UTILITY OF HIGH-RESOLUTION READOUT-SEGMENTED DIFFUSION WEIGHTED IMAGING OF THE PAROTID GLAND

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Background and Purpose

Diffusion-weighted imaging (DWI) of the parotid gland has been widely used for clinical application and been considered to be useful in estimating tumor characteristics or salivary gland function[1,2]. However, image quality of DWI of the head and neck region is sometimes unsatisfactory because of severe susceptibility artifacts or image distortion. Read-out segmented echo-planar imaging (RS-EPI) combined with 2D-navigator-based reacquision has been recently established with high resolution with distortion-free, reduced susceptibility artifact and blurring from T2* signal decay compared to conventional single-shot EPI (SS-EPI)[3]. In previous papers, RS-EPI DWI in the central neural system could successfully improve image quality and reduce susceptibility artifacts[3]. The purpose of our study is to evaluate the feasibility and utility of this newly developed RS-EPI DWI of the parotid gland compared with conventional SS-EPI DWI.

Background and Purpose

Both RS-EPI and SS-EPI DWI of the parotid glands were acquired in coronal orientation for 25 patients (for evaluation of clinically suspicious parotid tumor (n=14) or swelling (n=4), follow up study of unilateral parotid gland resection (n=7)), using a 3T MR scanner (MAGNETOM, Trio, A Tim System, Siemens Healthcare, Erlangen, Germany) with a 32-channel head coil. Scan parameters for RS-EPI DWI were: field-of-view (FOV) 180mm, matrix 160x160, resolution 1.2x1.2x4.0mm, number of slices 24, TR 4000msec, TE 54msec, Readout segment 16, scanned time 5min 58sec. Resolution and number of slices were same for SS-EPI DWI. Other parameters for SS-EPI DWI were: TR 4000msec, TE 92msec, parallel imaging factor 3, and scanned time 3min 2sec. Motion-probing gradient (MPG) were applied in orthogonal 3 directions with $b=600s/mm^2$ and $b=0$ s/mm^2 . As an anatomical reference, T2-weighted MR images with same slice thickness and number of slices were also acquired. Obtained images were evaluated using a five-point scale (1; not assessable -5; excellent) by two independent radiologists as to (1) delineation of the contour and (2) conspicuity of the internal structure of the parotid gland. Severity of the artifact was also assessed using a five-point scale (1: minimum or nothing - 5: unacceptable). Discrepancy was solved by consensus.

Results

In all cases, RS-EPI DWI showed clearer delineation of the parotid gland (average of the grading: 1.88 (SS-EPI DWI) vs. 3.56 (RS-EPI DWI)). In 23 of 25 cases (92%), RS-EPI DWI also demonstrated internal structure of the parotid gland more conspicuously (averaged grading: 1.60 (SS-EPI DWI) vs. 3.20 (RS-EPI DWI)). Artifact of the SS-EPI DWI was severer than that of RS-EPI DWI (averaged grading: 3.80 (SS-EPI DWI) vs. 2.48 (RS-EPI DWI)) in 24 of 25 cases (96%).

Discussion

It is sometimes difficult to make a precise evaluation of head and neck diseases using the conventional SS-EPI DWI, because of unavoidable image distortion or susceptibility artifact. In our study, RS-EPI DWI could reduce image distortion or susceptibility artifact and provide better delineation and visualization of internal structure of the parotid gland. Although further improvement might be necessary to shorten the scan time, this newly-developed RS-EPI MRI could be a promising tool to visualize and evaluate the head & neck organs.
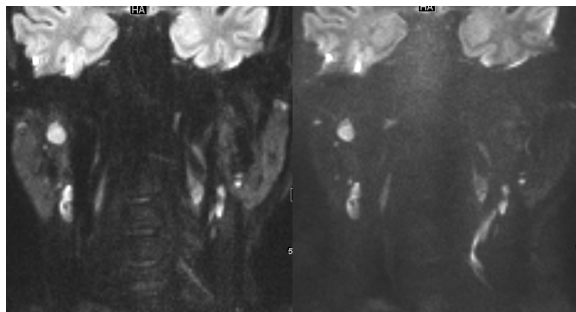

Figure: RS-EPI DWI (left) clearly demonstrated both parotid glands, whereas SS-EPI DWI (right) deteriorated visualization of the glands. Furthermore, artifact and image distortion of SS-EPI DWI was severer than that of RS-EPI DWI. Note that right parotid tumors could be also depicted.
Delineation of the contour and conspicuity of the internal structure of the parotid gland was ranked as 4/2 and 3/1 (RS-EPI DWI/SS-EPI DWI), respectively. Severity of the artifact was ranked as 3/4 (RS-EPI DWI/SS-EPI DWI)

Discussion

1. Kato H et al. J Magn Reson Imaging 2011; 34(4): 904-9.
2. Yabuuchi H et al. Radiology. 2008;249(3):909-16.
3. Porter DA et al. MRM 2010: 64; 9-14