The Egyptian Journal of Radiology and Nuclear Medicine (2015) **46**, 899–906

Egyptian Society of Radiology and Nuclear Medicine

The Egyptian Journal of Radiology and Nuclear Medicine

www.elsevier.com/locate/ejrnm
www.sciencedirect.com

ORIGINAL ARTICLE

Role of magnetic resonance venography in assessment of intra-thoracic central veins in hemodialysis patients

Mahmoud Abdel Latif *, Hossam El Wakeel, Dina Gamal, Ahmed G. Sadek

Mansoura University Hospital (MUH), Egypt

Received 20 March 2015; accepted 12 June 2015
Available online 20 August 2015

KEYWORDS

MRV;
Hemodialysis patients;
DSV;
Intrathoracic central veins

Abstract *Aim:* To determine diagnostic accuracy of magnetic resonance venography (MRV) in assessment of the patency and steno-occlusive disease of intrathoracic central veins in hemodialysis patients.

Patients and methods: Between February 2013 and December 2014, 40 hemodialysis patients with suspected intrathoracic central venous stenosis were examined by MRV (phase contrast in 35 patients and contrast enhanced in 5 uncooperative patients). Digital subtraction venography (DSV) was done in the 40 patients and used as the standard reference. The results of MRV were compared with those of DSV. Kappa index with percent agreement between 2 methods was calculated.

Results: The results showed excellent agreement as MRV detected 140 out of 141 patent, and all 36 stenotic and 62 out of 64 occluded segments of intra-thoracic central veins with k were 1.00, 1.00 and 0.97 and P value = <0.001, 0.001 and 0.023 respectively. MRV had 98.6% sensitivity, 100% specificity and 99.3% accuracy in diagnosis of patency and stenoocclusive disease of central veins.

Conclusion: MRV is a highly sensitive technique in the diagnosis of patency and steno-occlusive disease of intrathoracic central veins and may be used as an alternative to DSV for the abnormalities of central veins in hemodialysis patients.

1. Introduction

A common and significant problem in the management of hemodialysis patients is central venous steno-occlusive disease (CVSD), the incidence of which has been reported in the literature to be in the range of 25–40% (1). This can result in the loss of the access site, increased venous pressure on the dialysis machine leading to its stoppage, and arm swelling due to venous hypertension. Prompt treatment should be required (2).

The cause of central vein stenosis used to be iatrogenic; due to repeated insertion of dialysis catheters in the same vein over long period; and also the repeated infection that occurs at the tip of the catheter (3).

* Corresponding author.

Peer review under responsibility of Egyptian Society of Radiology and Nuclear Medicine.

http://dx.doi.org/10.1016/j.ejrnm.2015.06.006

The diagnosis of central venous stenosis is made based on both clinical and imaging findings. Digital subtraction contrast venography is the current reference standard (4). Ultrasonography has been widely used for the detection of CVSD, but it can only diagnose stenosis in internal jugular vein and subclavian vein and cannot detect stenotic lesions in other central veins such as brachiocephalic veins and superior vena cava (SVC) (5).

Magnetic resonance venography (MRV) shows to be more accurate and reliable than ultrasonography in diagnosis of CVSD, as the images obtained from MRV show better morphological findings detecting the length and degree of the lesions (4), which indicate whether interventional procedures are necessary and can identify the length of the lesion that requires crossing with the catheter and guide wire (2).

MRV can be done by contrast and noncontrast techniques. Noncontrast MRV using Time of Flight (TOF) and phase contrast (PC) techniques allows noninvasive visualization of the venous structures (6). Contrast enhanced MRV can also be done safely with using small dose of contrast such as gadoterate meglumine (Dotarem; Guerbet; Villepinte, France) instead of gadopentetate dimeglumine (Magnevist, Schering, Berlin, Germany). This contrast proved to be more safe in patients with renal impairment and less likely to induce nephrogenic systemic fibrosis (NSF) (7,8).

2. Aim of the work

To determine the diagnostic accuracy of phase contrast and three-dimensional gadolinium-enhanced magnetic resonance venography (3D-Gd-MRV) in assessment of patency and steno-occlusive disease of intrathoracic central veins in hemodialysis patients.

3. Patients and methods

3.1. Patients

During the period from February 2013 to December 2014, this study was conducted in the Radiology Department of Mansoura University Hospitals (MRI unit and Emergency Hospital). At first 45 patients were enrolled but five of them were excluded due to contraindications to examination; three Patients were with metallic prosthesis, one cardiac patient with pacemaker and one patient had claustrophobia. So, finally, 40 patients were included, and their age ranged from 25 to 70 years with mean age of 47.5 years. Inclusion criterion was hemodialysis patients with suspected intrathoracic central venous stenosis referred to us from the vascular surgery department. All patients had a history of previous catheterization in the internal jugular and/or the subclavian veins. 15 patients had manifestations of venous hypertension (all presented with arm swelling and 4 of them had associated facial swelling).

All participated patients signed the informed consents required by the Human Study Committee (see Figs. 1–5).

3.2. Methods

Phase contrast MRV was done in 35 patients and gadolinium-enhanced in 5 uncooperative patients for diagnosis of patency and stenoocclusive disease of intrathoracic central veins in hemodialysis patients. Digital subtraction venography was done in all the 40 patients and used as the gold standard reference.

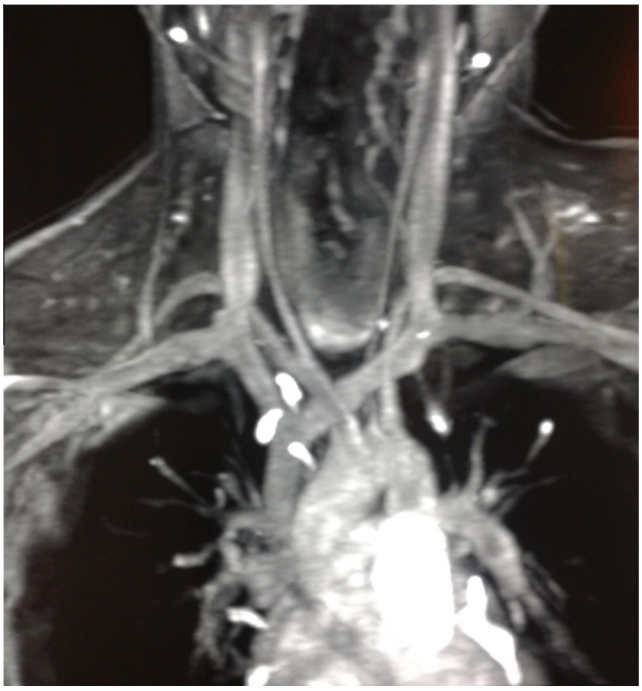

Fig. 1 Phase contrast MRV of a female patient aged 35 years (control group). 3D reformate of phase contrast MRV showed patent central veins.

MRI examination performed on a 1.5-T unit (Ingenia; Philips Medical Systems, Best, the Netherlands) using a torso phased-array coil centered over the thoracic inlet. The field of view (FOV) covered the region from above the clavicle to the diaphragm in craniocaudal extension and the whole chest in axial diameter.

3.2.1. Acquisitions of MRV

MRV was done by phase contrast (PC) technique in 35 patients. Phase contrast technique is a gradient echo technique with TR 8.0 ms; TE 4.5 ms; flip angle 15°; FOV 300 mm; Venc 20 cm/s; total scan time 6 min and 36 s. The remaining 5 patients of the diseased group were critically ill and cannot withstand the long time examination of phase contrast technique, so, MRV examinations were conducted using the contrast enhanced (CE) technique, as, gadolinium-based contrast material (Dotarem; Guerbet; Villepinte, France) was administered as a bolus injection at a weight adjusted dose (0.2 mmol/kg). 3D Dotarem enhanced MRV was performed during end-inspiratory breath-holding in the arterial phase and then in the venous phase of the central chest veins. A fixed delay of 20 s between both acquisitions was set, allowing the patient to breath in between. All injections were administered with flow rate of 2 mL/s and a 20 mL of normal saline solution was flushed through a 22-gauge injection cannula placed in peripheral vein. 3D data sets were acquired in the coronal plane using a spoiled GRE sequence with TR 4.6 ms; TE 1.8 ms; flip angle 30°; FOV (maximum, 500 mm); matrix 200–512; 1 excitation; bandwidth 390 Hz/pixel; and time of acquisition 23 s. Immediately after examination, a hemodialysis session was arranged to each case, observed for 24 h for