# Different injection duration combining with modality of k space sampling: Initial experience with a 3 T scanner

K. Lin[1,2], Z-Q. Zhang[2], B. Lu[2], W. Sun[3]

[1]Radiology, Beijing Institute of Heart Lung and Blood vessel diseases, Beijing, Beijing, China, People's Republic of, [2]Radiology, Beijing Anzhen Hospital, Beijing, Beijing, China, People's Republic of, [3]GE Healthcare, Beijing, Beijing, China, People's Republic of

**Purpose:** To test the hypothesis that injection duration of contrast medium affects image quality and various k space sampling modalities have different sensitivities to injection duration.

**Materials and Methods:** 80 patients (age 32-80 years, body weight 65-93Kg, mean 75.6Kg) suspected of having renal arterial disease or abdominal artery diseasesere randomly divided into four groups and underwent imaging with different 3D contrast-enhanced MRA scanning and injection protocol combinations. Two groups of patients were injected double dose (0.02mmol/Kg) and single dose (0.01mmol/Kg) respectively with elliptic centric view ordering for k space filling. Other two groups were injected double dose and single dose respectively with centric view ordering. The scan parameters were similar for all cases. The FOV was 40 cm (superior to inferior, frequency encoding direction) and covered origin of coeliac trunk to bifurcation of iliac artery in a total acquisition time of 16-19 seconds. Slice thickness was 2.4mm-2.6mm and matrix was 256X192. The flip angle was 40°. TR (3.1-3.6 msec) and (TE1.1-1.5msec) were automatically selected, NEX =0.75. MR angiographic pulse sequence was triggered due to peak enhancement of test bolus (2 ml/sec, total 2ml) into the renal artery ostium. Contrast medium (0.05mmol/ml, Gadopentetic Acid Dimeglumine Salt) was injected at 2ml/sec through a dorsal hand vein following 20ml flash of saline solution at 2ml/sec. The Contrast Noise Ratio (CNR, lumen to liver), signal intensity (SI) transverse lumen of vessel and the standard deviation (SD) of SI are compared by independent t test among different groups. Clinical criteria for overall quality are 5, excellent; 4, more than adequate for diagnosis; 3, adequate for diagnosis; 2, less than adequate for diagnosis; and 1, nondiagnostic.

**Result:** The injection protocol and quantitative analysis of the images are listed in table 1; the typical images for analysis are shown in Figure 1:

Table 1

| | Single Dose | | Double Dose | |
|---|---|---|---|---|
| | Elliptic Centric | Centric | Elliptic Centric | Centric |
| njection Duration(s) | 7.6 | 7.8 | 15.5 | 15.1 |
| Overall quality | 3.7 | 3.2 | 4.4 | 4.3 |
| CNR | 26.5 | 23.4 | 43.2 | 39.1 |
| SI (unit) | 1139.2 | 1003.6 | 1578.7 | 1430.5 |
| SD of SI | 75.5 | 95.3 | 57.6 | 66.8 |

Figure 1

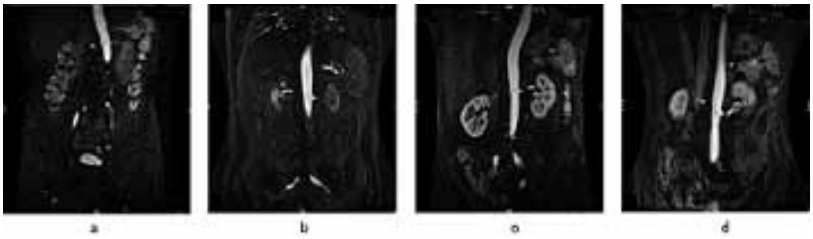

Figure 1 Quantitative analyses of source images from four patients

a *Single dose +CV, CNR,=28.9,SI=1161.3,, SD=95.7*

*b Single dose +ECV, CNR,=30.4, SI=1269.7, SD=68.5*

*c Double dose +CV, CNR,=42.8, SI=1130.9, SD=38.9*

*d Double dose +ECV, CNR,=47.7, SI=1680.5, SD=77.6.*

Injection duration of single dose groups is shorter than double dose groups ($P<0.05$). CNR, SI and Image quality of single dose groups are inferior to double dose groups. SD of SI of single dose groups is higher than that of double dose. Between groups with single dose, SD of SI of centric view ordering group is higher than elliptic centric view ordering group (95.3 vs. 75.5, $P<0.01$), while there is no difference between groups with double dose.

**Conclusion:** Short duration of contrast medium leads to poor quality images. With severe signal variation, centric view ordering seems more sensitive to short injection duration than elliptic centric view ordering of k space sampling.