Age-related Changes of Prostatic Tissues in Healthy Adults Measured by Kinetic Parameters from DCE MRI

Wenchao Cai[1], Feiyu Li[1], Yi Dang[2], Jue Zhang[2,3], Xiaoying Wang[1,2], and Xuexiang Jiang[1]

[1]Radiology, Peking University First Hospital, Beijing, Beijing, China, People's Republic of, [2]Academy for Advanced Interdisciplinary Studies, Peking University, Beijing, Beijing, China, People's Republic of, [3]College of Engineering, Peking University, Beijing, Beijing, China, People's Republic of

Introduction

Dynamic contrast-enhanced MRI (DCE-MRI) kinetic perfusion parameters such as K^{trans}(volume transfer coefficient), K_{ep}(rate contrast) and V_e(extravascular extracellular volume fraction) which represent angiogenesis properties have been shown to be useful in identifying prostate cancer compared to normal glandular tissue[1-3].Many studies showed that growth rate, prostate size, MR signal intensity,apparent diffusion coefficient values, cirtrate concentration and DNA methylation et al of the normal prostate tissue changes along with age grows[4-6]. Therefore,the purpose of this study is to identify age-related changes and differences in the kinetic parameters obtained from DCE-MRI within the prostate gland in heathy adult men.

Methods

This study was approved by the local institutional human ethics board, and informed consents were all acquired. A total of 68 heathy male volunteers were recruited into the study. The patients were divided into three age groups(10~30years,31~50years and >50years).All subjects displayed normal-appearing MR imagings,and had no symptoms or history of prostatic disease.They came to undergo the pelvic MR examination for rectal cancer or diseases of seminal vesicle or hip joints.The MR examinations were performed on a clinical 3.0 T MR scanner. The DCE-MRI used a 3-D spoiled gradient echo pulse sequence with a flip angle of 15°, 15 dynamic timepoints and a temporal resolution of 12s. On the second dynamic timepoint, 0.1 mmol/kg of body weight of 0.5 mmol/ml Omniscan (GE Healthcare) was administered through a Spectris power injector (Medrad Inc.) at a rate of 3 ml/. Post-procession of DCE-MRI data was conducted in the Matlab to obtain the K^{trans},V_{ep} and V_e Maps.Regions of interest (ROI) analysis:Six ROIs were placed in the peripheral zone(PZ)according to the sextant .Then the mean K^{trans},K_{ep} ,V_e was computed respectively by person.

Results

The Variance(ANOVA) analysis identified significant differences of K^{trans} , K_{ep} among the three age groups within the PZ (all P<0.05)(Table 1 and Fig 1),While V_e showed no statistically significant difference.

Age Group (years)	N	PZ		
		K^{trans}(min^{-1})	K_{ep}(min^{-1})	V_e
10-30	14	0.036±0.022	0.071±0.034	0.49±0.12
31-50	19	0.022±0.016	0.052±0.053	0.49±0.33
>50	35	0.012±0.007	0.025±0.013	0.47±0.12
AVONA	68	F=15.36,P<0.001	F=10.65,P<0.001	F=0.107,P=0.899

Table 1. The Variance(ANOVA) analysis of K^{trans} , K_{ep}, V_e among the three age groups within the peripheral zone(PZ).

Discussion

Our results shows that there is a decrease trend of K^{trans} and K_{ep} along with age increases within the prostate PZ of healthy adults.The reason maybe that the gland atropy and vessel function decrease in PZ as the individual ages,.Therefore we should take the age-related changes into consideration when using the kinetic parameters to make diagnosis of prostate diseases.
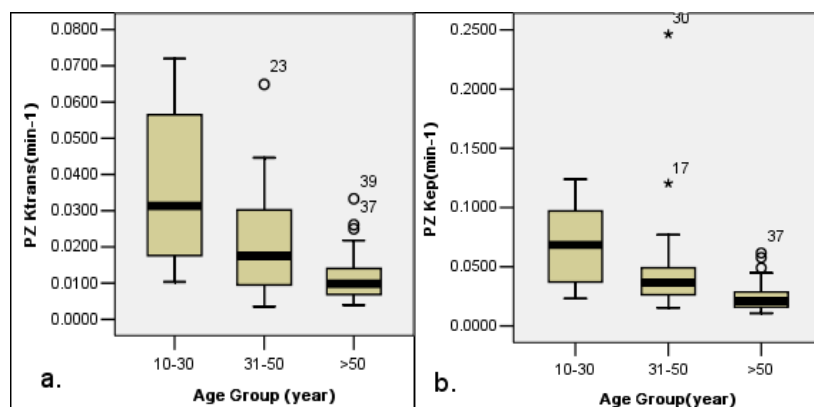

Figure 1.Boxplots of K^{trans} , K_{ep} values shows that the kinetic parameters in the peripheral zone(PZ) decrease along with age increases. (a.) K^{trans} (b.) K_{ep} .

References

1-Tofts P . JMRI.1997;91-101;

2-Kozlowski P et al.JMRI 2006;108-113;

3-Langer et al.Radiology 2010;385-494;

4-Kenneth SA et al.AJR1988;77-81;

5-Tsutomu et al.JMRI2008;552-556;

6-Martin L et al.MRM 1996;352-358.