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INTERVENTIONAL RADIOLOGY

Impact of evaluation in interventional radiology clinic prior to uterine artery embolization: changes in management

Masoud Nakhaei[1] · **Salomao Faintuch**[1] · **Olga R. Brook**[1]

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Abstract

Purpose To assess the impact of pre-procedural evaluation of patients with symptomatic uterine fibroids and adenomyosis in interventional radiology (IR) clinic.

Method In this IRB-approved, HIPAA-compliant retrospective study, consecutive patients evaluated in the IR clinic in a tertiary academic hospital between 1/1/2015 and 9/30/2018 by a single board-certified interventional radiologist were included. Medical records were reviewed to obtain medical history, imaging and endometrial biopsies results. Impact of IR clinic assessment of clinical, imaging, and pathological findings on patient's clinical course was assessed. Descriptive statistics were used.

Results 208 consecutive patients were evaluated in clinic for uterine fibroids 176/208 (85%), adenomyosis 8/208 (4%) or both 24/208 (11%) with age of 44.4 ± 5.8 years and BMI of 30.1 ± 8.6 kg/m^2. Leading presenting symptom was menorrhagia in 172/208 (80%) patients, pelvic pain in 91/208 (44%), and urinary symptoms in 88/208 (42%) patients. 159/208 (76%) patients underwent UAE, 12/208 (6%) patients underwent surgery, and 37/208 (18%) patients chose conservative management. 189/208 (91%) patients had pelvic MRI that altered management course in 7/189 (4%) patients due to intracavitary fibroids in two patients, endometrial polyps in two patients, non-enhancing fibroids in two patients, and adnexal mass in one patient. 166/208 (80%) underwent endometrial biopsy that altered management course in one patient (0.6%) due to endometrial intraepithelial neoplasia.

Conclusion Endometrial biopsy and pelvic MRI are helpful to detect cases of non-enhancing fibroids, intracavitary fibroids, and ovarian and endometrial malignancies and thus altered management of five percent of patients with symptomatic fibroids and adenomyosis.

Keywords Interventional radiology · Uterine artery embolization · Leiomyoma · Adenomyosis · Menorrhagia

Abbreviations

UAE	Uterine arterial embolization
IR	Interventional radiology
CI	Confidence interval
EIN	Endometrial intraepithelial neoplasia

Introduction

Uterine arterial embolization (UAE) is a minimally invasive, safe, and effective uterine-preserving treatment for symptomatic fibroids [1–4]. Since first reported by Ravina et al. in 1995, many studies have confirmed safety and efficacy of UAE as a successful alternative to hormonal therapy and surgery [4, 5].

Interventional radiology (IR) moved away from a purely procedural specialty to become a clinical specialty, involved in the patient's longitudinal clinical management. An integral part of this change is the widespread role of IR clinic [6]. Siskin et al. [7–9] noted that appropriate patient evaluation prior to any IR procedure increases the patients' satisfaction and technical success rate. SIR standards recommend IR clinic evaluation of patients with abnormal uterine

✉ Olga R. Brook
obrook@bidmc.harvard.edu

[1] Interventional Radiology, Department of Radiology, Beth Israel Deaconess Medical Center, 1 Deaconess Rd, Boston, MA 02215, USA

bleeding [10]. Nevertheless, the impact of the pre-UAE clinical evaluation in IR clinic has not been reported in the literature.

Pre-procedural evaluation of patients with menorrhagia in IR clinic is composed of an assessment of patient's medical history, physical examination, laboratory, pathology, and imaging [11]. This is followed by a review of available treatment options for menorrhagia with their advantages and disadvantages. One may argue that the referring physicians should have already done this assessment and thus interventional radiologists should not spend time on a clinic that brings relatively low revenue, as compared to procedural revenue. Nevertheless, in our experience, further work up is frequently necessary when a woman with abnormal uterine bleeding presents to IR clinic. Most women are referred to IR after menorrhagia evaluation and workup is performed by gynecologists. Sometimes, the workup has only partially been completed, as the referring physician is relying on interventional radiologists to complete the workup specific to UAE. In other cases patients are referred by physicians who may not be familiar with ACOG guidelines, or they are self-referred.

Furthermore, some interventional radiologists (personal communication) feel that pelvic MRI and endometrial biopsy are not necessary in the work up prior to uterine artery embolization. Their reasoning is based on the low yield to alter clinical management and financial and logistical difficulty in obtaining these tests that prevent women from following with the treatment that they need—uterine artery embolization.

Therefore, the purpose of our study was to assess the impact of pre-procedural assessment by interventional radiology in patients with symptomatic uterine fibroids and adenomyosis on identifying appropriate or inappropriate candidates for uterine artery embolization.

Materials and methods

This study was conducted with the approval of the institutional review board and was compliant with the Health Insurance Portability and Accountability Act regulations. The institutional review board waived the requirement for informed consent for the study.

Patients

Consecutive patients with uterine fibroids or/and adenomyosis that were evaluated in IR clinic of a tertiary academic center for potential uterine artery embolization between 1/1/2015 and 9/30/2018 were included in the study. Following data were collected: demographics, including patients' age, height, weight, BMI, presenting symptoms, history of prior pelvic surgery, anticoagulation, and comorbidities, referring physician if present. According to AHA/ACC/TOS guidelines, we classified patients into four groups regarding their BMI [12]: (1) underweight (< 18.5 kg/m^2); (2) normal (18.5–24.9 kg/m^2); (3) overweight (25–29.9 kg/m^2); and (4) obese (≥ 30 kg/m^2). Patients' comorbidities were calculated using updated Charlson Comorbidity Index [13]. Following findings of pre-procedural assessment specific to UAE were obtained: presence of fibroids, adenomyosis, or both based on MRI and/or US, imaging information, ordering physician for the imaging, referring physicians and the indication for referral, endometrial biopsy, and pathologic findings.

Patient's clinical course after consultation was evaluated to create five categories of patients: (1) patient proceeded with UAE; (2) medical history and/or physical examination findings precluded UAE; (3) imaging findings precluded UAE; (4) endometrial biopsy results precluded UAE, and (5) patients who decided not to undergo UAE based on personal preference.

IR clinic visit

Patients presented to IR clinic to be evaluated for abnormal uterine bleeding. Patients were evaluated by a trainee (IR fellow or resident) and an IR attending, subspecialized in the women's health interventions with 7 years of post-fellowship experience. A thorough medical history was obtained. This included the history of present illness, medications, allergies, past medical, surgical, and specific gynecological history relevant to presenting symptoms. A complete physical exam was performed. Pelvic MRI with and without contrast was obtained to evaluate location and vascularity of the fibroids, presence of adenomyosis, or any other abnormality that could explain menorrhagia. If an endometrial biopsy was required per ACOG guidelines [14] and was not performed prior to the IR clinic evaluation, the patient was referred to the gynecologist to obtain an endometrial biopsy. All treatment options for menorrhagia were again discussed with the patient, including the pros and cons of medical management, IUD, surgical management, and uterine artery embolization. A detailed explanation of the uterine artery embolization procedure and its risks, as well as clinical outcomes, was provided. In cases of endometrial polyps or completely intracavitary fibroids on pelvic MRI, a hysteroscopic resection was recommended. An informed consent was obtained from all the patients that desired to proceed with uterine artery embolization. After reviewing all the results (MRI, endometrial biopsy), the final plan was further discussed with the patients on the phone in 70/159 (44%) patients and they were scheduled for the procedure.

Statistical analysis

Continuous variables were described as mean and standard deviation, median, and range, as appropriate. Categorical variables were described as a percentage. Due to scattered data, median and 95% confidence interval (CI) were calculated for Charlson comorbidity score. Statistical analysis was performed using Microsoft Excel 2016.

Results

Two hundred eight consecutive patients were included in this study. Among them 176/208 (85%) patients were referred for uterine fibroids, 8/208 (4%) were referred for adenomyosis, and 24/208 (11%) patients were referred for both. The average age was 44.4 ± 5.8 years; the majority of our patients 169/208 (81%) were premenopausal. BMI ranged from 16.6 to 66.1 kg/m^2, with an average of 30.1 ± 8.6 kg/m^2; and the majority of the patients (70%) were either overweight or obese based on the criteria (Table 1). In regards to related past medical history 98/208 (47%) patients had history of pelvic surgeries, and 7/208 (3%) of patients were on oral anticoagulants at the time of referral. The average Charlson comorbidity score was 0.12, 95% CI [0.0656, 0.1744] with a median of 0.

Nearly all of the patients, 203/208 (98%) were referred by a gynecologist; in more than half instances 118/203 (58%) they were referred by gynecologists that were experts in management of uterine fibroids. Two out of 208 (1%) were referred by primary care physicians, 1/208 (0.5%) by a surgeon, and 2/208 (1%) were self-referred.

The majority of patients, 144/208 (69%) were referred to IR to consider UAE as an alternative to other treatment options, as presented by the referring physicians, these options included expectant management, medical management, endometrial ablation, laparoscopy, hysteroscopy, and abdominal surgery. 42/208 (20%) patients were referred to IR to undergo UAE: 31/42 (74%) patients were not good surgical candidates, and 11/42 (26%) patients were referred for preoperative embolization prior to hysterectomy or myomectomy. Sufficient data were not available in 22/208 (10%) patients regarding the discussion between referring physician and the patient about the treatment options.

Leading presenting symptom in all patients was menorrhagia, in more than 80% of patients. This was followed by pelvic pain in 43% of the patients with fibroids, 13% (1/8) of patients with adenomyosis, and 58% of the patients with both. The difference between the prevalence of pelvic pain between these three groups was not statistically significance ($p = 0.07$), likely due to very few number of patients with only adenomyosis. Urinary symptoms, such as frequency, incontinence, and nocturia were the third most common set of symptoms in 42% (88/208) of all patients.

The majority of patients referred to our clinic 159/208 (76%) underwent UAE. Among those who did not undergo UAE, 40/49 (82%) patients were referred for fibroids, 3/49 (6%) patients for adenomyosis, and six patients were presumed to have both pathologies (Table 2 and Fig. 1). In 70/159 (44%) of the patients who underwent UAE a phone consult preceded the procedure to finalize the plan after reviewing the endometrial biopsy and/or pelvic MRI.

Table 1 Patients' demographics, and related past medical, surgical, and medications history

Age (years)	44.44 ± 5.78
Premenopausal (< 50 years)	169 (81%)
BMI (kg/m^2)	30.1 ± 8.60
Underweight (< 18.5)	4 (2%)
Normal (18.5–24.9)	52 (28%)
Overweight (25–29.9)	55 (30%)
Obese (≥ 30)	75 (40%)
Updated Charlson comorbidity score	0.12 ± 0.41
Prior pelvic surgery	98 (47%)
Anticoagulation medications	7 (3.4%)

Table 2 The causes for not proceeding with uterine artery embolization in patients with uterine fibroids and adenomyosis who were evaluated in interventional radiology clinic

	Uterine fibroids, $n = 176$		Adenomyosis, $n = 8$		Fibroids and adenomyosis, $n = 24$	
	n	%	*n*	%	*n*	%
Patients who underwent UAE	136	65	5	2	18	9
Patients who did not undergo UAE						
Due to history and physical examination findings	11	5	1	0.5	1	0.5
Due to imaging results	7	3	0	0	1	0.5
Due to endometrial biopsy results	1	0.5	0	0	0	0
Patient's decision	21	10	2	1	4	2

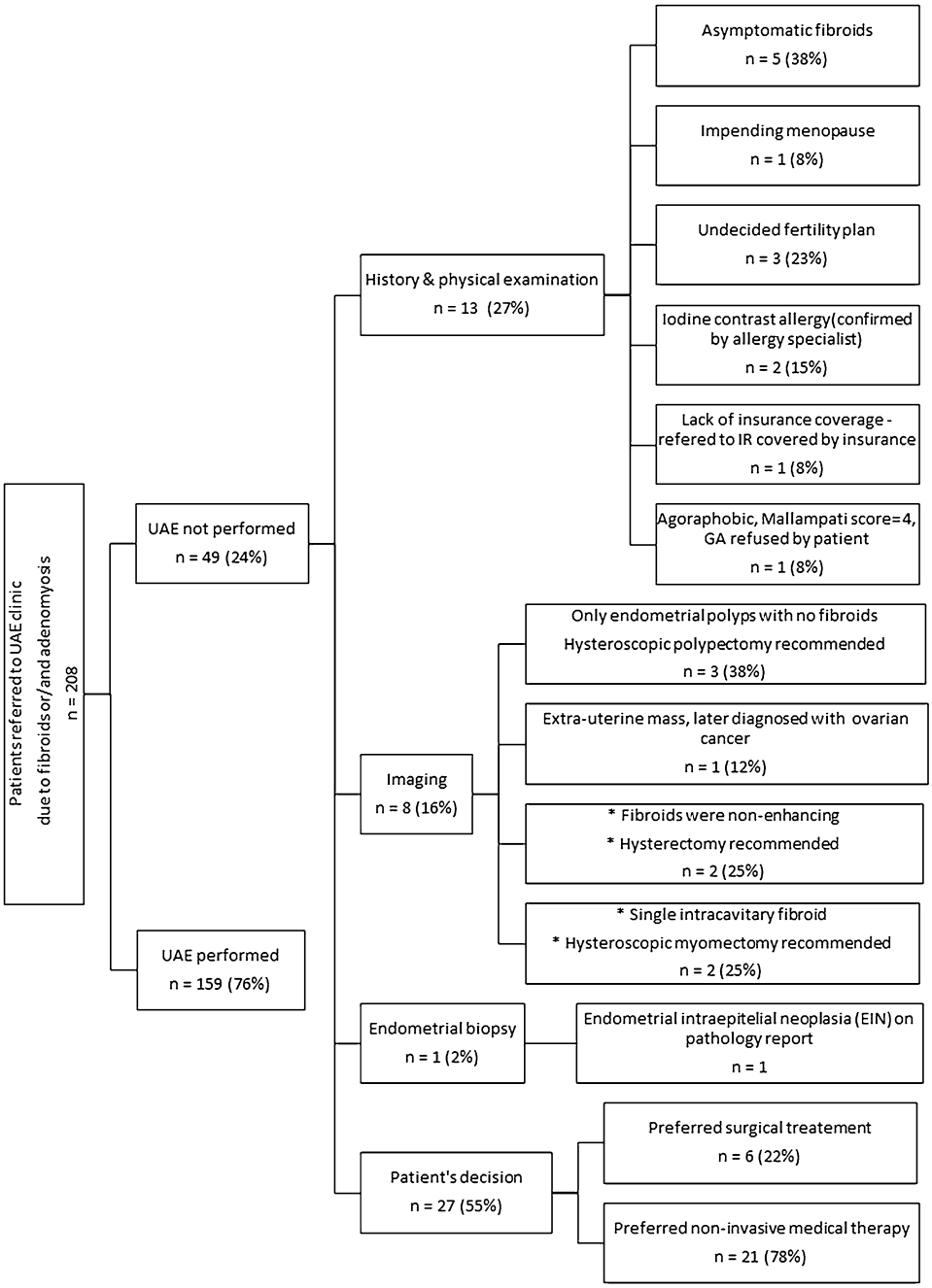

Fig. 1 Flow chart of patients evaluated in interventional radiology for uterine fibroids and/or adenomyosis with their respective clinical management after the clinic visit

189/208 (91%) patients had pelvic MRI with and without contrast prior to the procedure. 114/189 (60%) had an MRI prior to the IR evaluation, and 75/189 (40%) patients underwent MRI after the evaluation. The vast majority (148/189, 80%) of the MRI studies were performed in our facility, and 104/189 (70%) were ordered by an interventional radiologist (Table 3). 19/208 (9%) patients did not undergo MRI, most of them 13/19 (68%) because the patient decided not to proceed with uterine artery embolization (Table 4).

166/208 (80%) patients underwent endometrial biopsy prior to UAE, and 132/166 (80%) patients had the results prior to their IR consultation. Among 42/208 (20%) patients who did not undergo endometrial biopsy, 28/42 (67%) had no/minimal bleeding symptoms and therefore did not require a biopsy based on the ACOG guidelines, and 5/42 (12%) decided not to proceed with UAE (Table 4).

Endometrial biopsy showed benign secretory endometrium with no other pathological abnormality in 160/166 (96%) patients. One patient 1/166 (0.6%) had endometrial intraepithelial neoplasia (EIN) and therefore was referred to gyneco-oncologist for further workup and management. Chronic endometritis was detected by endometrial biopsy

Table 3 Details for MRI and endometrial biopsy for patients presenting to interventional radiology clinic

	n	%
MRI performed	189	91
MRI performed before clinic visit	114	55
MRI performed at our institution	148	80
MRI ordering physician in our institution		
Interventional radiologist	104	70
Gynecologist	20	14
Fibroid-expert gynecologist	24	16
Endometrial biopsy performed	166	80
Before initial clinic visit	132	63

in another patient 1/166 (0.6%). This patient underwent a successful UAE. However, to prevent flare of endometritis, she was treated with a prolonged antibiotics regimen prior to and after the procedure. One out of 166 (0.6%) patients had Eosinophilic Endometrial Metaplasia on endometrial biopsy. This finding was further discussed with the pathologist and deemed not to be a premalignant condition. 3/166 (2%) patients had focal endocervical metaplasia, which is a benign condition, and likely due to contamination of endocervical cells on endometrial biopsy. Thus this finding of focal endocervical metaplasia did not change the management of our patients.

Discussion

This study has shown that IR evaluation of women who are referred for uterine artery embolization for uterine fibroids and/or adenomyosis, results in a high rate of proceeding with the procedure while effectively identifying the patients that would benefit from alternative medical or surgical options.

In 2016, Taslakian et al. described a systematic approach for pre-procedural care in vascular and interventional radiology and emphasized the necessity of a multidisciplinary team approach for patient care [15]. Lutjeboer et al. [16] showed that routine implementation of IR clinic improves patient safety and satisfaction. Patient evaluation in IR clinic, as has been shown by our results was highly effective in identifying the appropriate patients for uterine artery embolization, while also referring other patients for more appropriate treatments, such as hysteroscopy for endometrial polyps and intracavitary fibroids, gyneco-oncology for ovarian mass and endometrial neoplasia, and hysterectomy for patients with non-enhancing fibroids. Furthermore, some patients experience significant anxiety from a mere diagnosis of uterine fibroids and thus seek treatment, while they are completely asymptomatic. These patients benefit greatly from the discussion with an interventional radiologist about this entity, the prevalence in the general population, and the timeframe it needs for proper management. Even if these patients do not undergo a uterine artery embolization, the evaluation by an IR team is beneficial for them.

Table 4 The causes for patients who did not undergo MRI or endometrial biopsy during their evaluation in interventional radiology clinic for treatment of fibroid and adenomyosis

Patients without endometrial biopsy	42	%
Decided not to proceed with UAE	5	12
No bleeding symptoms	28	67
UAE as a preparation prior to myomectomy	3	7
UAE after prior myomectomy	2	5
Virgin patient	1	2
Endometrial polyps without fibroids	1	2
Normal endometrium on imaging	1	2
Technically challenging anatomy precluding biopsy	1	2
Patients without MRI	19	%
Decided not to proceed with UAE	13	68
Asymptomatic fibroids	4	21
Concerning features referred for surgery	1	5
Nulliparity and desire to have children	1	5
Iodine contrast allergy	2	11
Patient's decision	5	26
MRI not covered by insurance	1	5
Decided not to proceed with UAE	13	68

Two women (1%) in our study had malignancy detected during their workup, an ovarian mass on MRI, and one endometrial neoplasia on endometrial biopsy. This number is likely underestimating the prevalence of neoplasms in this population, as some of the evaluation is performed by referring providers, and if they detect any neoplasia, the patient is not going to be referred to IR. Any suspected uterine, cervical, or adnexal malignancy is an absolute contraindication for UAE [17, 18]. Therefore, appropriate workup by an IR team, if not performed earlier, is a must prior to uterine artery embolization, despite a relatively low overall risk of malignancy in this population.

MR imaging is one of the cardinal tools in the pre-UAE evaluation. Several studies emphasized the value of MRI in obtaining vital information about uterine and adnexal anatomy, fibroid enhancement, and also ruling out malignancies or other pathologies such as adenomyosis [3, 19–21]. This study confirms the value of pelvic MRI prior to UAE—whether it is to detect adenomyosis, which is treated with smaller particles in our institution, or detection of endometrial polyps that can be managed with hysteroscopy or even non-enhancing fibroids, in which case the patient would not benefit from UAE.

Endometrial biopsy is recommended prior to the UAE in patients with abnormal uterine bleeding [1, 4, 14, 22]. The risk for leiomyosarcoma is low, with reported risk ranging from 1 in 350 to 1 in 8300. However, in more invasive cases, leiomyosarcoma can be diagnosed with an endometrial biopsy, thus acting as an additional failsafe for this rare diagnosis [23–25]. There were no cases of leiomyosarcoma in this study cohort, however, endometrial biopsy results changed management in two cases—one patient with endometrial neoplasia and the other with endometritis. Therefore, we concur with the ACOG recommendation of endometrial biopsy for patients with abnormal uterine bleeding prior to the UAE.

There are several limitations to our study. This study cohort is based on the large practice of two interventional radiologists in a tertiary academic institution; therefore, it has only evaluated a particular way of practice. It is possible that in a different setting, the rate of positive findings in preprocedural evaluation would be different. Furthermore, there is no comparison to similar patients with uterine fibroids and adenomyosis that were not evaluated by an interventional radiologist. Therefore it is possible that the findings could have been detected by referring gynecologists during their workup. We have not performed a cost-effectiveness analysis of our practice this could be evaluated in future studies.

Conclusion

(1) IR clinic evaluation plays an integral role in the management of patients prior to uterine artery embolization.
(2) Pelvic MRI findings altered clinical management of patients prior to uterine artery embolization in 4% of cases due to presence of intracavitary fibroids, endometrial polyps, non-enhancing fibroids, and adnexal mass.
(3) Endometrial biopsy findings changed management in 1% of cases due to presence of endometrial intraepithelial neoplasia and chronic endometritis.

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