

The Outcome of Uterine Artery Embolization in the Treatment of Uterine Leiomyomas in Mongolia

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Objective: To evaluate and determine treatment efficacy of uterine artery embolization versus uterine myomectomy in treating uterine leiomyomas. **Methods:** In 2010-2013, 94 women between the ages of 23-50 years were recruited in the study. They were divided into 2 treatment groups: uterine artery embolization and myomectomy (control) group and were followed up for two consecutive years. **Results:** After uterine artery embolization, the volume of leiomyomas decreased 56%-91% ($p < 0.05$). Menorrhagia in the uterine artery embolization versus myomectomy group was 95.2% and 92.8% ($p > 0.05$), anemia 87.5% and 85.7% ($p > 0.05$), pain subsided 72.2% versus 86.8% and "bulk" symptoms 87.5% versus 100% respectively ($p > 0.05$). Overall health-related quality of life score +27.6 versus +17.1 and SS score -34.0 versus -32.8, patient satisfaction 89.4% versus 72.3% ($p = 0.001$). Re-growth after uterine artery embolization 2.1% versus myomectomy 23.4% ($p = 0.0001$), Post-treatment conception 25.5% versus 31.9% and cesarean delivery rate 88.9% versus 90% respectively ($p > 0.05$). Duration of the procedure 38.9 ± 4.8 minutes versus 54.0 ± 26.3 minutes ($p = 0.0001$), length of hospital stay 2.4 ± 0.9 days versus 6.9 ± 2.3 days ($p = 0.0001$), days to recovery 10.6 ± 3.0 versus 26.2 ± 17.9 ($p = 0.0001$). **Conclusion:** Uterine artery embolization treatment effectively decreases the size of leiomyomas ($p = 0.015$), it particularly improves menorrhagia. The quality of life and patient satisfaction scores after uterine artery embolization are better ($p = 0.001$). There was no statistically significant difference with regard to conception rate or the need for cesarean delivery ($p > 0.05$).

Keywords: Uterine Leiomyoma, Uterine Artery Embolization, Myomectomy, Quality of Life, Conception After Treatment.

Introduction

Uterine leiomyoma are benign smooth muscle tumors of the uterus that can have considerable impact on women's

health, reproduction, ability to engage in social activities and their quality of life. Leiomyomas can cause urinary frequency, constipation, bloatedness, heavy bleeding during menses, anemia, iron deficiency, pain during intercourse, and low back

pain. When present, a woman can have one leiomyoma or many. Treatment of uterine leiomyomas is costly [1].

Among other sources of morbidity in women, uterine leiomyomas occur frequently in women and about 13-27 % of women in reproductive age suffer from leiomyomas. However, the incidence increases to 40-50 % in women over 35 years of age; 43-45% of all 'hysterectomy' surgeries performed in women due to gynecological problems are due to leiomyomas [2].

In the USA, leiomyomas are diagnosed in 12.8 per 1000 women [3]; 150-200000 hysterectomies and 34000 myomectomies are performed annually [4].

Downes et al. evaluated the syndrome and quality of life in women with leiomyomas using the UFSQOL questionnaire and found that when compared to age matched controls without leiomyomas the mean symptom score increased by 37.6 (95% CI, 32.2-43.0; P<0.001), quality of life score decreased by 69.7 (95% CI, 66.5-73.0; P=0.002), work productivity and social activities were reduced by 36.1 % and 37.9% respectively [1].

Jargalsaikhan et al. in 2014 found that the mean age of women suffering from leiomyomas in Mongolia was 43.91±8.03, and that the risk for developing leiomyomas increased with women's age, obesity, early/late menorrhoea,

multiple abortions, hypertension and inflammatory diseases of the pelvic organs, but the risk was reduced with the number of parities [5].

According to the Mongolia Health Development Center report, the incidence of uterine leiomyomas in all women of all age groups (15-80 years) has increased. In 2011-2013, and 2014-2016, there were a total of 6196 and 7492 morbidity cases, and 3463 and 2684 new cases respectively were registered in women of all age groups. Of the registered cases, the prevalence in last 5 years in women between the ages of 15-49 years was 195.84 per 100,000 population [6]. While leiomyomas occur more frequently in women over 40 years of age, the number of cases in women under 39 years of age has increased compared to previous years' incidence (Figure 1) [6].

In 2011, Duurenbileg conducted a prospective study of sixty pregnant women with uterine leiomyomas and found a prevalence of 28.3% of the women under the age of 30, 21.7% between 31-35 years of age, 41.7% between 36-40 years of age and 8.3% above 40 years of age. The study concluded that uterine leiomyomas are becoming more frequent and are more common among younger women [7].

Leiomyomas are treated surgically in 68.5% of cases in the USA, 51% of cases in South Korea, 54% of cases in Italy,

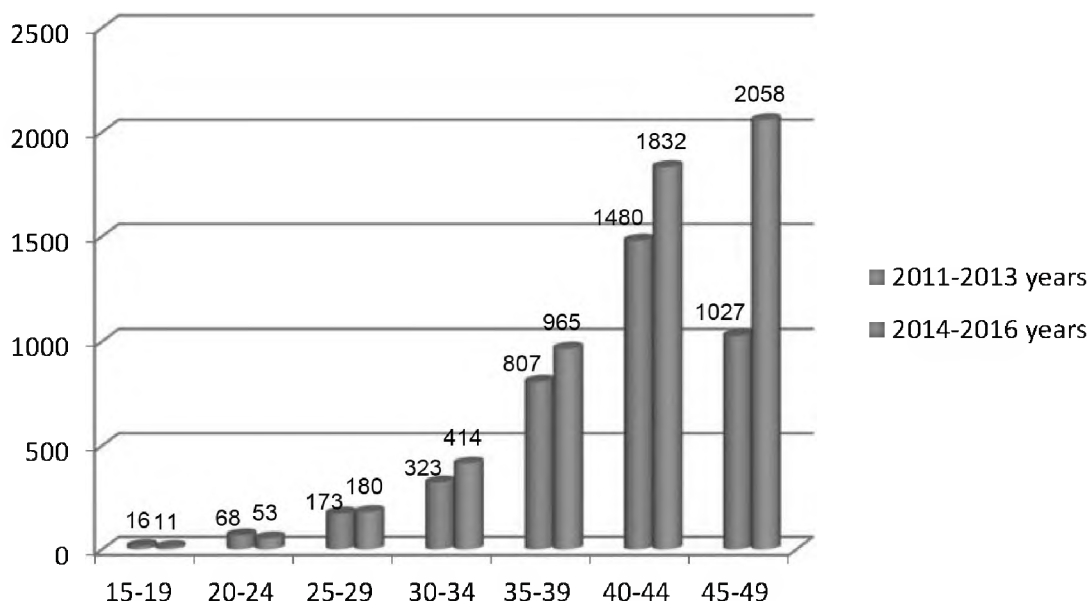


Figure 1. Incidence of leiomyomas in women 15-49 years of age.

and 35% of the cases in Canada. In the China transabdominal hysterectomy is still predominantly used to treat leiomyomas [9].

Transabdominal hysterectomy and myomectomy surgeries have been and continue to be the main treatment methods used to treat uterine leiomyomas in Mongolia [10]. In early 2000, laparoscopic surgery was introduced in gynecological practice in Mongolia, but it has only been used for performing laparoscopic myomectomy since 2011 [11]. Of the total gynecological surgeries performed, 30-35% are performed to treat uterine leiomyomas; of them, 60-80% are hysterectomies [12].

Due to increased prevalence of uterine leiomyomas in younger women of reproductive age in Mongolia, it was necessary to preserve their uterus and fertility in order to achieve patient satisfaction [10, 13]. Therefore, we chose to introduce a minimal invasive treatment fertility-sparing method to treat uterine leiomyomas in our gynecological practice. The method we chose was uterine artery embolization (UAE) and the purpose of this study was to determine the outcome and significance of Uterine Artery Embolization in treating uterine leiomyomas.

Materials and Methods

1. Study design and participant recruitment

The study was prospective non-randomized non-blinded clinical trial involving 94 women between the ages of 23-50 years during 2010-2013 at the Gynecological, Delivery and Diagnostic wards of the Metropolitan Urgoo Maternity Hospital and Angiography ward in the Third State Central Hospital. Participants who met the inclusion criteria were informed about UAE and myomectomy and were allowed to choose which procedure they wanted and were followed for 2 years after their procedure. For purposes of the study, the participants with a ratio of 1:1 were divided into UAE treatment and myomectomy control groups.

To be participate in the study, women met the following criteria:

1. Be of reproductive age and opt treatment that preserved their uterus.
2. Having menstrual periods.

3. Have symptoms related to leiomyomas, such as abnormal uterine bleeding and pain, or the volume of leiomyomas such as urinary frequency, constipation, and bloatedness ("bulk" symptoms).
4. The diameter of dominating leiomyoma had to be ≤ 14 cm in diameter or between 501 cm³ and 909 cm³ in volume and the leiomyomas had to be ≤ 10 in number.
5. Have no history of acute gynecological and/or organ and system inflammatory diseases.

Women were excluded women from the study for any of the following:

1. Known sensitivity to substances containing iodine.
2. Suspicious masses suggestive of uterine and/or ovarian malignancy.
3. Acute renal or genital tract infection.
4. Personal history of coagulopathy.
5. Leiomyomas which were submucosal in location and "0" shaped (L0 according to FIGO classification).
6. Leiomyomas which were subserous in location and "7" shaped (L7 according to FIGO classification).

2. Data collection

Demographic data were gathered including the characteristics of age, body mass index, educational level, vocation, reproductive history including duration of symptoms. The Uterine Fibroid Symptom and Health Related Quality of Life Questionnaire (UFS-QOL) developed by the Fibroid Registration and Research Center of America was used study the quality of life before and after the treatment of the recruited participants [31]. Measurements of uterine size, leiomyomas size and recurrence were determined using transvaginal Doppler ultrasonography before UAE and 6, 12 and 24 months after UAE. The blood supply to the leiomyomas was recorded during the UAE procedure.

3. Ethical considerations

Prior to conducting the study, all 94 women were introduced to the study and informed consent to participate in the study was obtained by using a standardized informed consent form whose contents were endorsed by the meeting of the Medical Ethics Inspection Branch Committee of the National Health Sciences University held in June 4, 2010 (Minutes of the Meeting 81/19).

4. Treatment group UAE

Selective uterine artery embolization was performed bilaterally by right femoral artery puncture using particles of 350-500 µm of polyvinyl alcohol (COOK, USA) and 700 µm of Embosphere TANDEM™ (CeloNova BioSciences, Inc., Germany) in the 47 women in the treatment group.

5. Control group Myomectomy

For 47 patients in the control group, the abdominal myomectomy was performed through a Pfannenstiel abdominal incision and the leiomyomas were enucleated and removed.

6. Measures of outcomes

Clinical outcomes were compared between the two groups. The parameters compared were the relief from symptoms, change in leiomyomas size and improved quality of their life.

Safety of the treatment was monitored by recording complications that occurred during and after the treatment, the regrowth of leiomyomas, need for re-treatment, the ability to conceive after treatment and delivery after treatment. The

outcomes were compared between the two groups.

Efficiency of the treatment was evaluated using the duration of the procedure performed, the length of hospital stay, and the time required to resume normal daily life and work.

7. Data analysis

All data were analyzed using SPSS 19.0 software and descriptive data are presented as the mean ±SD or percentage.

Shapiro-Wilk Test was used to determine if the data were normally distributed. Differences between paired and independent group's means were assessed by Student's t-tests. Differences in categorical data were assessed by Pearson chi square test and Fisher's exact t-test. Post treatment leiomyoma regrowth and number odds ratios (OR), and their confidence interval, was determined by simple and multiple risk binary logistic regression test with type of treatment, patient age, size as independent variables. Their statistical significance was determined by Wald test. A p-value ≤0.05, was considered statistically significant.

Table 1. Patient characteristics before the procedure

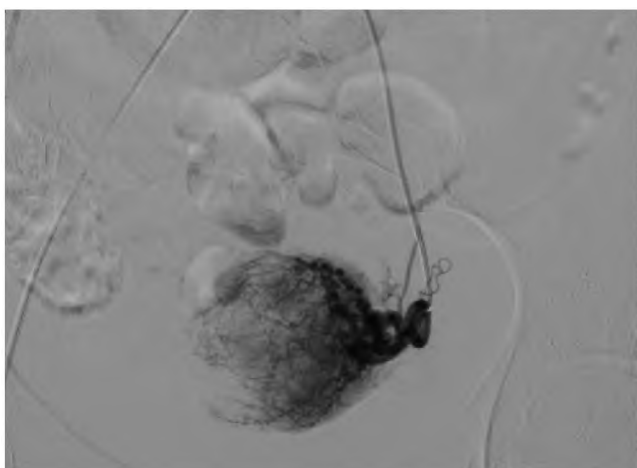
	UAE (n=47)	Myomectomy (n=47)	p-value
Age (mean)	38.5±5.9	37.6±4.5	0.902
Education (in percentage)			0.0001
Higher	78.3	57.4	
Secondary	19.6	6.4	
Vocational	2.2	34	
Elementary	0	2.1	
BMI (mean, kg/m ²)	26.3±5.6	27.9±9.2	0.589
Term disease diagnosed (in months)	36.0 (3.0-132.)	12.0 (1.0-156)	0.001
Previous history of conception	34 (67%)	43 (92%)	0.07
Previous history of childbirth	26 (56%)	34 (70%)	0.054
Previous history of treatment	25 (53.2%)	12 (25.5%)	0.006
Complaints	38 (80.9%)	45 (95.7%)	0.025
Leiomyoma size (mean, cm ³)	60.0 (4.0-341.0)	44.0(12.0-282.0)	0.573
Number of leiomyomas			0.168
1	25 (53.2%)	20 (42.6%)	
2-3	17 (36.2%)	15 (31.9%)	
More than 4	0 (10.6%)	12 (25.5%)	

Results

The demographic characteristics and gynecological history of the study participants are shown in Table 1. When compared to the myomectomy group, women in the UAE group had a higher level of education (78.3% vs. 57.4, $p=0.0001$), were previously treated for a longer period (36.0 ± 10.6 vs. 12.0 ± 5.2 months, $p<0.001$) after they were first diagnosed, were nearly twice as likely to have had previous treatment (53.2% vs. 25.5%, $p=0.006$), and had fewer complaints (80.9% vs. 95.7%, $p=0.025$). Sixty-seven percent had a history of previous conception and 56% had a history of previous childbirth.

With regard to performing UAE, the procedure was successfully completed in all cases. In 85.2% ($n=40$) of the total ($n=47$) cases, the leiomyomas were equally fed by and received blood supply from both uterine arteries, in 8.5% ($n=4$) cases, the leiomyomas were dominantly fed by the right uterine artery and in 6.3% ($n=3$) cases they were dominantly fed by the left uterine artery. Some typical images from a UAE procedure showing the blood supply of a leiomyoma before after embolization are shown in Figure 2.

(A) Before embolization pelvic arteriogram reveals enlarged left uterine radial artery with abnormal network of blood vessels encircling the leiomyoma. (B) Selective uterine arteriogram from left side after embolization shows stasis of flow in main uterine artery. But the network of blood vessels supplying the leiomyoma from the right side can be seen clearly before embolizing its blood supply from the right side.



1. Clinical outcome after the treatment

1.1. Relief of the symptoms

After treatment, all complaints related to leiomyomas improved in both study groups when compared before the treatment ($p<0.05$).

Comparing the relief of the complaints between the groups, 88.5% of the women in the UAE group and 77.7% of the women in the myomectomy group were relieved but 14.9% of the women in the UAE group and 21.3% in the myomectomy group had persistent complaints ($p<0.05$), demonstrating that the level of complaints in the UAE group was lower compared to those who had myomectomy Table 2.

Table 2 shows that the complaint of heavy menstrual bleeding effectively cleared after UAE and anemia was improved.

Symptoms of pain and "bulk" were completely relieved in the myomectomy group compared to UAE group ($p>0.05$). Relief of "bulk" symptoms following myomectomy was expected because these symptoms were caused by the size and location of the leiomyomas.

Before the treatment, of three of the women who were recruited in the UAE group were complaining of infertility; after the treatment all three of them conceived. However, only two women (18.2%) out of eleven women in the control group with infertility conceived after myomectomy.

Some women (19.2%) continued to have symptoms after treatment. Logistic regression was used to study the factors associated with continued symptoms and these results are found in Table 3.

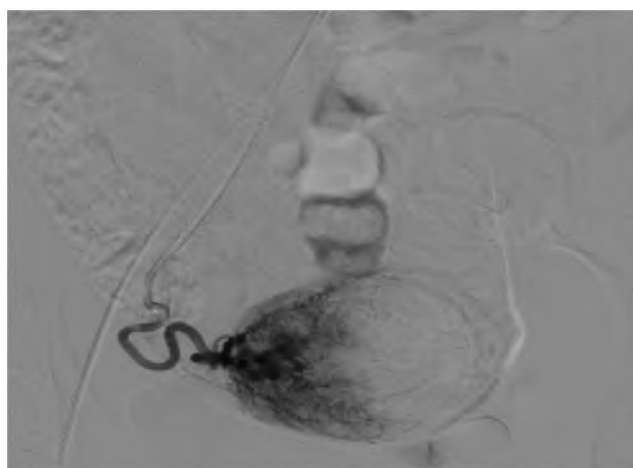


Figure 2. Angiogram before and after embolizing the left uterine artery.

Table 2. Outcome of symptom response

Response Category	UAE (n=47)	Myomectomy (n=47)	p-value
Number of patients with symptoms before treatment	38 (80.8%)	45 (95.7%)	
Number of patients with relief of all symptoms after treatment	31 (88.5%)	35 (77.7%)	0.421
Number of patients with relief of menorrhagia	20 (95.2%)	13 (92.8%)	0.999
Number of patients with relief of anemia	7 (87.5%)	6 (85.7%)	0.999
Number of patients with relief of pain	13 (72.2%)	32 (86.8%)	0.999
Number of patients with relief of bulk symptoms	7 (87.5%)	1 (100%)	0.315

Table 3 shows that women with adenomyosis were 58.17 (CI 95% 3.17-1068.83, p=0.006) more likely to have persistent symptoms than those without adenomyosis and those a personal history of sexual transmitted diseases had 20.16 times risk of persistent symptoms (CI 95% 1.56-260.26, p=0.021) compared to those who never had sexually transmitted disease. None of the other factors were statistically significant (p>0.05).

1.2. Reduction of leiomyoma size

Six, 12 and 24 months after the UAE, transvaginal Doppler ultrasonography was performed to examine and measure the reduction in size of leiomyomas. In general, in the first six months, the size of leiomyomas had decreased by 56% (60cm³ – 26cm³), in the following six months and after 24 months their size decreased by 85% (60cm³ – 8cm³) and 91% (60cm³

– 5cm³) respectively as shown in Figure 3.

1.3. The quality of life before and after the treatment

In study participants the Symptom Severity (SS) score of the UFS-QOL before the treatment was 41.8±17.1; after the treatment it was 13.4±15.8, a reduction of 28.4 (p=0.0001). Overall score of health-related quality of life had improved from 68.5±16.3 before the treatment to 90.0±10.6 after the treatment, an increase of 21.5 (p=0.0001).

Comparing the symptom severity after the treatment, following the UAE it was reduced by 34.0±18.7 and the following myomectomy it was reduced by 32.8 ±17.5 (p=0.751). Overall health related quality of life scores in the UAE and the Myomectomy groups increased by 27.6±17.7 and 17.1±12.4 respectively (p=0.001).

Table 3. Multiple logistic regression analysis of factors associated with continued symptoms after treatment.

Name of factors	OR	CI 95%		p-value
		Upper value	Lower value	
Treatment method (UAE, ME*)	1.51	0.32	7.14	0.606
Age	1.04	0.89	1.21	0.616
A/Hypertension**	0.54	0.05	6.26	0.622
Metabolic Disorder	3.26	0.58	18.40	0.181
Adenomyosis	58.17	3.17	1068.83	0.006
STDs***	20.16	1.56	260.26	0.021
Term disease was diagnosed	0.99	0.96	1.02	0.489
BMI****	1.06	0.97	1.16	0.194
Location of the leiomyomas	1.94	0.61	6.18	0.265
Leiomyoma size	1.00	0.99	1.01	0.595
Number of leiomyomas	0.98	0.76	1.26	0.864

UAE, ME* - Uterine Artery Embolization, Myomectomy, A/Hypertension** - arterial hypertension, STDs*** - sexual transmitted diseases, BMI**** - body mass index

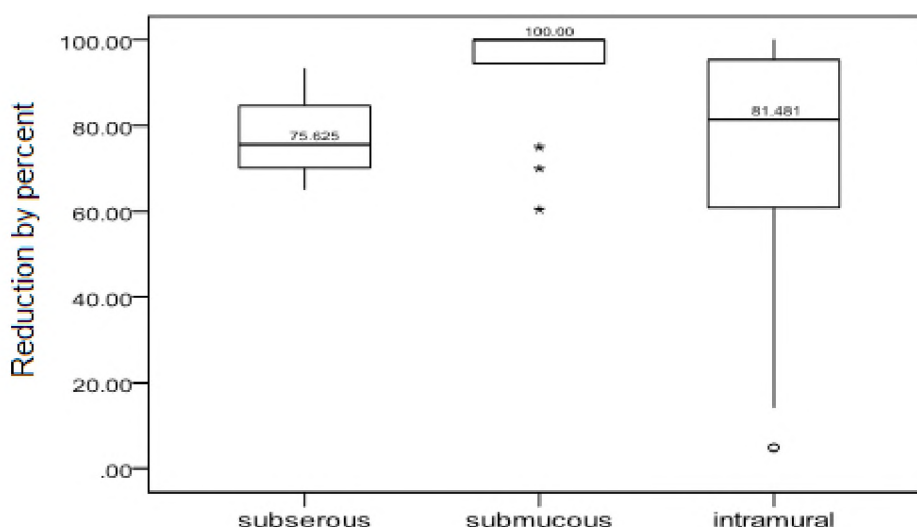


Figure 3. Reduction of the leiomyoma size after the UAE

In the UAE group, 89.4% of the women were content with the treatment compared to 72.3% of the women who had myomectomy and all of the UAE group said they would recommend their treatment method to others.

2. Safety of the treatment

2.1. Complications of UAE

The type of complications and their causes varied when the UAE and myomectomy were compared. Minor complications occurred during 6.4% (n=3) of the UAE procedures and during 2.1% (n=1) of the myomectomies. Minor post procedure complications occurred following 6% (n=3) of the UAE procedures and after 10.4% (n=5) of the myomectomies. These differences were not significant statistical (p=0.544). No major complication occurred during or after the UAE treatment.

After the treatment, 61.7% of the women in the UAE group and 72.3% in the myomectomy group received no additional treatment. Those women who returned to the hospital for treatment did so for relatively delayed symptoms other than uterine bleeding, which corresponded to the gradual reduction in the size of their leiomyomas.

During the course of the study, the rate of subsequent hysterectomy performed in women who underwent UAE was 4.3% (n=2) and was 2.1% in the myomectomy control group. However, 4.3% of the women in the control group had repeated myomectomy and 4.3% women in the UAE group had myomectomy as subsequent treatment.

In two cases (4.3%) that developed a necrotic submucosal leiomyoma following UAE, the leiomyoma was expelled from the vagina. This was followed by uterine curettage in one of those cases.

2.2. Leiomyoma regrowth after the treatment

Leiomyoma regrowth after the treatment is compared for two groups in Figure 4.

Re-growth of leiomyomas occurred in 2.1% of the patients after UAE. However, re-growth rate after myomectomy was over 10 times higher at 23.4% (p=0.022). Factors affecting leiomyoma regrowth were tested by logistic regression and their risk is reported in Table 4.

The risk of leiomyoma regrowth after myomectomy was 13.17 (CI 95% 1.55-111.83, p=0.018) times higher compared to UAE. Each additional leiomyoma increased the risk of re-growth by 1.21 times (CI 95% 1.00-1.47, p=0.049). The above results show that re-growth of leiomyomas is related to the number of leiomyomas and treatment method.

2.3. Fertility recovery after treatment

When studying fertility recovery, 12 women between the ages of 23-42 years who underwent UAE and 15 women between the ages of 30-40 years who had myomectomy conceived and were monitored (Figure 5). Of these women, 26 women conceived naturally and one woman had In Vitro Fertilization (IVF).

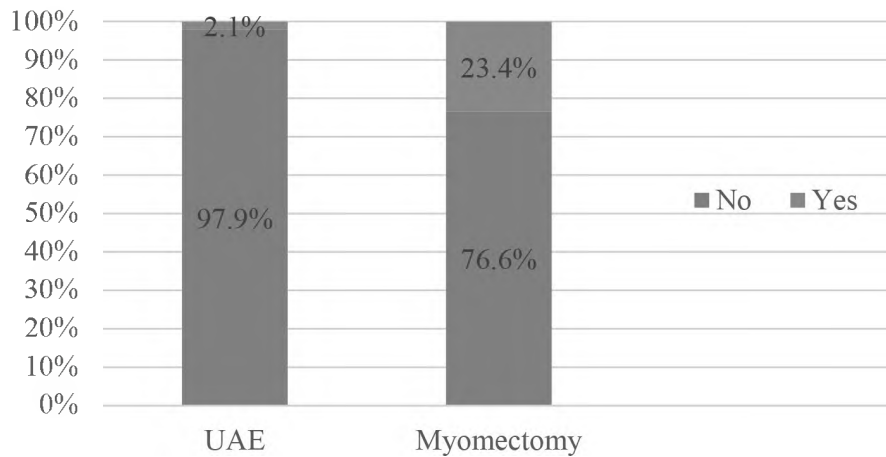


Figure 4. Leiomyoma regrowth (compared in two groups)

Twelve (25.5%) women after UAE and 15 (31.9%) women after myomectomy conceived ($p=0.494$). However, 50% of the UAE group and 57.1% in the myomectomy group ($p=0.729$) experienced at least one complication during pregnancy. C-Section was performed in 88.9% of the women in UAE group and 90.0% in the myomectomy group ($p=0.596$). From this we conclude that conception rate after treatment, complication during pregnancy and the need for Cesarean delivery were not statistically significant different ($p>0.05$) between the treatment methods. However, of the women who underwent UAE, 3 (33.3%) experienced complications associated with labor and required a Cesarean section compared to none of those women who had myomectomy ($p=0.047$). Among the women who required a C-section was a 23 year-old primigravida with placenta previa with hemorrhage and two 38-year-old women, one with placenta accreta following IVF who had a planned C-section to prevent massive obstetric hemorrhage and the

other woman was a multi-para who was delivering after long child-spacing. These C-sections were performed without complications while preserving their uteruses.

After UAE treatment 12 women became pregnant and 2 had an elective abortion. During the course of their pregnancy, 20% ($n=2$) experienced early threatened abortion, 10% ($n=1$) experienced threatened pre-term delivery, 10% ($n=1$) had preeclampsia and 10% ($n=1$) had placenta previa. This totals to 50% ($n=5$) of these pregnancies having a complication after UAE. After myomectomy 15 became pregnant and 1 had an elective abortion. During the course of their pregnancy, 50% ($n=7$) experienced early threatened abortion and 7.1% ($n=1$) had preeclampsia. This totals to 57.1% ($n=8$) of pregnancies having a complication after myomectomy ($p=0.729$).

Comparing the outcome of pregnancy, 12 women who conceived after UAE 75% ($n=9$) delivered, 8.3% ($n=1$) had spontaneous abortion and 16.7% ($n=2$) pregnancies were

Table 4. Risks factors affecting regrowth of leiomyomas after the treatment

	CrudeOR	95% CI		p-value	Multiple OR	95% CI		p-value
		Lower value	Upper value			Lower value	Upper value	
Treatment group								
UAE	1				1			
ME	14.05	1.73	113.99	0.013	13.17	1.55	111.83	0.018
Age of patients	0.995	0.887	1.12	0.929	1.02	0.89	1.18	0.748
Leiomyoma size (cm)	0.998	0.973	1.004	0.144	0.99	0.98	1.01	0.300
Number of leiomyomas	1.28	1.08	1.52	0.005	1.21	1.00	1.47	0.049

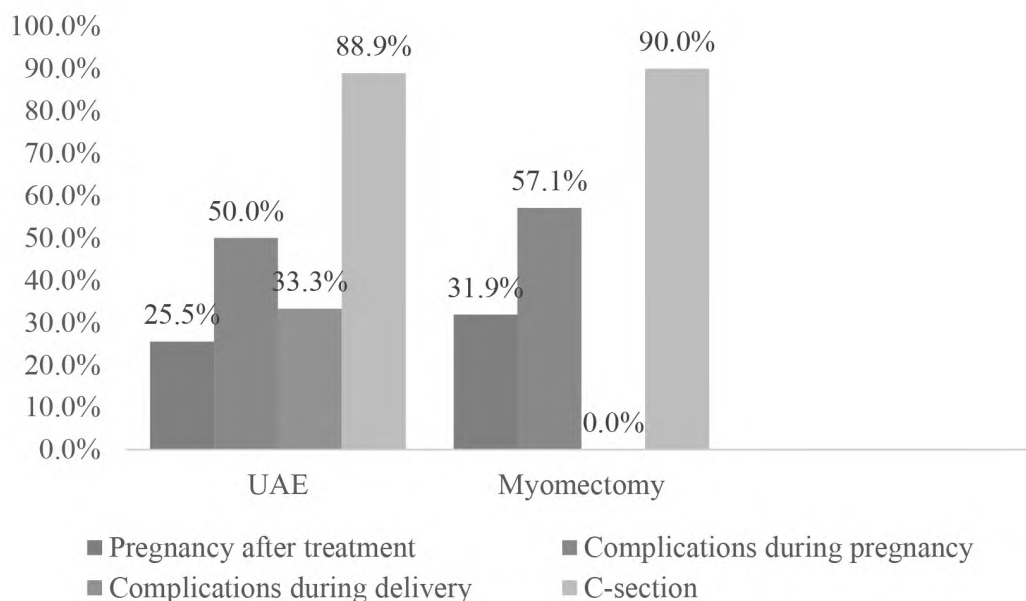


Figure 5. Outcome of reproduction post treatment

electively terminated. In the myomectomy group, 66.6% (10 of 15) women who conceived had normal, live childbirths, one had a still-birth during antenatal period, 13.3% (n=2) had spontaneous abortions, 13.3% (n=2) had missed abortions and 6.8% (n=1) was electively terminated (p=0.497).

Studying the outcome of delivery, the incidence of Cesarean delivery in UAE group was 88.9% and was 90% in the control group. Of the 8 Cesarean deliveries in the UAE group, 12.5% (n=1) had placenta previa, 25% (n=2) were late primigravids, 12.5% (n=1) had repeat C-section, 37.5% (n=3) were over 35 years old with long child spacing and 12.5% (n=1) had IVF. The reasons for Cesarean delivery in these women were not related to the treatment method. However, of the 9 women in the myomectomy group, 88% (n=8) had Cesarean delivery due to post-myomectomy scar and 11.1% (n=1) due to late primigravid, confirming that C-section after myomectomy was mainly performed due to uterine scar.

Among the women who experienced complication during childbirth after UAE was a 23-year-old prima-gravid woman who had to have C-section due to placenta previa and two 38-year-old women, one who had IVF and the other woman was a multi-para who was delivering after long child-spacing. The treatment provided to these women during their C-section was effective and their Cesarean delivery successfully with

preserving their uterus. Birth weight of newborns in the UAE group was 3054.4±753.3gm and 3250.5±1204.9gm in the myomectomy group with no statistical difference (p=0.681).

3. Efficiency of the treatment

3.1. Duration of the treatment

The duration of the UAE procedure was 38.9±4.8 minutes and myomectomy was 54.0±26.3 minutes (p=0.0001). From this it can be seen that UAE can be performed in a shorter period of time compared to myomectomy, another advantage of UAE.

3.2. Length of hospital stay

The length of hospital stay in patients who underwent myomectomy was 3-14 days (mean 6.9±2.3) compared to the UAE group which ranged from 1-5 days (mean 2.4±0.9, p=0.0001). This increased length of stay for the myomectomy group incrementally increased the hospital's direct cost of providing care.

3.3. Patient recovery

Patient recovery after the treatment was compared. Women in the UAE group resumed their normal daily life and work in 10.6±3.0 days after the treatment and the myomectomy group in 26.2±17.9 days, taking over twice as long to recover from

myomectomy compared to the UAE group ($p=0.0001$).

From the above analysis, it is evident that the duration of the procedure, the length of hospital stay and post-treatment recovery period were all lower following UAE ($p<0.05$).

Discussion

In 2010-2013, 94 women diagnosed with uterine leiomyomas referred for treatment were involved in our study. After informed consent, they self-selected their procedure and underwent UAE or myomectomy and were followed-up for two consecutive years.

We observed that among the women in the UAE group were older women (38.5 ± 5.9 years of age) had a higher level of education (78.3%), had desire to reproduce in the future (67% had previous history of pregnancy and 56% history of previous delivery) and, had been treated for a long period after they were first diagnosed (mean 36 months). UAE was unknown among our patients at the time we introduced it and we were intrigued that they opted UAE treatment and were willing to participate in the study. We interpreted this as evidence that older educated Mongolian women of childbearing age were seeking a more effective and minimally invasive treatment compared to the traditional surgical treatment.

Many researchers consider UAE a highly effective and 84%-100% technically successful procedure. Pron et al. (2003) and Mac et al. (2006) reported successful treatment of leiomyomas using UAE in 95% and 98% cases respectively [14].

We performed UAE procedure in 47 women with 100% success rate.

Ravina and many other researchers concluded in a manual on 'Quality Improvement guidelines of Uterine Artery Embolization in the Treatment of Leiomyoma' published (2004, 2010, 2014) by the Society of Interventional Radiology and Cardiovascular and Interventional Radiology Society of Europe that within 3-12 months after the treatment, leiomyomas decrease in size by 50-60%, the uterine size decreases by 40-50%, and there is constant improvement in symptoms and complaints related to leiomyomas is 75% of patients and, more particularly, an improvement in menorrhagia is 90% or more [15-24].

Gupta et al. concluded that there was a reduction in mean uterine volume of 26% to 59% and fibroid volume of 40%

to 75% in the first six months following UAE and indicated that the clinical success rate, that is improvement of symptoms, mainly menorrhagia, to be in the range of 60% to 90% [20].

In our study, 88.5% of the women who had UAE obtained relief of their symptoms and the volume of the leiomyomas decreased 56% ($60\text{cm}^3 - 26\text{cm}^3$) within the first six months, and after 24 months the volume reduced 91% ($60\text{cm}^3 - 5\text{cm}^3$) ($p<0.05$), which is similar to the above researchers' outcome.

After the treatment, we observed a relatively high improvement in menorrhagia compared to all the other symptoms (pain, anemia and "bulk"). Menorrhagia in the UAE and myomectomy group improved 95.2% and 92.8%, symptoms of anemia improved 87.5% and 85.7% respectively ($p>0.05$). Pain subsided 72.2% and 86.8% following UAE and myomectomy, and "bulk" symptoms subsided 87.5% and 100% respectively ($p>0.05$).

Improvement in menorrhagia following UAE resulted in improved anemia due to light menstrual bleeding.

However, pain and syndrome related to organ compression improved more in the myomectomy group. These symptoms are related to the size and location of the leiomyomas and immediately improved after the leiomyomas were removed.

Razavi et al. in their UAE versus myomectomy study indicated that "bulk" symptoms subsided 91% and 76% in myomectomy and UAE groups respectively [25].

Goodwin (2006) and Gupta (2012) reviewed UAE versus other surgical methods to treat leiomyomas, as well as the outcome of case control and clinical trials and a found notable improvement in health related quality of life after the treatment in both the groups (UAE versus myomectomy OR 1.05, 95% CI 0.33 to 3.36). They found that UAE patients found statistically significant reductions in length of hospital stay, time off work, and number of complications compared to the of the myomectomy group [26].

Reviewing the outcomes of methods used for treating leiomyomas in papers evaluated during the International Health Congress released by the Third National Institute of America in 2014, they report that complaints and symptoms after myomectomy improve by 75-87.9%, complications occur from 11.1 to 30%, and the incidence of re-growth rates are 15 to 51%. They report that the incidence of complication is higher, duration of the procedure is longer and the risk of re-growth is higher following myomectomy compared to UAE [27].

Comparing our study to that of the above Health Congress, we found that complaints and symptoms after myomectomy improved by 77.7%, complications occurred in 10.4%, and our incidence of re-growth was 23.4%. However, comparing UAE results we found that complaints and symptoms after UAE improved by 88.5%, complications occurred in 6% and our incidence of re-growth was 2.1%. Like the above study, we found that the incidence of complications is higher, duration of the procedure is longer and the risk of re-growth is higher following myomectomy compared to UAE.

Researchers are still debating about reproduction after UAE. Gupta et al. quoted the in the REST study in 2011 there were four births in the UAE group (4/106) and two in the myomectomy group (2/8). The study by Mara in 2008 studied 26 women after UAE and 40 after myomectomy but found no meaningful difference between the interventions (OR 0.26; 95% CI 0.08 to 0.84, $p>0.05$) [20].

In the past decade, the majority of studies are concluding that treating leiomyomas with UAE does not have an adverse effect on ovarian function and leaves the woman with ability to have normal conception and delivery; over time this ability improves and therefore it is possible to use UAE in those women with leiomyomas who have not yet delivered [24, 28-30].

Our study has some limitations. Our patients were not randomized nor were the patients and the physicians blinded regarding the treatment used. This affected the assessment of risks impacting post treatment pregnancy and the delivery indicators. Because UAE has only been available in Mongolia since 2010, it was not well known to our patients and was considered a relatively new treatment method. The supplies and materials required for the UAE procedure were more costly than those for myomectomy and paying for them likely created difficulties for many patients. The patients are now well aware of this treatment option and the availability of materials has improved as well.

Regarding future studies, the outcome of post UAE reproduction is still an area of scientific debate. By widely introducing UAE in our gynecological practice, we will be able to involve more women in our research regarding this question. We will continue our research in this field and will precisely investigate the complications and risk factors that influence pregnancy and delivery after UAE treatment.

Conclusion

The study confirmed that UAE treatment effectively decreased the size of leiomyomas, carrying a very low risk of complications associated with the procedure and fewer post-treatment complications. There were no statistically significant differences in the treatments with regard to conception rate after the treatment, complications during antenatal period and the need for cesarean delivery. UAE improved menorrhagia and pain more effectively than myomectomy, improved the quality of life and satisfaction more, and the duration of the procedure, the length of hospital stay and recovery were all reduced. We consider these to be substantial advantages of UAE over myomectomy.

Conflict of interest

The authors state no conflict of interest.

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