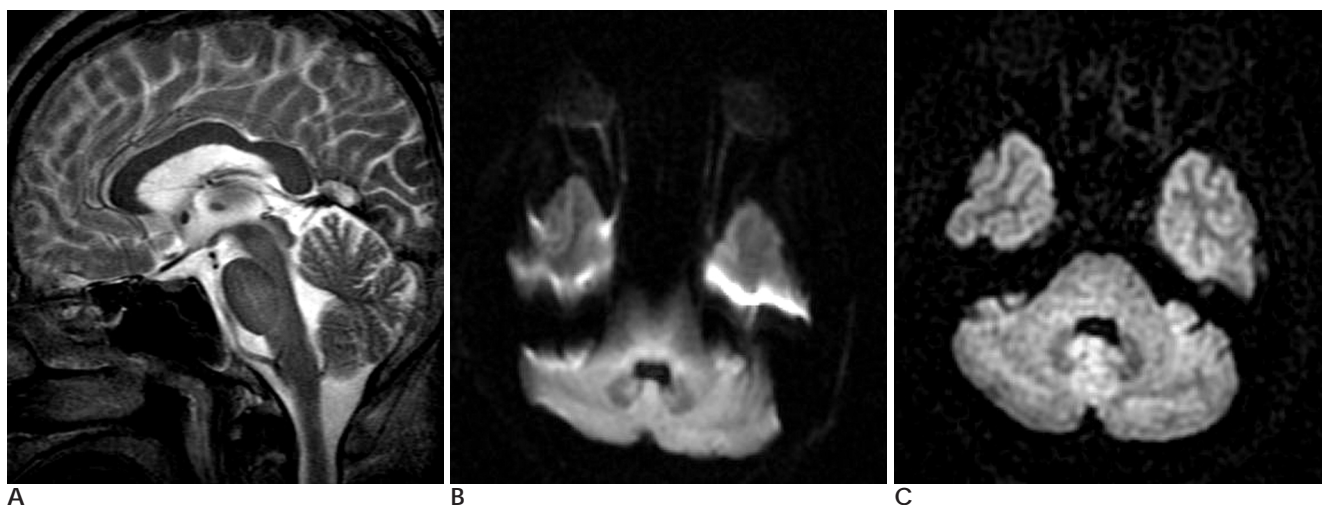


C



D

Fig. 2. Type-2 pneumatization of sphenoid sinus. Case 1; (A) midsagittal T2-weighted image shows more than 50% pneumatic sphenoid sinus, but (B) axial EPI diffusion-weighted image (DWI) does not make magnetic susceptibility artifact. Case 2; (C) midsagittal T2-weighted image shows fully pneumatization of sphenoid bone, and (D) axial EPI DWI shows high signal intensity susceptibility artifact at the anterior portion of basis pontis.



A **B** **C**

Fig. 3. Midsagittal T2-weighted image (**A**) shows type-2 pneumatic sphenoid sinus. Echo planar imaging diffusion weighted image (**B**) shows severe anatomical distortion of pons due to magnetic susceptibility artifact, but fast spin-echo periodically rotated overlapping parallel lines with enhanced reconstruction (PROPELLER) image clearly cancels the artifact.

The diagram illustrates the PROPELLER MRI sequence architecture. It shows the spatial encoding process in k-space, where multiple excitations (type 1, 2, 3) are used to fill k-space. The resulting 360-degree coverage is shown in the k-space diagram. The diagram also shows the relationship between the spatial encoding and the MSA (Multi-Slice Acquisition) process, which is used to acquire multiple slices simultaneously. The final output is a 3D volume with 180 slices.

1.5 tesla

가

가

, PROPELLER

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PROPELLER (periodically rotated overlapping parallel lines with enhanced reconstruction) and EPI Diffusion-weighted MR Imaging at 3.0 T: Pontine Magnetic Susceptibility Artifacts Depend on Pneumatization of the Sphenoid Sinus¹

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Purpose: In the case of well pneumatized sphenoid sinus, magnetic susceptibility artifact can be visualized at the brainstem and especially at the pons on echo-planar imaging (EPI) diffusion-weighted imaging. Fast spin-echo periodically rotated overlapping parallel lines with enhanced reconstruction (PROPELLER) is a novel imaging method that can reduce these artifacts. In 3.0T MR, we first evaluate the degree of the relationship of pneumatization of the sphenoid sinus with the occurrence of magnetic susceptibility artifacts (MSA) on the echo planar imaging (EPI) diffusion-weighted imaging (DWI), and we evaluated using PROPELLER-DWI for cancellation of MSAs of the pons in the patients who had MSAs on the EPI-DWI.

Materials and Methods: Sixty subjects (mean age: 58 years old and there were 30 men) who were classified according to the two types of sphenoid sinus underwent EPI-DWI. The two types of sphenoid sinus were classified by the degree of pneumatization on the sagittal T2-weighted image. The type-1 sphenoid sinus was 0% to less than 50% aeration of the bony sellar floor, and type-2 was 50% or more aeration of the bony sellar floor. Each of 10 subjects (n = 20/60, mean age: 53) of the two types had PROPELLER and EPI-DWI performed simultaneously. We first evaluated the absence or presence of MSAs at the pons in the two types, and we compared EPI and PROPELLER-DWI in the subjects who underwent the two MR sequences simultaneously. We used 3.0T MR (Signa VHi, GE, MW, U.S.A.) with a standard head coil. All the MR images were interpreted by one neuroradiologist.

Results: For the type-1, two (6.7%) cases had MSAs and 28 (93.7%) cases did not have MSAs on the EPI-DWI. For the type-2, twenty-seven (90%) cases had MSAs and 3 (10%) cases did not have MSAs on the EPI-DWI. The degree of pneumatization of the sphenoid sinus was related with the occurrence of MSAs of the pons, according to the chi-square test ($p=0.000$). All twenty cases who had PROPELLER-DWI performed had no MSAs at the pons regardless of the type of sphenoid sinus. But all ten cases of type-2 produced MSAs on the EPI-DWIs.

Conclusion: For EPI-DWI, a well aerated sphenoid sinus can induce MSAs at the pons, and we should recognize this phenomenon to differentiate it from true infarcted lesion. PROPELLER DWI can be an optional tool to use for canceling this artifact.

Index words : Brain, MR

Magnetic resonance (MR), artifact

Magnetic resonance (MR), diffusion study

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