

# Study of chronological effects of iodinated contrast medium on intrarenal water molecular diffusion by diffusion-weighted MR imaging

Jia Liu<sup>1</sup>, Kai Zhao<sup>1</sup>, and Xiaoying Wang<sup>1</sup>

<sup>1</sup>Peking University First Hospital, Beijing, Beijing, China

## Target audience

Radiologist and Nephrologist who focus on the functional MR imaging of kidney

## Purpose

To study the chronological effects of iodinated contrast medium on intrarenal water molecular diffusion by diffusion-weighted MR imaging (DW-MRI).

## Methods

17 healthy New Zealand white rabbits were studied with 3 types of treatment: 1) Iopamidol-370 group, 6 rabbits received iopamidol (370mg/ml) of 5ml/kg body mass intravenously. 2) Iodixanol-320 group, 6 rabbits received iodixanol (320mg/ml) of 5.8ml/kg body mass, keeping the total iodine equal to the previous group. 3) Control group, 5 rabbits received 0.9% normal saline of 5.8ml/kg body mass. For all the 17 rabbits, a serial study of diffusion-weighted imaging (DWI) was performed at 3 time points: 24h before the i.v. injection, and 1h, 24h after the injection. The apparent diffusion coefficient (ADC) value was obtained in cortex (CO), outer stripe of the outer medulla (OS) and the inner stripe of the outer medulla (IS) in left kidney. Repeated measures analysis of variance (ANOVA) test was performed to test the difference of ADCs among each time course within each group and one-way ANOVA test was performed to test the response among the three groups in each time course.

## Results

There was no statistically significant difference of ADCs in CO, OS and IS among the 3 groups at baseline (n=6,5,5,  $p>0.05$ ). Iopamidol (370mg/ml) induced obvious decrease in ADCs in CO and OS at 1h and a little further decrease at 24h ( $p=0.039$  in CO,  $p=0.029$  in OS). The decreased tendency of ADCs was observed in IS at 1h and 24h after iopamidol (370mg/ml) administration with no statistical difference ( $p=0.057$ ). No significant ADCs changes were observed in each renal region at 1h and 24h after iodixanol (320mg/ml) and normal saline injection ( $p>0.05$ ). However, among the three groups, there was no significant ADCs difference after administration ( $p>0.05$ ).

## Discussion

Usage of iodinated contrast medium during radiological procedure may cause contrast induced nephropathy (CIN)<sup>1</sup>. A previous study of 5-day sequential observation demonstrated a persistent 72h reduction in renal water transport function due to iodinated contrast medium administration<sup>2</sup>, whose results were similar to ours. Our study demonstrated that it is feasible to monitor the time course effects on renal function after different iodinated contrast medium administration in rabbit models using DW-MRI. ADCs decline in iopamidol-370 group may be caused by early sustained vasoconstriction and delayed limitation of water molecular diffusion<sup>3</sup>. Furthermore our study showed iopamidol (370mg/ml) caused more damage on renal function than iodixanol (320mg/ml) at 1-24h after injection. Although iopamidol (370mg/ml) is categorized into a sub-high-osmolality agent, its osmolality is still much higher than that of blood plasma, meanwhile the osmolality of iodixanol (320mg/ml) with higher viscosity is the same as blood plasma and it has fair tolerance for patients. High osmolality contrast medium induces vascular biphasic reaction and osmotic diuresis activating vasoconstrictors release, which aggravates blood flow decrease and renal medulla anoxia<sup>4</sup>. High viscosity contrast medium causes red cells stasis in blood vessels to diminish renal blood flow and oxygen supply, and meanwhile blocks the renal tubules to deteriorate renal filtration function<sup>5</sup>.

## Conclusion

Our time course study indicates that DW-MRI is a preeminent noninvasive method for quantitative evaluation of renal function in contrast-associated rabbit kidney models. Iopamidol (370mg/ml) causes more deterioration on intrarenal water transport function than iodixanol (320mg/ml). This may be helpful to understand the pathogenesis associated with CIN. We introduce a clinical clue to choose better contrast medium to prevent the incidence of CIN.

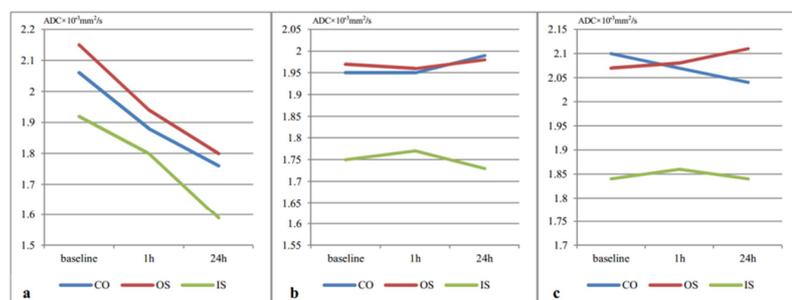


Figure1:  
(a) Serial ADCs changes in rabbit kidneys in response to iopamidol (370mg/ml) injection.  
(b) Serial ADCs changes in rabbit kidneys in response to iodixanol (320mg/ml) injection.  
(c) Serial ADCs changes in rabbit kidneys in response to 0.9% normal saline

## Reference

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