Contrast-enhanced MR arteriography to detect ovarian artery supply to uterine fibroids in patients scheduled for uterine artery embolization: Comparison with conventional angiography during uterine artery embolization for fibroids

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BACKGROUNDS/INTRODUCTION:

Uterine leiomyoma is the most common benign tumor of the female pelvis and affects 20-50% of women. Since 1995, uterine artery embolization (UAE) has been gaining acceptance as a primary uterine conserving treatment for women with symptomatic fibroids [1]. And, while the majority of post-UAE patients report significant symptomatic improvement, clinical failure rates range from 4-19%. The factors leading to clinical failure have not yet been fully identified, but unrecognized or untreated collateral blood supply to the uterus and/or fibroids has been implicated [2, 3, 4].

GOALS:

To detect ovarian arterial supply to uterine fibroids on contrast-enhanced magnetic resonance angiography (CE MRA) and correlate with conventional angiography in patients with symptomatic uterine leiomyomata under going UAE.

MATERIALS AND METHODS:

One hundred thirty six consecutive patients with uterine leiomyomata were evaluated by MRI prior to UAE between November 2001 and June 2004. Of these 136 patients, 100 cases were available for evaluation (mean age 43.6yrs, average volume of uterus 579.7cm^3, average volume of dominant fibroid 150.3cm^3). MR angiography (MRA) was performed in all patients using a dynamic contrast enhanced volumetric interpolated breath-hold examination (3D-VIBE) sequence (TR/TE 150/4.1, 80 degree flip angle) in the sagittal plane. Images were acquired during the arterial phase of gadolinium injection. On CE MRA ovarian arteries were evaluated as “definitely present (positive)”, “probably present (positive)”, or “definitely absent (negative)”. On conventional angiography ovarian arteries were considered as “positive” if they demonstrated at least marginal flow to the uterus and/or fibroids [2].

On MR, the presence, size, location and laterality of the ovarian arteries were evaluated using maximum intensity projection (MIP)/multiplanar reconstruction (MPR) techniques at a workstation and were compared to conventional angiography results.

RESULTS:

Of the 100 patients evaluated, CE MRA detected at least one ovarian artery in 15 patients (19 ovarian arteries in all). Ovarian arteries were bilateral in four patients and unilateral in 11 patients. Of these 15 patients, conventional angiography detected at least one ovarian artery with at least marginal flow to the uterus and/or fibroids in 5 patients (FIG 1). Conventional angiography also detected at least one ovarian artery supplying the uterus and/or fibroid in 2 patients that were not detected by CE MRA (FIG 2).

The sensitivity, specificity, PPV and NPV of CE MRA for detecting at least one ovarian artery supplying the uterus and/or fibroid ovarian for potential UAE patients were 71.4%, 89.2%, 66.7% and 97.6%, respectively.

On CE MRA, 5 ovarian arteries were larger than, 12 ovarian arteries were smaller than, and 2 ovarian arteries were equal in size to an ipsilateral lumbar artery. On conventional angiography, 2 ovarian arteries were larger than, 2 ovarian arteries were smaller than, and 1 ovarian artery was equal in size to a 5Fr catheter (1.7mm).

DISCUSSION AND CONCLUSIONS:

Up to 45% of patients may have ovarian arteries seen on routine aortography during UAE; however, only a small percentage may be at risk for clinical failure (6-12%) [2, 3, 5]. Our conventional angiography results are similar in that we found 7% of patients had at least some ovarian arterial supply to the uterus/fibroid on aortography. However, CE MRA detected ovarian arteries in 15% of patients. The discrepancy between the conventional angiography and CE MRA findings is likely multifactorial. In our study, conventional angiography was performed after UAE. Post UAE aortography may impact detection of ovarian arteries. That is, following UAE, ovarian-uterine artery anastamoses may allow inadvertent embolization of the ovarian arteries and/or an embolized uterine artery may alter flow dynamics such that it is difficult to detect ovarian artery supply to the uterus and/or fibroid (see FIG 2) [3, 5]. This phenomenon may account in part for false positive results on CE-MRA (assuming conventional angiography is the gold standard). Additionally, while we used a highly resolved MRA sequence, the tortuosity of the ovarian arteries coupled with their small size makes it difficult, if not impossible, to separate out normal ovarian arteries from those contributing to uterus and/or fibroids which could also contribute to the false positive rate. Conversely, bowel may have obscured ovarian arteries supplying the uterus and/or fibroids on CE-MRA and would have contributed to the false negative rate (FIG 3).

In conclusion, high resolution CE MRA has a high NPV for detecting ovarian arteries that may supply the uterus and/or fibroids. This may impact the routine performance of aortography during UAE. Specifically, potential UAE patients with a negative CE MRA for ovarian arteries may not need an aortogram. The ability to defer aortography has two potential benefits: (1) reducing the small, but real, radiation exposure to the patient and staff; and (2) reducing table time and therefore increasing patient throughput.

References

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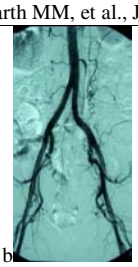


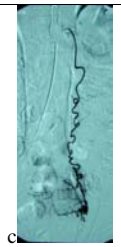
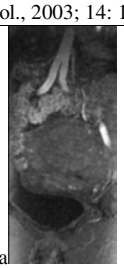


Figure 1: True Positive MRA and CA: Patient with a left ovarian artery that is detected by both contrast-enhanced magnetic resonance angiography and conventional angiography. (a) Maximum intensity projection of CE-MRA shows a left ovarian artery collateral. (b) Nonselective aortography demonstrates a left ovarian artery. (c) Selective catheterization of the ovarian artery shows moderate collateral flow in uterus and fibroids.



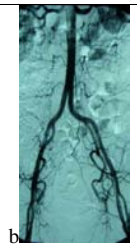
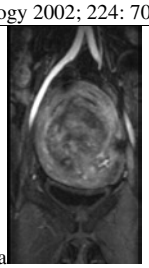


Figure 2: False negative MRA and true positive CA: Patient with right ovarian artery that is not detected by CE MRA, but is detected by conventional angiography. (a) Maximum intensity projection of CE-MRA demonstrates no ovarian arteries. (b) Nonselective conventional aortography shows a right ovarian artery. (c) Selective catheterization of the ovarian artery shows marginal flow in uterus.



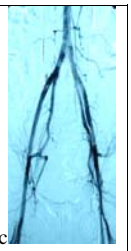


Figure 3: False positive MRA and true negative CA: Patient without ovarian arteries supplying marginal flow to the uterus and/or fibroids on conventional angiography, but CE MRA demonstrates a right ovarian artery. (a) (b) Maximum intensity projection of CE-MRA demonstrates a right ovarian artery. (c) Nonselective conventional aortography demonstrates no ovarian arteries.