Feasibility of High Resolution Diffusion-weighted MR Neurography for Spinal Nerves.

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Background and Purpose

Conventionally, combing heavily T2 weighting spin echo with fat suppression MR imaging can delineate the proximal roots of spinal nerves and ganglions. It was called MR neurography[1-3]. Recent advances in MR gradient technology allow acquisition of high-quality diffusion-weighted images and easy application for body imaging. In our clinical experiences of those imaging methods we had realized spinal roots were clearly visualized on axial images in many cases. So we tried to make three-dimensional reconstruction images of them. Amazingly, on those images the spinal nerves and plexus were continuously visualized clearly.

The purpose of this study was to determine the feasibility of high resolution diffusion-weighted MR images and 3D display in visualization of the spinal nerves and plexus (Diffusion-weighted MR Neurography; DW-MRN).

Methods

Five healthy volunteers were imaged using a single shot spin echo diffusion-weighted echo-planar sequence (TR/TE=5786/68ms, EPI factor=47, SENSE factor=2, b=600s/mm^2, Half scan factor=60%, Fat suppression (SPIR)) on 1.5T MR scanner (Gyroscan Intera, Philips Medical Systems, Best, Netherlands, 30mT/m-gradients, slew rate=150T/m/s) with synergy body coils. 2D axial images of the cervical and lumbar spine were obtained during no breath-holding with the following imaging parameters: 80slices, FOV=350mm, RFOV=70%, Matrix=160*256, thickness=4mm, gap=-1mm, NSA=6. Selective maximum intensity projection (MIP) was performed using a black & white inverse gray scale. Two radiologists (T.Y. and T.T.) reviewed the images jointly, and data were agreed on by consensus. We evaluated degree of visualization of spinal roots, ganglions, plexus, and peripheral nerves on the MIP images, and calculated apparent diffusion coefficient (ADC) for the ganglions of L5 and S1.

Results

All MR images were considered technically adequate, and no obtained data were excluded from this study. Table 1 shows the numbers of visualized nerve roots, ganglions, plexus, and major peripheral nerves (i.e. the femoral and sciatic nerves) on the MIP images. Most of the ganglions and nerves were visualized clearly on MR images. Value of ADC ranged from 1.14±0.07 to 1.72±0.09 *10^{-3} mm^2/s.

Conclusion

High resolution diffusion-weighted MR imaging and its 3D display can be considered as an acceptable way for imaging of spinal nerves.

References

1)Howe F.A.*Magn.Reson.Med.*28,328,1992.
2)Filler A.G. et al, *Lancet*, 341,659,1993.
3)Dailey A.T. et al, *Lancet*, 350, 1221, 1997.

	No. of Visualized Ganglions / Total	No. of Visualized Proximal Nerves / Total
C1	0/8	0/8
C2	6/8	0/8
C3	10/10	0/10
C4	10/10	4/10
C5	10/10	10/10
C6	10/10	10/10
C7	10/10	10/10
C8	10/10	6/10
Th1	9/10	4/10
L1	10/10	0/10
L2	10/10	7/10
L3	10/10	10/10
L4	10/10	10/10
L5	10/10	10/10
S1	10/10	10/10

		No. of Visualized Nerves / Total
Brachial Plexus	Supraclavicular	10/10
	Infraclavicular	6/10
Lumbar Plexus	L1	0/10
	L2	7/10
	L3	10/10
	L4	9/10
Femoral Nerve		10/10
Sacral Plexus	L4	8/10
	L5	10/10
	S1	10/10
Sciatic Nerve		10/10

Table 1. Numbers of visualized ganglions, proximal nerves, plexus, and peripheral nerves on DW-MRN.

Figures are DW-MRN of the cervical (right) and lumber (left) spine.