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RESEARCH

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Transarterial embolization of uterine arteries in emerging dysfunctional uterine bleeding: a single-center case series study

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Abstract

Background Uterine artery embolization is proven to be an effective treatment for symptomatic uterine fibroids. Yet, its role in the management of dysfunctional uterine bleeding is still debatable. Patients with dysfunctional uterine bleeding have abnormal bleeding from the uterine vascular bed with variable underlying mechanisms. Uterine artery embolization will reduce/prevent bleeding by occlusion of the vascular bed, with subsequent cutoff of the effect of hormones on the endometrium. The aim of this work is to demonstrate the safety, efficacy and possible short-term complications of uterine artery embolization in the treatment of dysfunctional uterine bleeding (DUB) as a first-line treatment modality rather than the current treatment options (hormonal and surgical treatment).

Methods Thirty patients included in the study were clinically and laboratory diagnosed based on FIGO classification system (PALM-COEIN) as DUB, and the diagnosis was confirmed by MRI imaging. All patients were subjected to transcatheter uterine artery embolization with subsequent clinical and radiological follow-up to assess the treatment outcome.

Results Uterine artery embolization was able to control bleeding in patients diagnosed as DUB, with subsequent complete cessation of medical treatment; no surgical interference was needed with much less morbidity. We had 93.3% improvement in the frequency, volume of bleeding and 100% improvement of the presenting anemia. No significant change in uterine volume or in endometrial thickness has been noted.

Conclusions Uterine artery embolization is safe, effective procedure to control dysfunctional uterine bleeding with the preservation of the uterus especially in critical age groups.

Keywords Dysfunctional, Uterine bleeding, DUB, Embolization, Menstrual disturbance

Background

God blessed feminity with rhythm and cycle. H.C. Malhotra in his Book 'Menses and Health', stated, "Never neglect disorders of menstruation. Get these treated intelligently and you will have health and real happiness in life" [1]. Heavy menstrual and perimenopausal bleeding affects up to 30% of women throughout their reproductive lifetime [2]. Abnormal uterine bleeding (AUB) is any variation of the normal menstrual bleeding, in terms of regularity, frequency and duration as well as the amount of blood loss [3–5]. Also, it can be defined as excessive blood loss which interferes with the woman's physical, social, emotional and marital quality of life that can occur alone or in combination with other symptoms [6, 7].

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Dysfunctional uterine bleeding (DUB) is the most common cause of abnormal uterine bleeding [8]. It is usually found in the absence of obvious local organic disease, likely due to hormonal disturbance; reduced levels of progesterone cause low levels of prostaglandin F2 alpha that causes menorrhagia and increased levels of tissue plasminogen activator (TPA) leading to more fibrinolysis [9, 10].

The treatment strategy for DUB is almost medically by hormonal therapy, and the dose of combination hormonal therapy is based upon the patient age at time of presentation [11, 12]. It has been postulated that hormonal therapy will induce the growth of endometrium from rising levels of estradiol which has a healing effect on the endometrium.

Estrogen also affects the endometrium by decreasing capillary permeability and by increasing fibrinogen levels, clotting factors and platelet aggregation, which in turn promotes coagulation [13]. If medical treatment failed, the non-medical treatment options for patients with DUB are limited to UAE, endometrial ablation and hysterectomy [14]. Hysterectomy is carried out on 60% of women referred to secondary care with menorrhagia [15].

Uterine artery embolization (UAE) was firstly reported by Ravina 1995 [16]. Based on the pathophysiology of DUB (low levels of prostaglandin F2 alpha that causes menorrhagia and increased levels of tissue plasminogen activator (TPA) leading to more fibrinolysis) [9, 10], these changes occur locally within the endometrial bed; thus, occlusion of the vascular bed will reduce the likelihood of bleeding by interfering with these changes, i.e., interruption of the hormonal cascade.

Methods

This was a retrospective single-center case series study conducted between November 2022 and November 2023 and was approved by the ethics committee of our institution (approval number 970/11/2023).

Study participants

Patients were referred from the obstetrics and gynecology department; their ages ranged from 22 to 50 years. All patients were clinically diagnosed as dysfunctional uterine bleeding by a senior consultant gynecologist with 10-year experience after laboratory exclusion of other possible non-structural and systemic causes that may cause bleeding like coagulation disorders.

The patients were then subjected to pelvic MRI examination to determine the uterine volume and to exclude any possible uterine bleeding structural etiology by MRI imaging.

MRI protocol: Non-contrast T2 weighted imaging in three orthogonal planes angled to the uterine cavity, slice thickness < 4 mm, FOV 25 cm, high-resolution matrix.

MRI exams were evaluated independently by two consultant radiologists with at least 10-year experience.

All interventional procedures were carried by two consultant interventional radiologists, each of at least 5-year experience

The inclusion and exclusion criteria were as follows.

Inclusion criteria

- Adults with DUB, diagnosed after exclusion of other possible causes of bleeding.
- Age from 20 to 50 years old
- Patients with failed, non-compliant trial of hormonal medical treatment
- Patients refusing surgical interference or hysterectomy

Exclusion criteria

- Out of age range
- Patients with suspected other bleeding source like urogenital bleeding
- Focal cause of bleeding like endometrial lesions, fibroids or cervico-uterine malignancy
- Other medical conditions that may induce bleeding like hyper-thyroidism and coagulation disorders
- Contraindication for MRI examination
- Renal impairment or on regular dialysis
- Allergy to contrast medium
- Contraindication for MRI examination

After excluding patients out of criteria, thirty patients were included in our study.

For all patients, renal function, CBC, coagulation profile was done. MRI was the corner stone imaging modality, which was used as a baseline study for follow-up.

Philips BV Pulsera C-Arm with fluoroscopic capability was used for the procedure, the machine is capable of serial radiography and digital subtraction angiography.

Procedure

The patient was positioned supine in the interventional suite, and both groins were sterilized and draped. Unilateral femoral access was used in most cases using 6-Fr femoral sheath. Crossover of the aortic bifurcation to reach the contralateral iliac vessels was done, by using 0.035 hydrophilic guide wire (Radifocus Inc.) and 5-Fr Cobra catheter (Angiodynamic/Cordis, Queensbury, NY). There is more advancement by catheter over

a hydrophilic guide wire to reach the internal iliac artery anterior division, which is the origin of the uterine artery.

Anteroposterior and contralateral oblique DSA projections were taken.

In twenty-five out of the thirty cases, microcatheter was used to catheterize uterine artery (2.7 Fr Renegade ® Hi Flo™ Microcatheter Boston Scientific, Natick, MA, with a 0.027 in. inner diameter & 0.021 wire) due to sever tortuosity and difficult cannulation. When the catheter tip was placed in the transverse portion in the uterine artery, arteriography was done to confirm the proper selective catheterization of the uterine artery.

Embolization was done by using tri-acryl gelatin microspheres (Embosphere, Merit Medical, South Jordan, UT, USA) and/or polyvinyl alcohol particles (PVA, Merit Medical, South Jordan, UT, USA) or contour particles (Boston Scientific, USA); we started by 300–500 μm microspheres or 355–500 μm PVA particles for uterine bed embolization and then increased size up to 500–700 μm microspheres or 500–710 μm PVA particles for main uterine artery.

The endpoint of embolization was complete occlusion of the distal uterine spiral branches and endometrial bed vascularity with stasis of flow in the uterine artery. Once this point was reached, we usually wait 5 min to allow redistribution and allows more push of the particles by the arterial flow to confirm adequate stasis. Proximal withdrawal of the catheter and final internal iliac arteriogram is performed to verify completion of embolo-therapy.

Catheterization of the ipsilateral uterine artery is performed using Waltman's loop with selective catheterization of the ipsilateral uterine artery either with 5-Fr Cobra, Simmons catheters or microcatheter. Some patients required bilateral femoral artery access; this was attributed to difficulty to obtain Waltman's loop from ipsilateral side due to difficult anatomy with steep aortic bifurcation and difficult pelvic anatomy.

Post-procedural care

After the procedure, all patients were admitted in the obstetrics and gynecology department. During hospital stay, which usually ranged from one to two days based upon patient tolerance for pain after procedure, most care concerned about pain control, nausea and postoperative broad-spectrum antibiotic injection (Ceftriaxone) 1Gm for 2 days to avoid post-procedure infection.

Following UAE, patients may develop moderate to severe pelvic pain and cramps. It is essential to ensure that there was appropriate pain management. Patient-controlled analgesia either intravenous or oral medication regimens was used in all cases, and anti-inflammatory drugs as supplementary second line that may help in pain control of the post-UAE pain were added in some cases with severe pain. (We didn't depend on anti-inflammatory drugs only and thus we can't conclude its role solely.) Our regimen includes:

- Ketorolac 30 mg given before the procedure and after, and then 30 mg every 6 h intravenously (IV) as an inpatient
- Ibuprofen scheduled during post-procedure observation and opioid of choice available for several days after discharge

The decision regarding discharge must be made on a case-by-case basis based on the patient's level of comfort.

Follow-up was done clinically for improvement of the bleeding and radiologically by MRI, which was done at one, and six months after the procedure. Stoppage of bleeding and adequate clinical improvement were the crucial signs of treatment success.

Inadequate clinical improvement or bleeding recurrence on one-month follow-up usually required a second session of embolization done one month after the first session. Usually, second session of treatment should be preceded by a discussion with the patients, illustrating the ovarian collateral supply, which is the most common cause for treatment failure and discussing the drawback of more aggressive embolization during the second session that may result in ovarian compromise and may accelerate ovarian failure.

Statistical analysis

Data were tabulated. Data entry was done by SPSS version 25 and analyzed by the same software. The sensitivity, specificity and overall accuracy were calculated. The probability (p value) of less than 0.05 was used as a cutoff point for all significant tests.

Results

Thirty patients were included in the study during the period between November 2022 and November 2023; all were referred from the obstetrics and gynecology department; their ages ranged from 22 to 50 years old with mean age 36.2 years; five of them were at the post-menopausal period; and the rest were pre-menopausal. Eight patients were singles, and 22 were married. Twenty patients were multipara and having children (Table 1).

All patients were presented by abnormal uterine bleeding, variable degrees of anemia and related manifestations (Hb ranging from 5 to 10 g/dL, (56.6% of all patients); some required blood transfusion (46.6%) (Table 2).

Only one patient had comorbid mitral valve replacement, and she was under anti-coagulant therapy for life;

Table 1 Demographic data of the study group

Descriptive statistics (n = 20)			
	Range	**Mean**	**± SD**
Age	(22–50)	36.2	± 9.7
Menopause	Premenopausal	Postmenopausal	
	25 (83%)	5 (17%)	
Marriage	Single	Married	
	8 (27%)	22 (73%)	

Table 3 Patterns of abnormal bleeding in the studied group

Type of bleeding	**Menorrhagia**	**Menometrorrhagia**	**Polymenorrhea**
Number	12	14	4
Percentage	40%	46.6%	13.3%

the patient developed uterine bleeding that required uterine artery embolization as strong indication and an alternative treatment option to surgery for blood loss control (Table 2).

Different types of bleeding were encountered among the patients involved in the study, 14 patients (46.6%) had irregular acyclic heavy uterine bleeding (menometrorrhagia), 12 patients (40%) had regular cyclic heavy uterine bleeding (menorrhagia), and four patients (13.3%) had frequent menstruation occurring every 21 days or less (polymenorrhea) (Table 3).

During selective uterine artery angiography, we noticed hypertrophied endometrial bed vascularity with prominent distal spiral uterine arteries at uterine bed on both sides nearly in all cases (Fig. 1b, d).

No significant reduction in the uterine size was noted (more than 20% of its size) among the treated patients in spite of bulky uterine size in preoperative assessment; the range of uterine volumes was 47–410 cc (mean = 191.1 cc) on pre-embolization images compared to 47–350 cc (mean = 178.85 cc) on post-embolization images; this equals 6.7% reduction in uterine size. No further reduction of uterine size was recorded in the six-month follow-up. MRI was the cornerstone for follow-up to assess the changes in uterine size at one-month follow-up, compared with the pre-procedure images (Table 4).

All cases showed normal endometrial thickness in pre-embolization US and MRI with no significant change in endometrial thickness noted in all cases post-embolization during the follow-up periods (Figs. 2, 3).

The response was evaluated clinically; 28 out of 30 patients (93.3%) had complete treatment response with no more bleeding after the procedure till the end of the follow-up period with correction of anemia, while 2 patients (6.6%) had recurrence of bleeding (Table 5).

Patients were evaluated clinically post-embolization, regarding the bleeding by a questionnaire about improvement and regularity and amount of their cycles. Local assessment was also done searching for local post-procedure complications as well as follow-up by MRI, and the evaluation was focused on assessment of uterine size and any developed uterine parenchymal changes and monitoring of postoperative complications.

Table 2 Preoperative presentation and co-morbidities

Bleeding	**Anemia**		**Blood transfusion**		**Associated systemic disease**	
All	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
30 (100%)	13 (43.3%)	17 (56.6%)	16 (53.3%)	14 (46.6%)	26 (86.6%)	4 (13.3%)

(See figure on next page.)

Fig. 1 (Case 1) 32-year-old patient, complaining from menometrorrhagia diagnosed as DUB. **A** longitudinal ultrasound images showing bulky uterus measuring 8 × 5.7 × 5 cm in diameters. Endometrial thickness = 8 mm which is seen slightly gapped. No fibroids or endometrial lesions. **B** Pre-embolization DSA images. Left image: catheterization of the contralateral left internal iliac artery showing the left uterine artery (white arrow). Right image: selective catheterization of the left uterine artery showing evident dilated tortuous left uterine artery with opacification of the uterine vascular bed which is pathologically dilated (black arrows). **C** Post-embolization DSA image showing complete occlusion of the distal uterine artery and its vascular bed. **D** DSA images. Left image: catheterization of the ipsilateral right internal iliac artery using Waltman's loop showing the right uterine artery (white arrow). Right image: pre-embolization DSA image: selective catheterization of the right uterine artery which is seen dilated and tortuous with opacification of the uterine vascular bed which is pathological dilated and engorged (black arrows). **E** Post-embolization DSA images showing complete occlusion of the distal right uterine artery and its vascular bed with preserved patency of cervico-vaginal branch (white arrow). **F** Post-embolization sagittal T2W MRI follow-up images 1 month after embolization showing bulky uterus with no significant reduction of uterine size and diffused increase in myometrial signal intensity mostly due to post-embolization ischemia

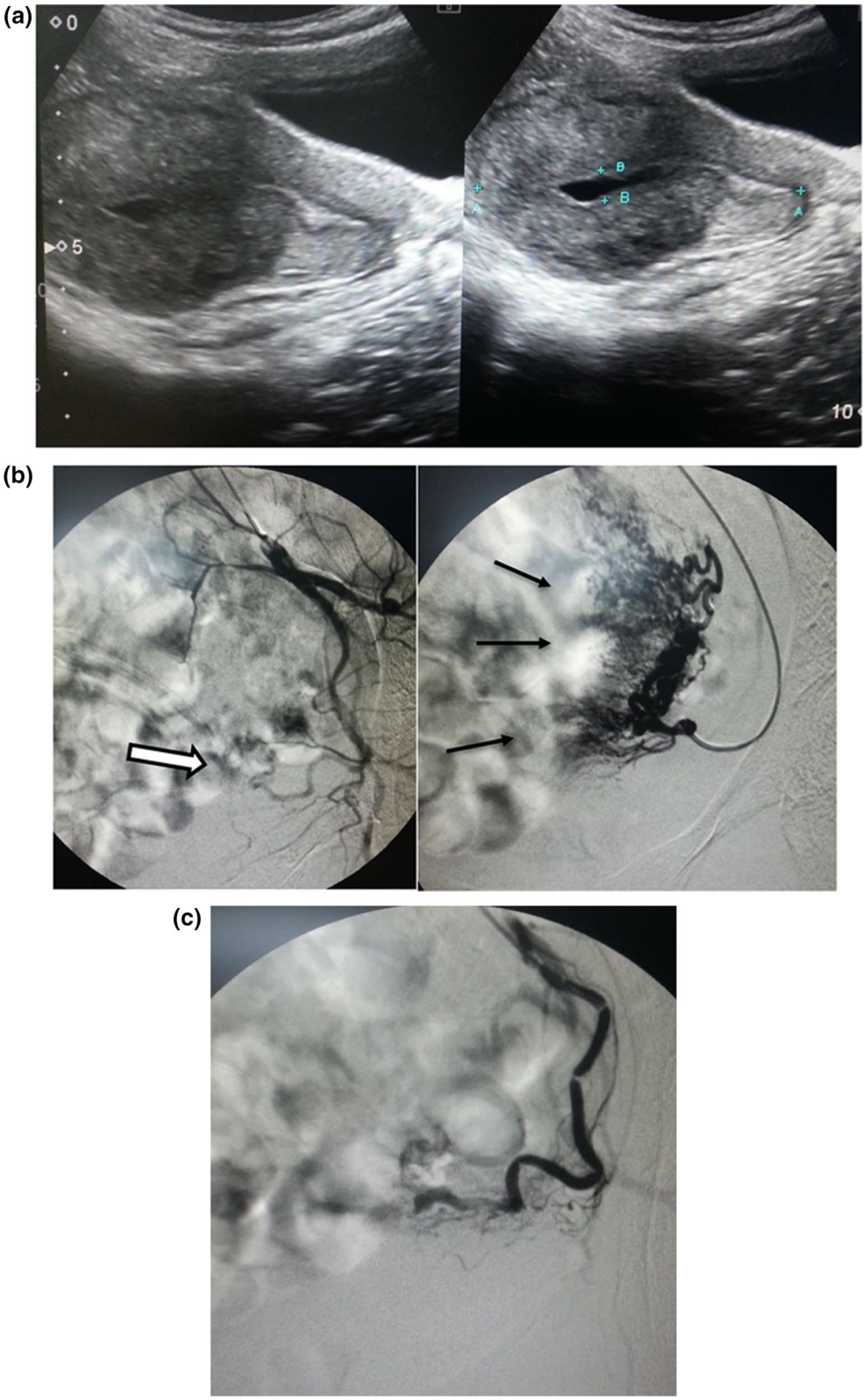

Fig. 1 (See legend on previous page.)

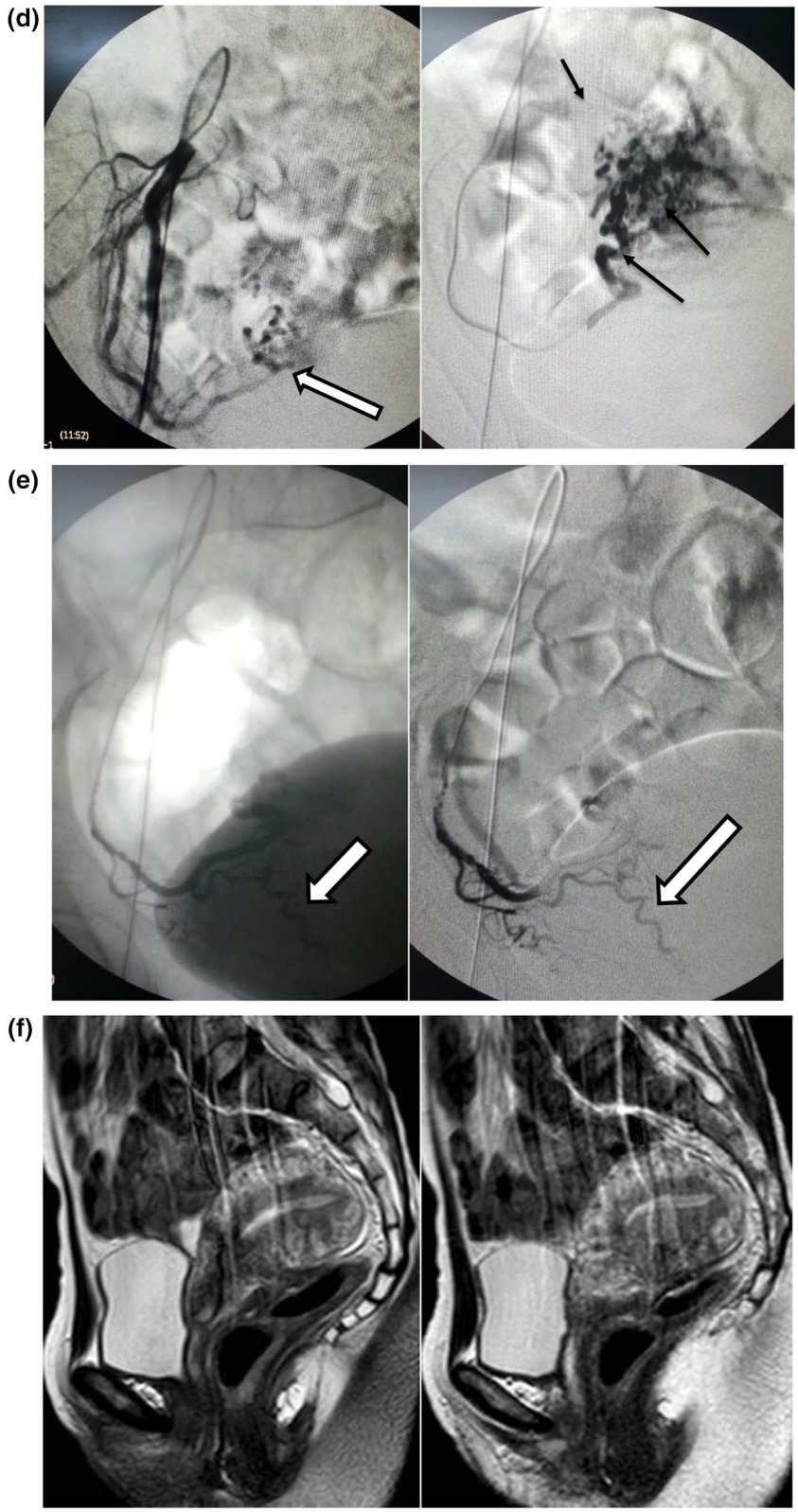

Fig. 1 continued

Table 4 Uterine size pre- and post-embolization in the study group

Uterine volume			
Pre-treatment		**Post-treatment**	
Range	**Mean ± SD**	**Range**	**Mean ± SD**
(47–410)	191.1 ± 102.4	(47–350)	178.85 ± 99.47

Of the thirty patients with DUB included in the study, 26 (86.6) of them had bilateral uterine artery embolization and only 4 patients (13.3%) had unilateral uterine artery embolization (Table 6).

Although UAE is relatively safe procedure, like any endovascular procedure it has its own complications, we encountered some complications, and most of them were in the acceptable range and treated conservatively

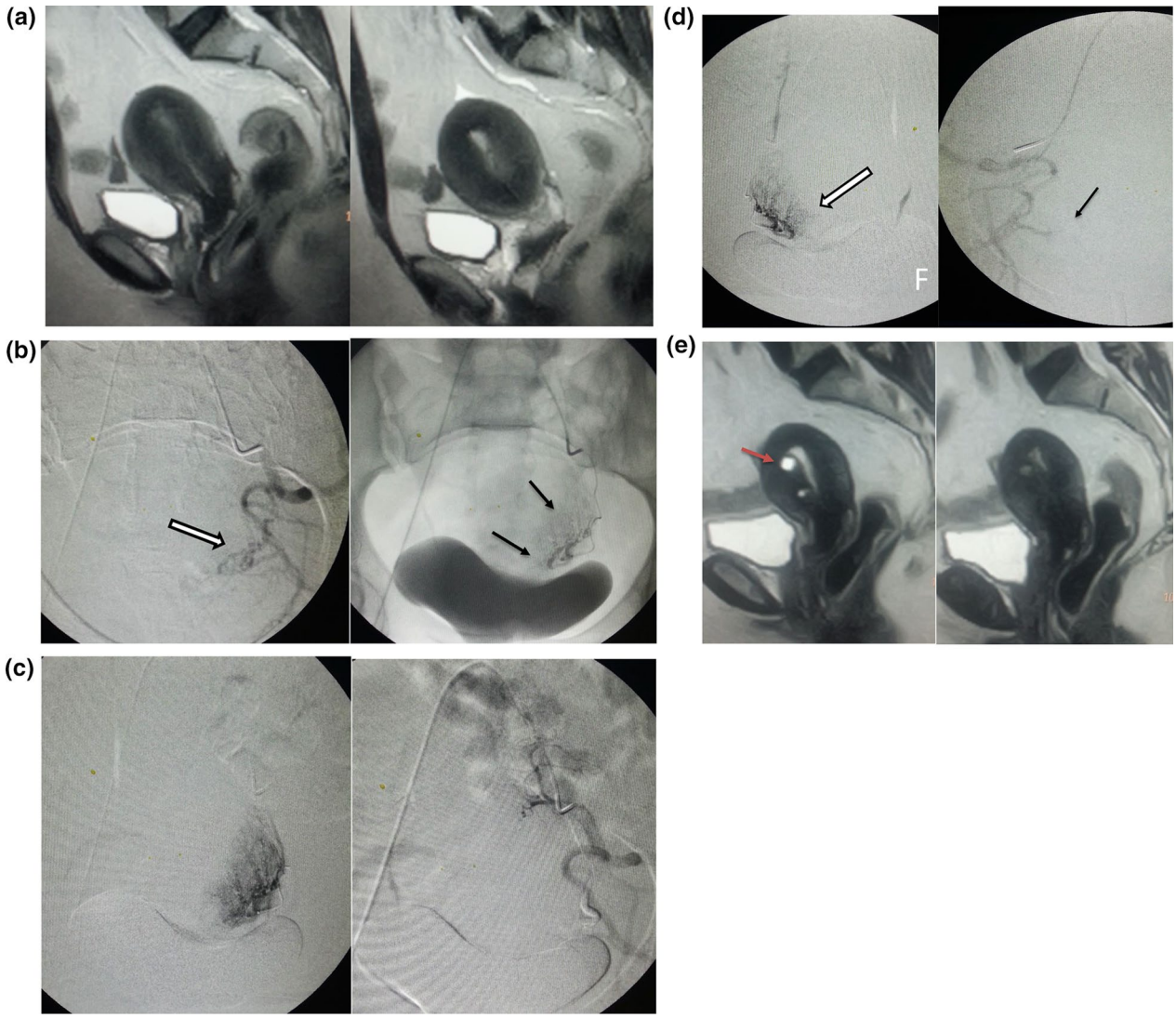

Fig. 2 (Case 2) Premenopausal 43-year-old patient, complaining from menometrorrhagia diagnosed as DUB. **A** Sagittal T2W MRI images showing average-sized uterus with normal endometrial thickness and no uterine fibroids. **B** DSA images, left image: contralateral catheterization of the left internal iliac artery showing the left uterine artery (white arrow). Right image: Pre-embolization DSA image showing selective catheterization of the left uterine artery showing tortuous uterine vascular bed (black arrows). **C** DSA images, left image: pre-embolization DSA image with selective catheterization of the left uterine artery showing engorged tortuous left uterine vasculature with opacification of the uterine vascular bed. Right image: post-embolization DSA image showing complete occlusion of the distal part of the uterine artery and its vascular bed. **D** Right image: pre-embolization DSA image showing selective catheterization of the right uterine artery showing engorged tortuous uterine vascular bed (white arrows). Left image: post-embolization DSA image showing complete occlusion of the distal part of the uterine artery and its vascular bed (black arrows). **E** Post-embolization sagittal T2W MRI follow-up images 6 months after embolization showing no significant reduction of uterine size, with small cystic changes seen at the anterior uterine wall junctional zone mostly due to ischemic necrosis (red arrows)

with no need for any surgical interference. Complications were divided into minor and major complications;

1. Minor complications: two patients had post-embolization syndrome in the form of post-procedure abdominal and pelvic pain, transient vomiting and fever. One patient only developed post-procedure pelvic infection with infected vaginal discharge. No puncture site hematoma was encountered. No endometritis or pyometra was recorded in our study.
2. Major complication that required surgical consultation: one patient had non-targeted embolization and shortly after the procedure she developed severe gluteal pain followed by bilateral buttocks ischemic patches and skin ulcers; this patient required surgical debridement with no need for grafts.

Post-procedure recurrence of bleeding occurred in two patients (6.6%) recently after the procedure (within 3 months after embolization), in both patients unilateral uterine artery embolization was done due to difficult access. One of them required a second session to control bleeding, and the other one refused to repeat the technique again (Table 7).

Discussion

Avicenna (Abu al Hussain ibn Sina), the eleventh-century Persian scholar, philosopher, and physician, in the first book of his Canon of Medicine writes about a situation where "menstruation is profuse and is arrested with difficulty" [19]. Dysfunctional uterine bleeding is defined as a state of abnormal uterine bleeding without any clinically detectable organic, systemic, and iatrogenic cause (pelvic pathology, e.g., tumor, inflammation or pregnancy is excluded) [20].

Since it was firstly described in 1995, UAE is known to obstetric and gynecologists (OBGs) as a preoperative procedure to reduce intraoperative blood loss or to treat post-partum and post-surgical bleeding [21]. Over the recent decades, UAE has become an accepted alternative treatment option for women with symptomatic fibroids to avoid surgical intervention; however, there are a large number of women complaining of uterine bleeding with no gross or focal intrauterine pathology and they are diagnosed as dysfunctional uterine bleeding, in spite of long-term hormonal treatment.

Dysfunctional uterine bleeding is caused by an ovulatory cycle that results in high estrogen levels with no progesterone, and continuous estrogen stimulation causes endometrial proliferation and blood supply overgrowth. By the end, the endometrium slough with persistent high estrogen level and partial healing also occur in some parts, so there is always healing with alternating sloughing, resulting in menometrorrhagia [22].

Currently, the role of UAE in the management of menorrhagia has been proved to be effective in the treatment of uterine fibroids. EMMY trial showed good results up to 70% of the treated patients who were randomized to the UAE did not require a hysterectomy up to 5 years of follow-up [23, 24].

Patients with DUB have almost similar endometrial vascular bed and clinical manifestations, which is almost menometrorrhagia like those in patients with uterine fibroids; the question was why UAE did not have been used extensively in treatment of patients with DUB; hence, the idea to treat DUB patients came, aiming for de-vascularization of the endometrial outgrown vascularity which can lead to reduction of blood loss and control bleeding; and this was relatively confirmed during uterine artery angiography that showed an increase in the caliber and flow of the uterine artery [15].

During selective uterine artery angiography, we noticed hypertrophied endometrial bed vascularity with prominent distal spiral uterine arteries at uterine bed on both sides nearly in all cases; however, no pathological blush was seen at all cases, which is matching with the pathophysiology of the disease (DUB) that affects the endometrial bed (angiogenesis and outgrown vascularity).

Studies on monkeys have shown that tortuous uterine arteries are only an anatomical variation which is not an indicator for uterine pathology in all cases, that is

(See figure on next page.)

Fig. 3 (Case 3) Premenopausal 45-year-old patient, complaining from menorrhagia, diagnosed as DUB. **A** DSA images, left image: DSA image showing contralateral catheterization of the left internal iliac artery showing the left uterine artery (white arrow). Right image: pre-embolization DSA image with selective catheterization of the left uterine artery showing evident pathologically tortuous left uterine artery with opacification of the uterine vascular bed (black arrows). **B** Left image: DSA image during embolization showing marked reduction of uterine artery vascularity as well as non-opacified uterine vascular bed. Right image: post-embolization DSA image showing complete occlusion of left uterine artery and its vascular bed. **C** Pre-embolization DSA images showing selective catheterization of the right ipsilateral uterine artery showing evident pathologically tortuous right uterine artery with opacification of the uterine vascular bed (black arrows). **D** Left image post-embolization DSA image showing complete occlusion of distal uterine artery vascularity and its vascular bed. Right image: follow-up sagittal T2W MRI image showing insignificant reduction of uterine size six months after embolization

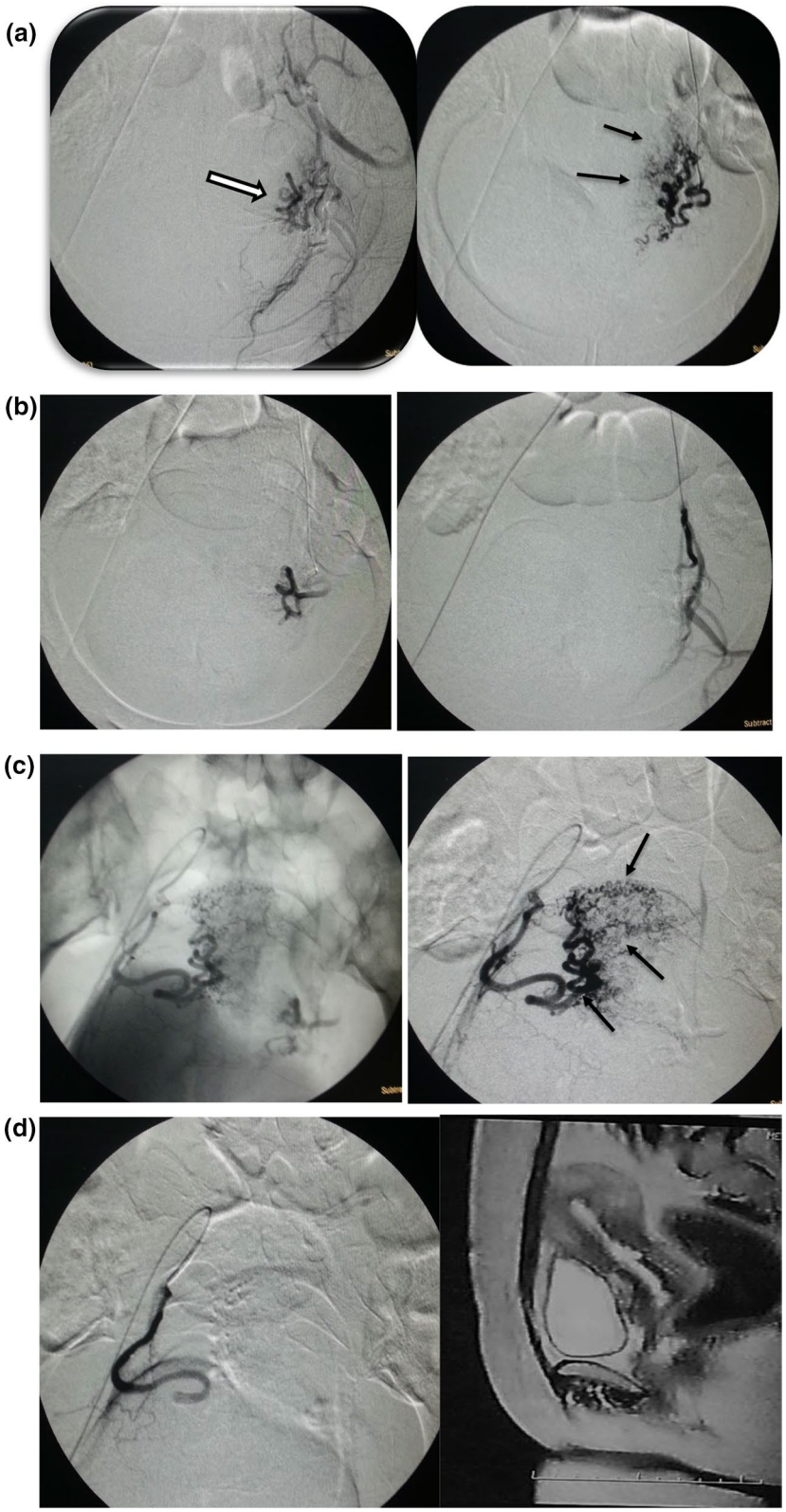

Fig. 3 (See legend on previous page.)

Table 5 Post-treatment response (bleeding and anemia)

Symptom (n)	Improved	Unchanged/recurrent
Bleeding (30)	28 (93.3%)	2 (6.6%)
Anemia (17)	17 (100%)	0 (0%)

Table 6 Number of unilateral and bilateral UAE among the study group

	Bilateral UAE	Unilateral UAE
Number	26	4
Percentage	86.6%	13.3%

Table 7 Post-procedure complications

Minor complication			Major complications		
Post-embolization syndrome	Puncture site hematoma	Pelvic infection	Untargeted embolization	Ovarian failure	Bleeding recurrence
2 (6.6%)	0	1 (3.3%)	1 (3.3%)	0	2 (6.6%)

why it is not a standard to embolize the uterine artery based on it being tortuous but based on clinical indications like menorrhagia and chronic blood loss [28].

The ages of patients involved in the study ranged from 22 to 50 years old with mean age of 36.2 years; five of them were in the post-menopausal period, and the rest were pre-menopausal. All patients were presented by dysfunctional uterine bleeding (DUB), 17 patients (56.6% of all patients) sought medical advice because of anemia and related manifestations secondary to chronic blood loss (Hb < 10 g/dL), and 14 patients required blood transfusion (46.6%).

Of the thirty patients with DUB included in the study, 26 of them had bilateral uterine artery embolization and only 4 patients had unilateral uterine artery embolization, which is attributed to difficult access or severely tortuous uterine artery which made its selective cauterization to be difficult in 3 cases, while in the 4th case we did unilateral embolization intentionally due to dominant uterine artery in one side and the other one on opposite side was small, not dilated and less dominant.

Compared with UAE for fibroids, angiographic exploration of pelvic vasculatures was the most crucial step in DUB to roll out which artery is dominant to be used as a route to de-vascularize the endometrial vascular bed, avoiding the less dominant one to save the uterus by reducing the extent of uterine ischemia and necrosis. While bilateral was done in patients with profuse uterine blood supply and heavy bleeding, also the end point of embolization was not to occlude the uterine artery main stem, and occluding the vascular bed was our aim.

For DUB, there was no predilection for a specific embolizing material, PVA particles & microspheres (Embosphere) were used, particle size used was 250-355 μm, 355–500 μm, 500–710 μm regarding PVA, 300–500 μm, and 500–700 μm regarding embosphere. The small-sized particles were used for embolizing distal endometrial bed vascularity, while larger particles were used for proximal uterine arteries.

Twenty-eight patients (93.3%) had complete treatment response with no more bleeding after the procedure till the end of the follow-up period, with correction of anemia in all patients presented with anemia (17 patients (100%)), while 2 patients (6.6%) had recurrence of bleeding, in both patients unilateral uterine artery embolization was done due to difficult access which indicated that adequate occlusion of endometrial bed vascularity by bilateral embolization is mandatory for treatment success in DUB cases like fibroid cases, all patients with DUB were closely monitored postoperatively, and the absence of short-term complication forces us to continue treatment strategy.

There was no significant reduction of uterine size noted at the post-procedure follow-up imaging, this may be attributed to that there is no focal pathology made uterine volume large and arterial occlusion was not that aggressive as in those with uterine fibroids, and the occlusion of the uterine bed was the target to reduce the impact of ischemia on the myometrium, saving the uterus for further future pregnancy; that is why the uterine size had no comparable difference in the size at the pre- and post-embolization imaging.

All cases showed normal endometrial thickness in pre-embolization images with no significant change in endometrial thickness noted in all cases post-embolization during the follow-up periods which indicate that no significant endometrial ischemia had happened after embolization.

Most of the encountered complications were at the acceptable range and treated conservatively, and two patients had post-embolization syndrome. Only one patient developed mild post-procedure pelvic infection with infected vaginal discharge. No puncture site hematoma was encountered. One patient had non-targeted embolization, we had no definite explanation, and few days after treatment patient started to complain from buttocks pain and gluteal ulcer started to appear, so our explanation was non-targeted embolization which may be because some embolic particles had reached or refluxed to the inferior gluteal artery.

Post-procedure recurrence of bleeding occurred in 2 patients (6.6%) recently after the procedure (within 3–6 months after embolization). No ovarian failure symptoms or amenorrhea were noted in our study.

In a study by Manyonda et al. 2012 [26], minor complications were reported in nine women (13.2%) which were usually related to post-embolization syndrome, including pyrexia, pain, and increased analgesia requirement as well as UTI. Major complications occurred at two (2.9%) patients at 1-year follow-up. Treatment failure reported at nine patients (14.8%) requiring repeat intervention (six hysterectomies, two myomectomies, and one repeat embolization after an initial unilateral embolization) for continued or recurrent symptoms.

In a study by Smeets et al. 2006 [27], adverse events were limited. Temporary amenorrhea following UAE was reported in 17% and permanent amenorrhea in 3%, all 3 women who developed permanent amenorrhea were over 45 years of age, vaginal dryness was not reported by any of the responders in this study, vaginal discharge was reported by only 2 women as a new symptom after UAE, and vaginal expulsion of a fibroid occurred in 4 (4%) patients without further complications.

Limitation of the study

- Being a single-center case series study, more multicentric, randomized trials are needed to generalize the results
- Short-term follow-up of the treatment response and longer follow-up are needed
- No DSA follow-up was done to ensure stable occlusion of the uterine arteries.
- In vivo hormonal assessment may be required in further studies

Conclusions

We postulate that there may be a possible role for UAE in the management of DUB in women who desire conservation of fertility and uterine preservation or in patients who are not fit for surgical interference and not responding to medical treatment especially in critical age groups. Also it may play an important role in virgin (non-married) patients with DUB and seeking for non-surgical management.

However, further studies will need to be performed to ascertain the effectiveness of UAE in the management of DUB and to determine long-term rate of bleeding recurrence after embolization.

Abbreviations

UAE Uterine artery embolization
OBGs Obstetric and gynecologists
DUB Dysfunctional uterine bleeding
DSA Digital subtraction angiography
MRI Magnetic resonance imaging

Acknowledgements

Not applicable.

Author contributions

TEE and ASI carried out the procedure, study design, statistical analysis, imaging reading and analysis as well as editing of publications/presentation. TEE carried out imaging reading and analysis in addition to editing of publications. MFA and MAM carried out data collection, imaging analysis and editing of publications. All authors read and approved the final manuscript.

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The study had no funding from any resource.

Availability of data and materials

The datasets used and analyzed during the study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the Research Ethics Committee of the Faculty of Medicine, Minia University, on November 2023; reference number of approval: (970/ 11/ 2023). All cases gave written informed consent to participate in the research.

Consent for publication

All patients included in this study gave written informed consent for data publishing contained within this study.

Competing interests

The authors declare that they have no competing interests.

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