The Initial Clinical Application of Arterial Spin Labeling Perfusion MRI in Prostate Cancer

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Introduction
Pulsed arterial spin labeling (PASL) MRI is a non-invasive imaging tool capable of quantitatively measuring the microvascular perfusion characteristics of tissue through tagging arterial water to obtain the blood flow (BF) map [1,2]. The PASL method has been proved to be effective and repeatable in many studies about cerebral diseases [2-4]. But the inversion time is an important influence factor for the absolutely quantitative interpretation [5,6]. Prostate cancer is a hypervascular tumor certified by dynamic contrast-enhanced (DCE) MRI and histopathologic findings [7,8]. Therefore, in this study we applied the PASL technique to detect the prostate cancer and to compare the differences blood flow values between the malignant and normal prostate peripheral zones.

Methods
The local ethics committee approved the study and six patients (mean 78±3 years; range 74-82 years) with pathologically confirmed prostate cancer were recruited. All patients had elevated serum prostate-specific antigen (PSA) level (mean 117.9±106.8 ng/mL, range 11.41-294.8 ng/mL).

The PASL pulse sequence was performed on a clinical 3.0T MR scanner (Signa HD; GE Healthcare, Milwaukee, Wisconsin). The PASL protocol was performed with single shot fast spin echo (SSFSE) sequence (TI 1000/1200/1400/1600 msec; TR 3500 ms; TRM 6000 ms; phases 8). The regions of interest (ROIs) were placed in the cancerous and noncancerous prostate peripheral zone, and the average BF in these regions for each patient was computed respectively.

Results
The mean BFs determined by PASL MRI with different TI in the prostate cancer were significantly higher than those in noncancerous regions (P < 0.05, Paired T-test) (Table 1, Figure 1).

<table>
<thead>
<tr>
<th>TI (msec)</th>
<th>Cancer BF (ml/100g/min)</th>
<th>Non-cancer BF (ml/100g/min)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>106.4±30.96</td>
<td>37.43±8.53</td>
<td>.0045</td>
</tr>
<tr>
<td>1200</td>
<td>111.1±34.30</td>
<td>38.19±9.99</td>
<td>.0023</td>
</tr>
<tr>
<td>1400</td>
<td>102.9±30.55</td>
<td>32.40±8.96</td>
<td>.0027</td>
</tr>
<tr>
<td>1600</td>
<td>105.3±31.64</td>
<td>43.05±8.70</td>
<td>.0024</td>
</tr>
</tbody>
</table>

Table 1. Results of comparison of perfusion parameter (BF) between cancerous and noncancerous peripheral zone of prostate.

Discussion
This study demonstrates that PASL sequence can be used to evaluate the difference of BF value between cancer and noncancerous tissue in prostate. The higher BF in the cancerous region indicates hypervascular property of the prostate carcinoma, which is consistent with previous findings based on the pathology and DCE-MRI. It is a new imaging method with potency in detecting, staging and monitoring therapy efficacy of prostate cancer.

References