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CLINICAL ARTICLE

The evaluation of uterine artery embolization as a nonsurgical treatment option for adenomyosis

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ABSTRACT

Objective: To evaluate the safety and efficacy of uterine artery embolization (UAE) for the treatment of adenomyosis. *Methods:* A prospective study was performed at Yuhuangding Hospital, China, between January 2012 and December 2013, enrolling premenopausal patients diagnosed with adenomyosis. All patients were treated with bilateral UAE using 500–700-μm tris-acryl gelatin microspheres. At baseline, and 3, 6, and 12 months after UAE, magnetic resonance imaging was used to assess uterine volume and patient-assessed improvements in dysmenorrhea were recorded. Any complications and adverse events were reported. *Results:* In total, 117 patients with adenomyosis were enrolled. The bilateral UAE procedure was successful in 115 (98.3%) patients, who were able to return to normal activity within 1 week of treatment. At 12-month follow-up, a median 51.0% reduction in uterine volume from baseline was recorded ($P = 0.005$). Marked and moderate improvements in dysmenorrhea symptoms were reported by 64 (55.7%) and 31 (27.0%) participants, respectively. Pelvic pain of varying intensity was reported by 112 (97.4%) patients but was managed with analgesia. Persistent amenorrhea was experienced by 2 (1.7%) individuals following treatment. Patients did not encounter any new gynecologic or general complications following UAE treatment. *Conclusion:* UAE could be considered as a minimally invasive treatment option for patients with adenomyosis. Further research to compare the efficacy and safety of UAE with conventional hysterectomy is warranted.

1. Introduction

Adenomyosis, a common benign uterine pathology, is a non-neoplastic process where endometrial tissue proliferates into the myometrium, accompanied by smooth muscle hypertrophy [1]. Adenomyosis is diagnosed through histological analysis [2]; it is a common disorder and prevalence rates of 5%–70% have been reported in the literature [3]. A more recent study reported the prevalence of adenomyosis to be 10%–18% [4]. The most frequent symptoms at presentation include abnormal uterine bleeding and dysmenorrhea.

Hysterectomy is currently considered to be the definitive therapeutic option for the treatment of adenomyosis [5]; however, with advancements in minimally invasive therapies, novel therapeutic options are available for individuals with adenomyosis. Uterine artery embolization (UAE) is a minimally invasive technique that has the potential to be used as a first-line therapy for adenomyosis [6].

UAE can be considered preferable to hysterectomy for the treatment of adenomyosis in patients who are not suitable candidates for blood transfusions and in patients with severe anemia that requires immediate intervention [7]. In comparison with surgical approaches, UAE is a cost-effective treatment, and it results in a shorter recovery period for patients and less post-procedural pain [8]. Additionally, there are several prerequisites for patients with adenomyosis before they can undergo hysterectomy. Careful evaluation prior to surgery is essential to ensure that patients are not pregnant and are free from genital-tract malignancies. Other contraindications for hysterectomy include any comorbidities that could increase a patient's risk of encountering infectious complications such as pelvic inflammatory disease or active genitourinary infection, an adnexal mass, and concurrent conditions that would contraindicate any endovascular procedures (e.g. reduced immune status, severe coagulopathy, severe contrast medium allergy, and impaired renal function) [9]. By contrast, there are no contraindications for UAE in the treatment of adenomyosis. However, owing to a lack of high-quality data, the efficacy of UAE for adenomyosis remains unclear [10]. The aim of the present study was to evaluate the safety and efficacy of UAE in the treatment of patients with adenomyosis.

2. Materials and methods

The present prospective study was performed at the Department of Obstetrics and Gynecology, Yuhuangding Hospital, China, between January 1, 2012 and December 31, 2013. All premenopausal patients presenting with adenomyosis with heavy menstrual bleeding and dysmenorrhea during the study period were invited to enroll. Patients

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with childbearing potential were not specifically excluded but they were informed of the uncertain adverse-event profile of UAE in patients who are pregnant [11]. Individuals who had a confirmed pregnancy, active pelvic inflammatory disease, renal insufficiency, undiagnosed pelvic mass, or urogenital infections were excluded from the study. Written informed consent was provided by all participants and the ethics committee of Yuhuangding Hospital, Medical College of Qingdao University, approved the present study.

Prior to UAE, a venous blood sample was collected from each patient to test for complete blood count, blood urea nitrogen, creatinine levels, and prothrombin time; the uterus was examined for each patient using magnetic resonance imaging (MRI).

All UAE procedures were performed by the same interventional radiologist (S.W.) using the same protocol. After receiving a local anesthetic, vascular access was achieved with a 5 F catheter via the right femoral artery and the aortic bifurcation, extending to the contralateral internal iliac artery. Digital angiography was performed to identify the origin of the uterine artery. Subsequently, the left uterine artery was catheterized with a coaxial 2.8 F microcatheter (Progreat; TERUMO, Japan). The tip of the microcatheter was placed in the distal third of the left uterine artery. Tris-acryl gelatin microspheres (BiosphereMedical, Rockland, MA, USA.), 500–700 μm in size, were introduced to the catheter until the flow had reached stasis. Once a stagnant column of contrast was present in the left uterine artery, this procedure was repeated for the right uterine artery. The procedure was considered complete when no flow could be detected in either uterine artery. All catheters were removed and groin pressure was maintained for 5–10 minutes. The therapeutic goal was to occlude only the uterine artery branches that supplied the adenomyotic area, sparing the unaffected myometrial vessels. Following the completion of the procedure, arteriograms were performed to ensure that the complete occlusion of branches supplying the adenomyotic tissue had been achieved.

Following UAE, patients were hospitalized for 24–48 hours to monitor any hematoma formation at the arterial puncture site. Patients were given intravenous medications for nausea, vomiting, and pain control as necessary before being discharged. All patients in whom the procedure was successful underwent gynecologic examination, MRI, and completed a questionnaire at 3, 6, and 12 months after embolization. Any changes in uterus volume were calculated and patients were asked to evaluate their dysmenorrhea symptoms, which were classified as markedly improved, moderately improved, slightly improved, or unchanged.

The mean ± SD and range were calculated for patients' uterine, demographic, and clinical characteristics. Changes from baseline uterine volume were compared using a Student paired t test and $P < 0.05$ was considered statistically significant. All analyses were performed using SPSS version 17.0 (SPSS Inc, Chicago, IL, USA).

3. Results

A total of 117 patients were enrolled in the present study. Table 1 contains a summary of patient baseline characteristics. Bilateral UAE was successful in 115 (98.3%) patients but failed in 2 (1.7%) participants owing to the presence of malformed vessels; data from these patients were excluded from the statistical analyses. The mean UAE procedure time was 47.0 ± 5.3 minutes (range 35.1–80.5 minutes). All patients were discharged from hospital within 1 week of undergoing UAE and the mean hospital stay was 3.4 ± 0.7 days (range 3.0–6.0 days) (Table 1).

Table 2 details the post-procedural complications experienced by participants. Although a majority of patients experienced pelvic pain after UAE, the symptoms were well managed using the study institution's standard analgesia protocol (narcotics and nonsteroidal anti-inflammatory drugs). Some participants experienced nausea but this was managed using antiemetic drugs. All patients completely recovered and were able to resume their normal daily activities within 1 week of UAE treatment. Amenorrhea affected 2 (1.7%) participants after the procedure; both of these individuals were aged over 45 years. No participants were lost to follow-up and no gynecologic or other medical adverse effects were reported during the follow-up period. No deaths or significant adverse events were recorded. Premature menopause was recorded in 2 (1.7%) patients.

Each patient's uterine volume was examined using MRI at 3, 6, and 12 months (Table 3). Median decreases from baseline uterine volume of 28.0%, 37.0%, and 51.0% were observed at 3, 6, and 12 months, respectively. The change in uterine volume from baseline at each follow-up examination was statistically significant ($P = 0.02$, $P = 0.02$, and $P = 0.005$, respectively).

At 12 months, marked and moderate improvements in symptoms of dysmenorrhea were reported by 64 (55.7%) and 31 (27.0%) participants, respectively. A slight improvement in symptoms was reported by 13 (11.3%) patients and only 7 (6.1%) individuals reported no change in dysmenorrhea symptoms (Table 4).

4. Discussion

In the present study, the UAE procedure was successfully completed in nearly all patients. In the treatment of adenomyosis, UAE resulted in decreased uterine volume and improved dysmenorrhea, with no significant adverse events recorded in the 12-month follow-up period.

Adenomyosis is a benign uterine disorder known to cause menorrhagia and dysmenorrhea [11]. The classical definition of adenomyosis describes the condition as a benign invasion of the endometrium into the myometrium, and that this results in the development of a diffusely enlarged uterus, microscopically exhibiting ectopic, non-neoplastic, endometrial glands and stroma. This is, in turn, surrounded by hypertrophic and hyperplastic myometrium [4]. This description is still clinically relevant but has been clarified through the inclusion of the observation that the endometrial glands and stroma are located unevenly and can be located deep within the myometrium [12].

UAE has been clinically applied as a minimally invasive treatment option for patients with symptomatic fibroids. A recent report found that UAE using polyzene F-coated hydrogel microspheres was effective in 28 of 29 patients treated [13]. However, UAE has not been successfully introduced as an alternative treatment option to conventional hysterectomy for patients with adenomyosis because previous studies have been unable to demonstrate significant efficacy for this indication [14]. The reasons for unsuccessful treatment with UAE have included a lack of a defined arterial supply in patients and the diffuse distribution of endometrial glands and stroma throughout the myometrium [15].

In recent years, several studies have demonstrated that UAE could be an effective option for curing patients with adenomyosis [16]. The present study demonstrated UAE to be an efficacious treatment for adenomyosis. Similar to other minimally invasive techniques, which

Table 1
Baseline characteristics of patients who underwent successful uterine artery embolization procedures (n = 115).[a]

Variable	Value
Age, y	38.9 ± 3.1 (36.5–47.5)
Weight, kg	59.7 ± 3.7 (51.2–77.9)
Procedure time, min	47.0 ± 5.3 (35.1–80.5)
Duration of hospitalization, d	3.4 ± 0.7 (3.0–6.0)

[a] Values are given as mean ± SD (range).

Table 2
Adverse events experienced by patients follow uterine artery embolization (n = 115).

Complications	No. (%)
Pelvic pain	112 (97.4)
Nausea	64 (55.7)
Amenorrhea	2 (1.7)

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