

# Iopamidol CEST for pH mapping on a 7T scanner: phantom and normal mice kidneys in vivo study

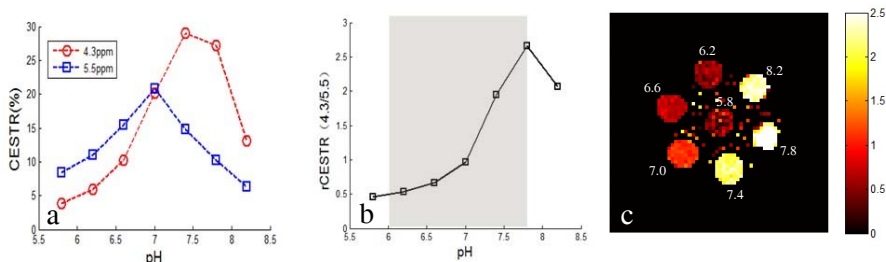
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**Purpose:** Human tissue lesions are often associated with cell internal and external disturbance of pH, and most of them showed the pHe value decreased.<sup>2</sup> Therefore the determination of pHe in the tissue will have certain value for early diagnosis and identify of diseases. Up to now, the Iopamidol as a CEST imaging contrast agents have been reported.<sup>1-3</sup> The aim of this study was to measure pH in vitro and in normal mice kidneys with Iopamidol use a new method and more simple ratiometric method on a 7T scanner<sup>3</sup>.

**Methods:** In vitro: A phantom was used with 7 tubes filled with a 50 mM Iopamidol solution with pH values in the range of 5.8 to 8.2 with an interval of 0.4. In vivo: Mice were anesthetised by injecting chloral hydrate solution (Southern Medical University, GuangZhou, China) 3g/kg and placed in a body coil. Iopamidol (corresponding to 0.75 mg I/g body weight) was slowly injected into the tail vein before scanning. Both the in vitro and in vivo experiments were performed on Agilent 7T scanner. The chemical exchange saturation transfer parameters were:

B1 (continuous-wave) = 2.5  $\mu$ T, pulse duration = 5s, TR = 6000ms, TE = 30ms, matrix = 64\*64, average = 4 slice thick = 3mm. The CEST curves were determined and the saturation transfer of both Iopamidol peaks at 4.3 ppm and 5.5 ppm were calculated. All the images were processed with MATLAB (The Mathworks, Inc., Natick, MA, USA) software and acquired pH weighted image.



**Fig.1.** Iopamidol ratiometric pH MRI; a) CEST ratio (CESTR) calculated from the asymmetry analysis as a function of pH. b) Ratiometric CEST analysis is sensitive to pH ranging from 6 to 7.8. c) Ratiometric pH map.

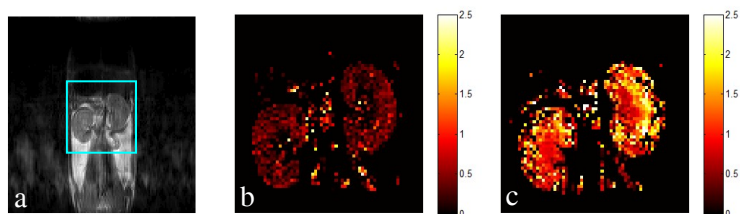
**Results:** Fig. 1a shows CEST asymmetry ratio (CESTR) computed at 5.5 (squares) and 4.3 ppm (circles). While CEST effect initially increased with pH, CESTR at 5.5 ppm peaked at pH of 7 and CESTR at 4.3 ppm peaked at pH of 7.5. Fig. 1b shows that the rCESTR increases from  $0.6 \pm 0.1$  to  $2.6 \pm 0.1$  for pH at 6 and 7.8, respectively. Fig. 1c shows the ratiometric pH map, which displaying better pH contrast between 6 and 7.8. Fig. 2 shows the ratiometric pH map before and after Iopamidol injected respectively (b-c). There is very little difference in kidney signal intensity before Iopamidol injected (b). After injection of Iopamidol, the renal medulla showed obvious difference signal with cortex, which is significantly higher than medulla (c).

**Discussion:** The in vitro results show that a pH measure with Iopamidol in the scope of 6.0 to 7.8 is credible. The kidney of rats experiments support this result.

**Conclusion:** This experiments proved that pH mapping can be achieved based on Iopamidol. This technology may provide complementary information to conventional imaging. Further studies are required to determine the potential diagnostic value of this technique.

## References:

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2. Longo DL, Dastrù W, Digilio G, et al. Iopamidol as a responsive MRI-chemical exchange saturation transfer contrast agent for pH mapping of kidneys: In vivo studies in mice at 7 T. *Magn Reson Med*. 2011;65(1):202-211.
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**Fig.2.** Iopamidol CEST for pH mapping; a) T2w image. b) Ratiometric pH map pre-injection. c) Ratiometric pH map at 5 min post-injection.