Evaluation of Venous Spread of Renal Cell Carcinoma by Non-Contrast-Enhanced Magnetic Resonance venography: a SLEEK sequence

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Introduction

Renal venogram is often used to diagnose renal vein thrombosis. Currently contrast-enhanced MR venography (CE-MRV) and computer tomography venography (CTV) imaging can show the presence of tumor thrombus extension into renal venous (RV) and inferior vena cava (IVC) in renal cell carcinoma (RCC), but the contrast enhanced technique may cause the problems as follow: 1: nephrogenic systemic fibrosis (NSF) or contrast-induced Nephropathy; 2: the arterial contamination; Therefore, it is desirable to develop a non-contrast-enhanced MR venography (NCE-MRV) for presenting clearly the tumor thrombus in RV and IVC, especially for those patients with renal insufficiency such as RCC. In this study, we propose whether a new NCE-MRV (**S**patial **L**ab**E**ling with multiple invErsion pulses, SLEEK) has the ability to delineate the venous spread of RCC and to present the superior extent of tumor thrombus.

Methods

The prospective NCE-MRV study was performed on 13 patients diagnosed with RCC with venous spread (5 males and 8 females; age range 36–67years). NCE-MRV using SLEEK sequence was carried out on a 1.5 T MR system (EXCITE HD, GE, Healthcare, Waukesha, WI, USA). The SLEEK preparation adopted one transversal broad band located inferior to the upper pole of kidneys to invert the artery blood and show venous with an in-flow effect. TI is selected to null the inflow blood signal. Adiabatic SPIR chemical saturation pulse is applied prior to the data acquisition for fat signal saturation. The diagram of the pulse sequence was shown in Figure 1. All postprocessing techniques were performed by two experienced radiologists, and the findings of the location and size of tumor thrombus were evaluated in their consensus. NCE-MRV diagnosis was compared with CE-MRV or CTV findings. some patients were confirmed by radical nephrectomy plus vena cava thrombus removal operation.

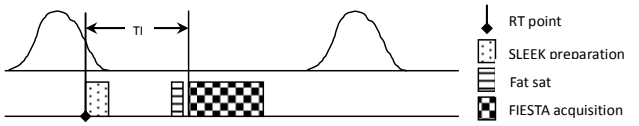

Fig 1: **Respiratory triggered fat-sat FIESTA sequence, with SLEEK preparation**

Results

Within 13 NCE-MRV using SLEEK examinations, 4 patients were performed with CTV and 10 underwent CE-MRA, 5 patients were confirmed by surgery. The excellent correlation between NCE-MRV and CE-MRV or CTV was found in predicting the presence of tumor thrombus extension into RV and IVC with RCC (Fig2, 3). Including tumor thrombus extension into RV only (T3b stage, levelⅡ) in 3/13(23.1%) patients, involvement of infradiaphragmatic level of infrahepatic vena cava (T3c stage, levelⅢ) in 5/13 (38.5%) patients (Fig2) and of intrahepatic subphrenic vena cava (T3c stage, level Ⅲ) in4/13 (30.8%) patients, and supradiaphragmatic level of IVC (T4b stage, level Ⅳ) in 1/13 (8%) patients (Fig 3). In comparison with surgical report, the upper extent of the tumor thrombus was correctly diagnosed by NCE-MRV in 4/5 (80%) operated patients. NCE-MRV using SLEEK has the advantage of avoiding certain interferences from spinal bones and arterial system enhancement.

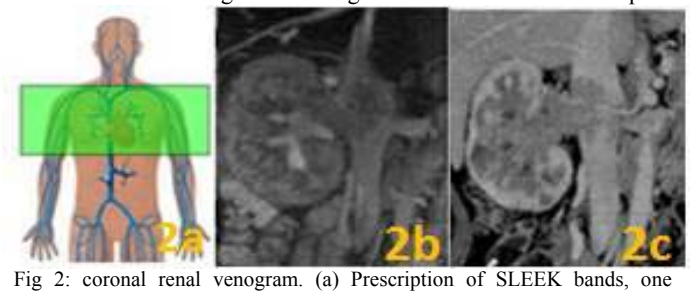

Fig 2: coronal renal venogram. (a) Prescription of SLEEK bands, one transversal broad band located inferior to the upper pole of kidneys; (b) Reformatted coronal view on NCE-MRV; (c) Reformatted coronal view on CTV. NCE-MRV is corresponding with CTV in displaying the tumor thrombus extension into infradiaphragmatic level of infrahepatic vena cava.

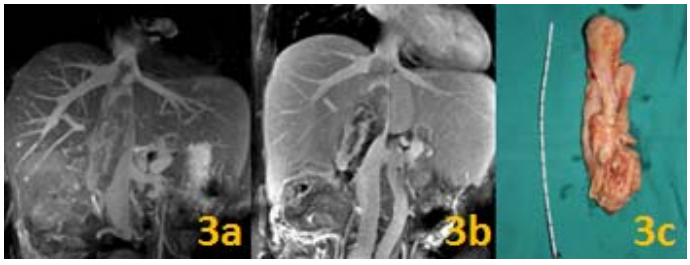

Fig 3: coronal renal venogram. (a) Reformatted coronal view on NCE-MRV; (b) Reformatted coronal view on CE-MRV; (c) the size of tumor thrombus with operation ; NCE-MRV is corresponding with CE-MRV in displaying the size of tumor thrombus extended into supradiaphragmatic level of IVC confirmed by surgery.

Conclusion

NCE-MRV using SLEEK represents a non-renal complication, relatively inexpensive, and reliable diagnostic method for evaluating the venous spread of RCC. It may be as an alternative choice to replace CE-MRV or CTV for delineating the tumor thrombosis in RCC.