Using Phase Contrast MRA for the diagnosis of Pelvic Congestion Syndrome.

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Introduction: Pelvic Congestion Syndrome (PCS) is an important cause of chronic pelvic pain. PCS is produced by anomalous flow in ovarian veins (OV) and it is a pathology typically under-diagnosed (1). Direct venography (DV) is currently the gold-standard test; however, this is an invasive exam that can only provide information about the size and morphology of the veins but not about their flow. Previous studies have shown that current non-invasive exams (CT-scan, Doppler US and anatomical MRI) are not accurate enough (2). Phase-contrast magnetic resonance angiography (PC-MRA) appears as non-invasive alternative that would permit a morphologic and functional evaluation of the OV, although the correct measurement of flow velocities in these veins is difficult because of the background noise.

Purpose: to evaluate the accuracy of flow velocity (measured with PC-MRA) as a diagnostic criterion and to compare it with DV for the diagnosis of PCS.

Patients and methods: We included prospectively all patients sent to our institution for DV with clinical suspicion of PCS within a six-month period. The PCS was suspected in patients with history of chronic pelvic pain (for at least 3 months, localized and is severe enough to cause functional disability) without evidence of any other inflammatory disease. The pain should be exacerbated with standing positions and associated to bladder irritability or varicosities in vulva, buttocks or thighs and/or dyspareunia.

Before the DV all patients were scanned with a 1.5 T Siemens Avanto MRI system (PC-MRA, 144x192, 1x1 mm, slice thickness 4mm, TR/TE=45/7,6 ms, VENC=10 cm/s, 16 frames). The PC-MRA slices were acquired perpendicular to the ovarian veins at equivalent locations and were cardiac retrospectively triggered. In PC-MRA we considered as indicative of the presence of PCS the following findings: slow anterograde flow velocity (peak velocity less than 5 cm/s) and retrograde flow.

We performed the DV using a standard technique (3). The presence of one or more of the following venographic appearance was considered as diagnostic of PCS: Ovarian vein diameter $\geq$ 6 mm, uterine venous engorgement, congestion of the ovarian plexus, filling of the pelvic veins across the midline or filling of vulvovaginal and thigh varicosities.

Results: We included 8 women in this study (mean age 44 y.o., range 26-48 y.o.). We analyzed the data of 16 veins using a home-made software written in Matlab (The Mathworks) to segment out the veins and to compute the velocity parameters. There were 12 abnormal veins according to the DV analysis and in all of them the PC-MRA analysis showed slow anterograde flow velocity or retrograde flow (Fig. 1 and 2). There were 4 normal veins; two of them were correctly identified with PC-MRA (Fig. 3). In the remaining 2 normal veins (corresponding to a single patient), the PC-MRA analysis showed slow anterograde flow but the DV did not show abnormalities despite the typical clinical symptoms presented by the patient (Fig. 4). Additionally, it was observed that all normal veins showed a homogeneous (laminar) flow pattern (Fig. 5) whereas the abnormal veins showed a turbulent flow pattern at some stages of the cardiac cycle (Fig. 6), this finding might suggest an additional criterion to diagnose PCS.

Conclusion: PC-MRA is a useful non-invasive diagnostic technique for patients with clinical suspicion of PCS and could avoid unnecessary invasive DV, such as those patients that do not require endovascular treatment.

The dilatation of ovarian veins and pelvic plexus reflects the reduction of venous clearance occurring in the PCS (1). In our study, the patient with normal DV and slow flow velocity measured in PC-MRA clearly had the typical symptoms of PCS. This finding might suggest that DV cannot detect the PCS at early stages (venous stasis before the dilatation had occurred), but this hypothesis must be confirmed in prospective studies. The presence of turbulent flow patterns showed by the PC analysis might also contribute to diagnose PCS; however this criterion must also be confirmed by studies with a larger population. The PC-MRA adds functional information that could be relevant for the study of PCS and should be considered in patients at early stages of the disease.

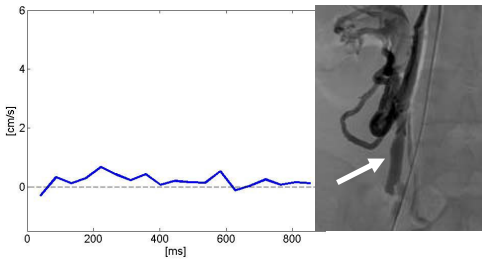

Figure 1: slow anterograde flow with an abnormal dilated vein in DV (arrow)

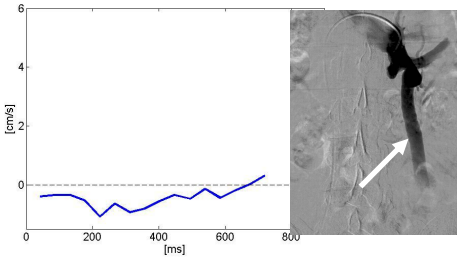

Figure 2: retrograde flow with an abnormal dilated vein in DV (arrow)

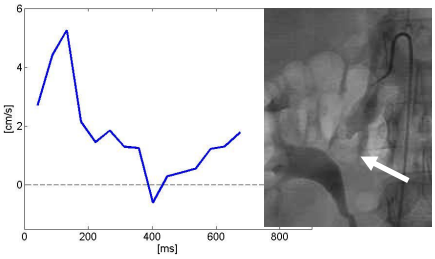

Figure 3: Normal anterograde flow with a normal vein in DV (arrow)

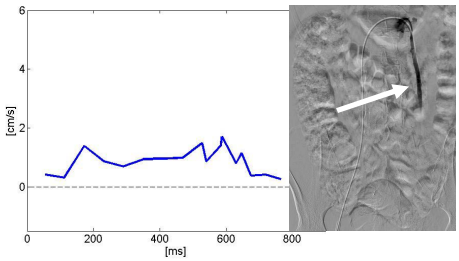

Figure 4: This is the only case with discrepancy. PC-MRA showed a slow flow but DV demonstrated normal vein (arrow). This patient had typical symptoms of PCS

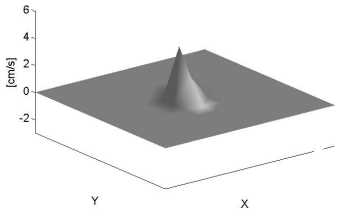

Figure 5: Spatial profile of laminar blood flow in a normal ovarian vein

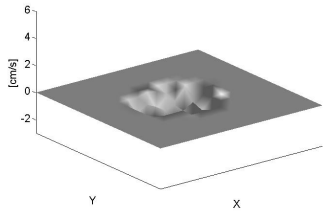

Figure 6: Spatial profile of turbulent blood flow in an abnormal ovarian vein

References: (1) Ganeshan et al. Cardiovasc Intervent Radiol (2007) 30: 1105-1111. (2) Rozemblit et al. AJR (2001) 176: 119-22 (3) Kim et al. JVIR (2006) 17: 289-297.