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Uterine Artery Embolization as an Alternative to Hysterectomy, in Patients with Uterine Myomas

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Abstract

Uterine artery embolization (UAE) is a minimal invasive technique that uses transcatheter common femoral artery approach to block uterine blood supply.

The aim of the procedure is to occlude or markedly reduce blood flow in both uterine arteries at the arteriolar level. This causes irreversible ischemia and leads to necrosis and subsequent shrinkage of uterine myomas.

In current clinical practice, uterine artery embolization represents an acceptable alternative to hysterectomy and myomectomy.

Keywords: Uterine artery embolization, selection criteria, effectiveness, complications

1. Introduction

Uterine artery embolization (UAE) is a minimal invasive technique that uses transcatheter common femoral artery approach to block uterine blood supply.[1] It is based on established techniques for treating pelvic bleeding.[2]

It was first described in 1976, for the treatment of abnormal uterine bleeding in patients with gynecological malignancies.[3] Several years later, in 1994, UAE has been used preoperatively in patients with uterine myomas in order to reduce intraoperative blood loss and decrease transfusion requirements.[1, 4, 5] One year later, in 1995, UAE was introduced in patients with uterine myomas as an alternative approach to avoid surgical operation.[1, 4]

In recent years, UAE represents an acceptable alternative to hysterectomy and myomectomy. [2, 6-8]

2. Technique

The procedure is usually performed under intravenous conscious sedation. Using the transcatheter unilateral common femoral artery approach where both uterine arteries are selectively catheterized with a catheter or micro-catheter.[1, 4]

Following the sterile preparation of the right groin and local anesthesia, an arterial sheath (4–6 French) is introduced in the right common femoral artery using the Seldinger technique.[4] An angiography is then performed, in order to manipulate a visceral angiography catheter into the left internal iliac artery [Figure 1].[4]



Figure 1. After insertion of the sheath, an angiography is performed to manipulate a visceral angiography catheter into the contralateral internal iliac artery.

Thereafter, a new angiography is performed in the contralateral oblique projection in order to identify the origin of the left uterine artery.[4] Then, the angiography catheter, or a micro-catheter, is placed into the transverse segment of the left uterine artery [Figure 2].[4, 9] If it is technically feasible, the catheter tip should be placed beyond the origin of the cervicovaginal branch, excluding it from embolization.[4, 9]

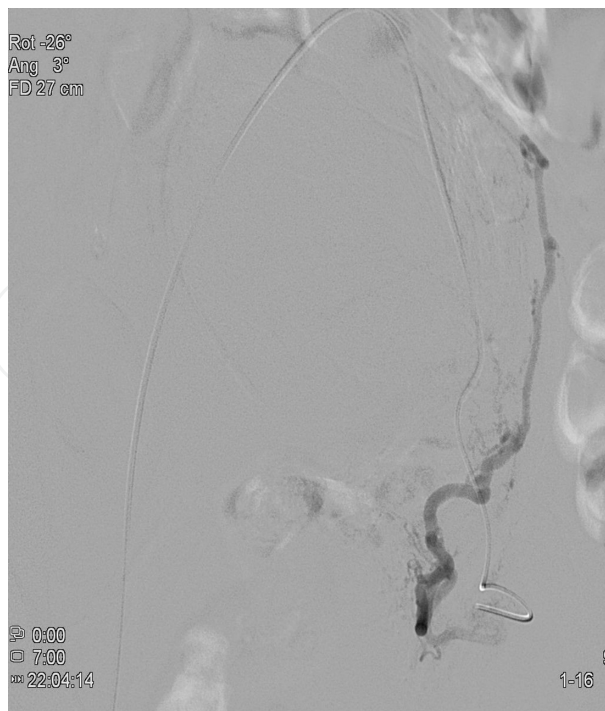


Figure 2. The angiography catheter or micro-catheter is illustrated, placed in the transverse segment of the uterine artery distal to the origin of cervicovaginal arteries.



Figure 3. Following the correct positioning of the catheter or micro-catheter and under angiographic control, an embolic agent is then injected and UAE is performed.

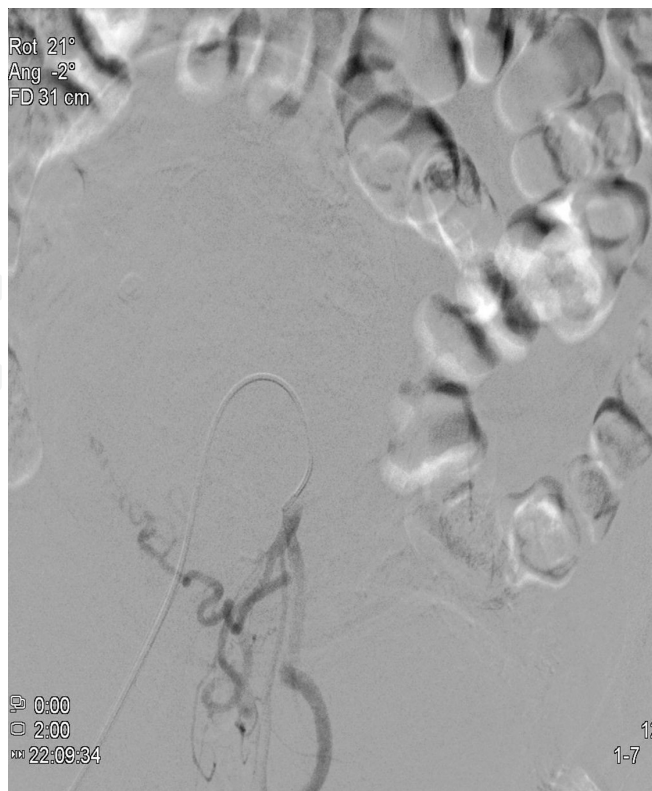


Figure 4. Subsequently the angiography catheter is manipulated into the ipsilateral internal iliac artery.



Figure 5. Finally the angiography catheter is placed in the lumen of the ipsilateral uterine artery.

Following the correct positioning of the catheter or micro-catheter and under angiographic control, an embolic agent (trisacryl gelatin microspheres, spherical polyvinyl alcohol) is injected and UAE is performed [Figure 3].[1, 2, 4, 9-11]

Subsequently, the angiography catheter is manipulated into the right internal iliac artery and placed in the right uterine artery [Figures 4, 5]. If this is not made possible, then the left common femoral artery is punctured and the procedure repeated.

Finally, when UAE has been completed, the catheter and sheath are removed. Hemostasis of the common femoral artery is achieved with manual compression.

The aim of UAE is to occlude or markedly reduce the blood flow in both uterine arteries at the arteriolar level.[2] This causes irreversible ischemia and leads to necrosis and the subsequent shrinkage of uterine myomas.[1, 2, 12]

3. Selection criteria

3.1. Indications

UAE is an alternative to hysterectomy in patients with uterine myomas.[2, 13] It is performed on appropriately selected patients who wish to preserve their uterus and avoid a surgical operation.[4, 6, 7, 10, 11, 13, 14]

A point of special interest is that UAE can be performed in patients with relevant co-morbidities (obesity, coronary artery disease) and increased perioperative risk for hysterectomy.[2, 7, 8]

Moreover, it can be performed on patients who refuse blood transfusion (for health concerns or religious reasons).[13]

3.2. Contraindications

Conditions that represent absolute contraindications for an UAE procedure are: pregnancy, active pelvic inflammatory disease, or other pelvic infection, genital cancer, history of pelvic radiation and impaired immune status [Table 1].[2, 4, 6, 10, 11, 14, 15]

Absolute contraindications	Relative contraindications
pregnancy	severe vascular disease limiting access
active pelvic inflammatory disease	severe allergy in radiographic contrast media
other pelvic infection	coagulopathy
genital cancer	impaired renal function
history of pelvic radiation	desire for future fertility
impaired immune status	

Table 1. Contraindications for uterine artery embolization.[2, 4, 6, 10, 11, 14-16]

Relative contraindications for UAE procedure are: severe vascular disease limiting access and catheter manipulations, severe allergy in radiographic contrast media, coagulopathy, impaired renal function, and desire for future fertility [Table 1].[2, 4, 6, 10, 11, 14-16]

The size and location of uterine myomas should also be considered in the patient selection process.[2]

4. Treatment advantages

UAE is a safe and effective technique for appropriately selected patients.[4, 6, 10, 14] It is a percutaneous procedure that involves no general anesthesia and no surgical incisions.[13]

The mean operative time is significantly shorter for patients treated with UAE than for hysterectomy patients (79 minutes vs. 95.4 minutes).[17, 18]

Intraprocedural blood loss is significantly less among patients treated with UAE, than among hysterectomy patients (30.9 ml vs 436.1 ml).[17, 18] As a result, blood transfusion requirements are significantly lower for patients treated with UAE than for hysterectomy patients (0% vs. 10–13.3%).[17-19]

Postoperative pain score during the first 24 hours is significantly less for patients treated with UAE than for hysterectomy patients.[17, 20, 21] However, postoperative pain during the entire hospital stay did not differ between the two groups (88.9% vs. 94.7%).[17, 18, 20, 21]

Febrile morbidity during hospital stay is significantly less common among patients treated with UAE than among hysterectomy patients (4.9% vs. 20%).[17, 18]

The length of hospital stay is significantly shorter for patients treated with UAE, than for hysterectomy patients (1–2 vs. 5–5.85 days).[13, 14, 17-19, 21] Recovery and return to normal activities are significantly swifter for patients treated with UAE than for hysterectomy patients (28.1 days vs. 63.4 days).[13, 14, 17-21]

The overall satisfaction rate among patients treated with UAE is high (80%–90%), comparing well with the satisfaction rate among hysterectomy patients.² [13, 14, 17, 21, 22]

5. Treatment effectiveness

For the majority of patients treated with UAE, there is a substantial improvement in terms of symptoms and in quality of life aspects.[2, 4, 6, 10, 21] More specifically, there is reduction in bulk symptoms (88%–92%), elimination of abnormal uterine bleeding (>90%) and successful control of symptoms (75%).[2, 19]

Postoperatively among patients treated with UAE, there is a significant reduction in leiomyoma (50%–60%) and uterine (40%–50%) volumes.[2, 13, 19, 23] In the majority of cases, the

reduction in leiomyoma and uterine volumes becomes noticeable in several weeks and sustains for 3–12 months after UAE.[2, 13, 23]

The effect of UAE on ovarian reserve is not well-established.[24] Follicle stimulating hormone (FSH) levels have no significant differences between patients treated with UAE and hysterectomy patients.[24]

A forthcoming pregnancy is feasible in patients treated with UAE.[25, 26] However, close monitoring of the placental status is recommended.[25]

6. Postoperative complaints

Postoperative symptoms (bleeding, pain, and pressure complaints) during the first 6 weeks among patients treated with UAE are slightly more common than among hysterectomy patients.[17, 18, 20, 21]

The readmission rate during the first 6 weeks for patients treated with UAE, is 11.1%; significantly higher than what it is for hysterectomy patients.[17, 18] However, since most readmissions in patients treated with UAE occurred at a time when patients treated with hysterectomy had not been yet discharged from the hospital, that figure might actually represent an overestimation.[18]

Readmissions for patients treated with UAE are mostly for: pain (22.2%), febrile morbidity (22.2%), or a combination of both (44.4%).[17, 18] Most of them occurred within the first week after discharge (77.8%), underlining the need for adequate postoperative follow-up during this period.[18]

Unscheduled hospital visits during the first 6 weeks are more common among patients treated with UAE than in patients treated with hysterectomy (32.5%–37% vs. 20%–25.3%).[17-19]

7. Treatment failure

The secondary intervention rate at 2 years of follow up is significantly higher among patients treated with UAE than among hysterectomy patients (23.5% vs. 8.0%).[17, 21, 23]

The secondary intervention rate at 5 years of follow up is significantly higher among patients treated with UAE than among hysterectomy patients (28.4% vs. 10.7%).[17, 21, 22]

Most of the secondary interventions on patients treated with UAE (77.2%) occur during the first 2 years of follow up.[14, 17, 22, 23]

There are many possible reasons for a UAE failure.[13, 27] Perhaps an incomplete uterine artery infarction results in regrowth of uterine myomas despite an initial reduction.[13, 27] Otherwise, UAE preserves apparently normal myometrium that may give rise to new uterine myomas.[13]

8. Complications

8.1. Intraprocedural complications

Overall, the intraprocedural complication rate does not differ significantly between patients treated with UAE and hysterectomy patients (8.6%–25% vs. 2.7%–20%).[17-19]

	Intraprocedural complications	Early postprocedural complications	Late postprocedural complications
Major complications	pulmonary embolism	pneumonia	
		sepsis	
		deep venous thrombosis	
		fibroid expulsion (requiring reintervention)	
		death	
		uterine necrosis	
		non-target embolization	
		vesicouterine fistula	
		small bowel volvulus	
		acute renal failure	
Minor complications	arterial spasm	vaginal discharge	permanent amenorrhea
	postpuncture hematoma	pain/fever (requiring readmission)	transient amenorrhea
	nerve injury at puncture site	fibroid expulsion (not requiring intervention)	prolonged vaginal discharge
	allergy in radiographic contrast media	postpuncture hematoma	
	nephrotoxicity	urinary tract infection	
	uterine artery dissection during catheterization	urinary retention	
	gluteal artery perforation	renoureteral colic	
	formation of blood clot in the gluteal artery	urinary incontinence	
		endometritis	
		hot flashes	
		thigh paresthesia	

Table 2. Complications in patients treated with uterine artery embolization.[2, 11, 13, 18, 19]

The intraprocedural *minor* complication rate is significantly lower among patients treated with UAE than among hysterectomy patients (22.2% vs. 30.7%).[18] The most common intraprocedural *minor* complications in patients treated with UAE are: arterial spasm, postpuncture

hematoma, nerve injury at the puncture site, allergy in the radiographic contrast media, nephrotoxicity, and uterine artery dissection during catheterization [Table 2].[2, 11, 13, 18, 19] Other rare intraprocedural *minor* complications are: gluteal artery perforation and formation of blood clot in the gluteal artery [Table 2].[2, 11, 13, 18, 19]

The intraprocedural *major* complication rate has no significant differences between patients treated with UAE and hysterectomy patients (1.2% vs 1.3%).[18] Pulmonary embolism represents the most common intraprocedural *major* complication for patients treated with UAE [Table 2].[18]

8.2. Early postprocedural complications (up to 6 weeks)

Overall, the early postprocedural complication rate is significantly higher among patients treated with UAE than among hysterectomy patients (72% vs. 45%).[19]

The early postprocedural *minor* complication rate is significantly higher among patients treated with UAE, than among hysterectomy patients (58% vs. 40%).[18] The most common early postprocedural *minor* complications among patients treated with UAE are: vaginal discharge, pain/fever (requiring readmission), fibroid expulsion (not requiring intervention), postpuncture hematoma, urinary tract infection, urinary retention, renoureteral colic, urinary incontinence, endometritis, hot flashes, and thigh paresthesia [Table 2].[2, 11, 13, 18, 19]

The early postprocedural *major* complication rate is also higher among patients treated with UAE than among hysterectomy patients (3.7% vs. 1.3%).[18] The most common early postprocedural *major* complications among patients treated with UAE are: pneumonia, sepsis, deep venous thrombosis, and fibroid expulsion (requiring reintervention) [Table 2].[11, 18, 19] Other rare early postprocedural *major* complications are: death (secondary to septic shock, pulmonary embolism, non-target embolization), uterine necrosis, non-target inadvertent embolization (buttock necrosis, labial necrosis), vesicouterine fistula, small bowel volvulus, and acute renal failure [Table 2].[2, 13, 28]

8.3. Late postprocedural complications (up to 6 months)

The most common late postprocedural minor complications after UAE are: permanent amenorrhea (3.9%) and prolonged vaginal discharge (2%–17%) [Table 2].[2, 11, 13, 18, 28]

Transient amenorrhea after UAE is usually limited to a few cycles and it is not considered as a genuine complication.[2] Permanent amenorrhea after UAE occurs much more frequently in patients older than 45 years.[2, 13]

9. Postembolization syndrome

The syndrome is characterized by the occurrence of: pelvic pain, low-range pyrexia, nausea, vomiting, loss of appetite, and malaise.[2, 13] It primarily occurs the first few days after the procedure.[2, 13] It has a variable degree of intensity.[2]

It probably results from the release of cytokines related to ischemia and necrosis of uterine myomas.[2]

The postembolization syndrome is not considered as a complication of the UAE procedure.[2] However, in many cases it can result in prolonged hospitalization (beyond 48 hours), readmissions, and unexpected increase in the required level of care.[11]

10. Pregnancy after UAE

Full-term pregnancy is feasible for patients treated with UAE.[25, 26] However, there is increased risk of obstetric complications (miscarriage, abnormal placentation, preterm labor, malpresentation, and postpartum hemorrhage) for patients treated with UAE.[13, 25, 26, 29]

In particular, close monitoring of placental status is recommended for pregnant patients following UAE.[25, 26]

11. Conclusion

It is obvious that nonsurgical management of uterine myomas has shown promising results, simplifying or eliminating the need for surgical intervention in carefully selected patients.[7] However, it is not the treatment of choice for infertile women and for women wanting to preserve future childbearing capability. [7, 8 30]

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We declare that we have no conflict of interest.

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