

# Diagnosis and treatment of submucous myoma of the uterus with interventional ultrasound

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**Abstract.** The value of interventional ultrasound in the diagnosis and treatment of submucous myoma of the uterus was assessed to study the ultrasonographic features of modified sonohysterography for submucous polyp of uterus. A total of 25 patients diagnosed preliminarily as submucous myoma of the uterus via conventional ultrasound examination from June 2014 to December 2016 were enrolled in the study. The diagnosis was made via the comprehensive analysis of ultrasound-guided modified SHG, followed by ultrasound-guided needle biopsy and sclerotherapy of tumor. After modified SHG and ultrasound-guided needle biopsy, 96% (24/25) cases were confirmed pathologically as submucous myoma of the uterus. After treatment, the maximum diameter of myoma in patients with submucous myoma of uterus was significantly different, and the volume of myoma was significantly reduced. After treatment, the clinical symptoms of patients with submucous myoma of the uterus were obviously improved compared to before treatment ( $P<0.05$ ). It was found in the follow-up after treatment that a small number of patients suffered from mild abdominal pain, increased secretion, slight vaginal bleeding, cold sweat, pale complexion, dizziness and other symptoms, which, however, disappeared after treatment for about 1 week. The score of 36 item Short-Form Health Survey Questionnaire of patients with submucous myoma of the uterus was significantly different before and after treatment ( $P<0.05$ ). Interventional ultrasonography can effectively diagnose the submucous myoma of uterus. The treatment of submucous myoma of uterus with ultrasound-guided intratumor injection of lauromacrogol is characterized by simple operation, which can effectively reduce the tumor diameter and volume, improve the blood flow in patients, reduce the postoperative adverse reactions

and alleviate the patient's pain, so it is a new type of minimally invasive treatment method of submucous myoma of the uterus, and it is worthy of clinical promotion and application.

## Introduction

Myoma of the uterus is one of the most common benign tumors of the reproductive system in women, the incidence rate is about 50-60%, and it occurs frequently in the female in reproductive age (1). According to different sites of myoma of the uterus, it can be divided into the following three types: Intramural myoma, submucous myoma and subserous myoma, among which intramural myoma has the highest incidence rate. The survey shows that the incidence rate of submucous myoma of the uterus is about 20-40%, and the disease frequently occurs in women aged 30-50 years. However, according to the latest research, the incidence of submucous myoma of the uterus shows an increasingly younger trend. Clinical studies have confirmed that myoma of uterus can cause infertility and anemia, and even threaten the life of severe cases. The results of a survey for patients with submucous myoma of the uterus showed that the disease can have a greater impact on the fertility and menstrual status of patients, and cause infertility, hemorrhagic anemia and other symptoms (2,3). At present, the traditional treatment methods of myoma of the uterus include the myomaenucleation and hysterectomy, but the above methods have the disadvantages of large trauma, serious postoperative adverse reactions and longer postoperative recovery (4) so there have been some minimally-invasive clinical treatment means in previous years (5-7). As one of the important parts in ultrasound medicine, interventional ultrasound plays an important role in the clinical diagnosis and treatment of various diseases. In the present study, 25 patients diagnosed preliminarily as submucous myoma of the uterus via conventional ultrasound examination were enrolled in the study, so as to investigate the value of interventional ultrasound in the diagnosis and treatment of submucous myoma of the uterus.

## Patients and methods

**General materials.** A total of 25 patients diagnosed preliminarily as submucous myoma of the uterus via conventional ultrasound examination (two-dimensional ultrasound + color

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Doppler + spectral Doppler) from June 2014 to December 2016 were selected for the study. Exclusion criteria (8): i) Mentally-ill patients; ii) patients complicated with malignant tumors or diseases of the blood system; iii) patients with unclear consciousness or severe illness; iv) patients complicated with organic lesions in heart, liver or kidney and v) patients who refused to cooperate with the researchers. The study was approved by the Ethics Committee of The First Affiliated Hospital of Soochow University (Suzhou, China). Written informed consents were signed by the patients and/or guardians.

**Research methods.** Research indexes: i) First, the conventional ultrasound examination was performed to carefully observe the shape, boundary, internal echo, blood supply and resistance index of the lesion, and the diagnosis was basically confirmed; ii) the ultrasound-guided modified sonohysterography (modified SHG) was performed to mainly observe the size, shape, site and boundary of the myoma and their correlations with the muscular layer, and the diagnosis was made via the comprehensive analysis; iii) under the guidance of ultrasound, the best puncture path was confirmed, and the needle biopsy was performed in the blood flow-rich areas via the vaginal posterior fornix using the Bard biopsy gun and the disposable MN616 biopsy needle to take three lesion tissues, and the tissues were fixed and sent for pathological diagnosis; iv) under the guidance of ultrasound, the tumor received sclerotherapy. Type 0, submucous myoma: Lauromacrogol was injected into the pedicle of submucous myoma; type I and II, submucous myoma: Lauromacrogol was injected into the pseudo-capsule of tumors; v) after operation, the conventional ultrasound, color Doppler and ultrasonography were performed. Follow-up contents: The changes in clinical symptoms of patients were evaluated; the change in myoma volume was established; the adverse reactions in patients during and after ablation were recorded in detail to determine the relationship with ablation; and vi) the patient's life quality was evaluated using the 36 item Short-Form Health Survey Questionnaire (SF-36) (Fig. 1).

**Criteria of submucosal myoma of the uterus.** In the present study, patients with submucosal myoma of the uterus were divided into the following three types according to the classification criteria of Netherlands International Hysteroscopy Center: submucous myoma with pedicles (type 0): The myoma is located in the uterine cavity without expansion into the muscular layer; submucous myoma without pedicles (type I):  $\leq 50\%$  myoma expands to the muscular layer; submucous myoma without pedicles (type II):  $>50\%$  myoma expands to the muscular layer.

**Blood flow grading criteria.** In the present study, the blood flow signal in patients with submucosal myoma of the uterus was divided into the following four grades using the Adler method: Grade 0: no blood flow signal in myoma; grade 1: A small amount of blood flow in myoma, showing no more than two thin-rod or dotted blood vessels; grade 2: A medium amount of blood flow in myoma, showing one longer blood vessel into the lesion or three-four dotted blood vessels; grade 3: A large amount of blood flow in myoma, showing two longer blood vessels or no more than five dotted blood vessels.

Table I. Results of the pathological diagnosis of submucous myoma of the uterus.

Diagnosis result	Before treatment (n, %)	After treatment (n, %)	$\chi^2$	P-value
Type 0	6/24 (25.00)	0/24 (0.00)	1.000	<0.05
Type I	14/24 (58.33)	2/24 (8.33)	7.613	<0.05
Type II	4/24 (16.67)	1/24 (4.17)	8.257	<0.05

**SF-36 scoring criteria.** In the present study, the life quality of patients was evaluated using SF-36, including a total of eight dimensions: General health status, physical function, physical pain, somatic role, social function, life vitality, emotional role and mental health. The higher the score was, the better the health status of patients would be. Note: SF-36 can monitor the health of community population, compare the life quality between patients with chronic diseases and ordinary population, evaluate the burden of different chronic diseases, find the influencing factors of the life quality of patients and provide a basis for the prevention and control plan of chronic diseases in community.

**Statistical analysis.** All data in this study were analyzed using SPSS 20.0 statistical analysis software (IBM Corp., Armonk, NY, USA). Measurement data are presented as mean  $\pm$  standard deviation (mean  $\pm$  SD). One-way analysis of variance or repeated measurement analysis of variance was used for the comparison among groups, and least significant difference t-test (LSD-t) was used for pairwise comparison. Enumeration data are presented as percentage (%), and Chi-square test was used for the comparison among groups.  $P < 0.05$  was considered to indicate a statistically significant difference.

## Results

**Pathological diagnosis of submucous myoma of the uterus.** After modified SHG and ultrasound-guided needle biopsy, 24 out of 25 cases were confirmed pathologically as submucous myoma of the uterus, and the diagnostic accordance rate was 96%, including 6 cases of type 0, 14 of type I and 4 of type II submucous myoma. After treatment, 6 cases of type 0 completely disappeared and 18 of type I and II submucous myoma shrunk dramatically to intramural myoma. There was a significant difference in the pathological type of submucous myoma of uterus before and after treatment ( $P < 0.05$ ) (Table I).

**Changes in clinical symptoms of patients with submucous myoma of the uterus before and after treatment.** Before treatment, there were 10 cases of excessive menstruation, 6 of too-long menstrual period and 4 of anemia in patients with submucous myoma of uterus; after treatment, there were 6 cases of excessive menstruation and 2 of too-long menstrual period, and no patient suffered from anemia. The hemachrome level in patients before treatment was  $84.51 \pm 10.62$  g/l, and it was increased to  $116.32 \pm 12.21$  g/l after treatment. After treatment, the clinical symptoms of patients were significantly

Table II. Changes in clinical symptoms of patients with submucous myoma of the uterus before and after treatment.

Clinical symptom	Before treatment	After treatment	$\chi^2$ /t-test	P-value
Excessive menstruation (n, %)	10/24 (41.67)	6/24 (25.00)	8.216	<0.05
Too-long menstrual period (n, %)	6/24 (25.00)	2/24 (8.33)	7.079	<0.05
Anemia (n, %)	4/24 (16.67)	0/24 (0.00)	10.221	<0.05
Hemachrome (g/l)	84.51±10.62	116.32±12.21	7.233	<0.05

Table III. Maximum diameter and volume of myoma of patients with submucous myoma of the uterus before and after treatment.

Index	Before treatment	After treatment	t-test	P-value
Maximum diameter of myoma (cm)	3.25±0.47	2.02±0.23	9.105	<0.05
Volume of myoma (cm <sup>3</sup> )	25.91±3.47	18.15±2.39	11.336	<0.05

Table IV. Blood flow grading of patients with submucous myoma of uterus before and after treatment.

Blood flow grading	Before treatment (n, %)	After treatment (n, %)	$\chi^2$	P-value
Grade 0	0/24 (0.00)	14/24 (58.33)	1.000	<0.05
Grade 1	3/24 (12.50)	6/24 (25.00)	6.337	<0.05
Grade 2	7/24 (29.17)	5/24 (20.83)	5.275	<0.05
Grade 3	15/24 (62.50)	0/24 (0.00)	1.000	<0.05

improved compared with those before treatment ( $P<0.05$ ) (Table II).

*The maximum diameter and volume of myoma of patients with submucous myoma of the uterus before and after treatment.* Before treatment, the maximum diameter of myoma of patients with submucous myoma of the uterus was  $3.25\pm0.47$  cm, and it was reduced to  $2.02\pm0.23$  cm after treatment. The volume of myoma was  $25.91\pm3.47$  cm<sup>3</sup> before treatment, and it was reduced to  $18.15\pm2.39$  cm<sup>3</sup> after treatment. The maximum diameter and volume of myoma of patients with submucous myoma of uterus after treatment were significantly different from those before treatment ( $P<0.05$ ) (Table III).

*Blood flow grading of patients with submucous myoma of the uterus before and after treatment.* Before treatment, in terms of blood flow grading of patients with submucous myoma of the uterus, there was 0 case of grade 0, 3 of grade I, 7 of grade II and 7 of grade III. After treatment, there were 14 cases of grade 0, 6 of grade I, 5 of grade II and 0 of grade III. The blood flow grading of patients with submucous myoma of the uterus after treatment was significantly different from that before treatment ( $P<0.05$ ) (Table IV).

*Comparisons of SF-36 scores of patients with submucous myoma of the uterus before and after treatment.* The score of each dimension of patients with submucous myoma of the

uterus after treatment was significantly higher than that before treatment ( $P<0.05$ ). The SF-36 scores of patients with submucous myoma of the uterus after treatment were significantly different from those before treatment ( $P<0.05$ ) (Table V).

*Adverse reactions of patients with submucous myoma of the uterus after treatment.* The follow-up after treatment showed that there were 8 cases of mild abdominal pain, 7 of increased secretion, 6 of slight vaginal bleeding, 1 of cold sweat, 1 of pale complexion and 2 cases of dizziness. The above symptoms disappeared after treatment for about 1 week (Table VI).

## Discussion

Patients with myoma of the uterus are often accompanied by long menstrual period and profuse menstruation, and the severe cases may suffer from infertility or anemia, seriously threatening the health and even life of patients (9). At present, the main clinical treatment method of myoma of the uterus is laparoscopic fibroidectomy, but this surgical method has disadvantages of general anesthesia and higher cost; besides, the uterine arterial embolization has a higher technical requirement and the postoperative adverse reactions of patients are more serious. Patients receiving the above surgical treatment will have a longer recovery period after treatment, while those receiving interventional ultrasound-guided puncture injection of lauromacrogol have a shorter postoperative recovery period

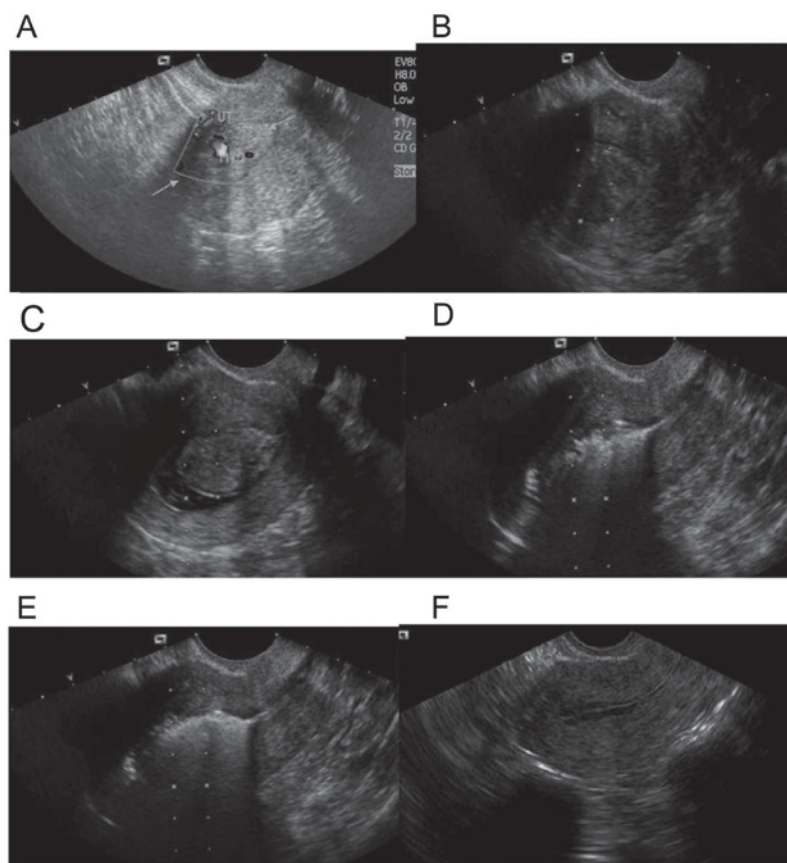


Figure 1. Diagnosis and treatment processes of interventional ultrasound. (A) Color Doppler image before intervention. (B) Needle insertion map in SHG; (C) Injection of normal saline in SHG; (D) Injection of hardening agent into the pedicle of tumors; (E) Uniform diffusion of hardening agent in the whole tumor; (F) Disappearance of 3M tumor after intervention.

Table V. Comparisons of SF-36 scores of patients with submucous myoma of the uterus before and after treatment.

Item	Before treatment	After treatment	t-test	P-value
General health	51.73±4.75	55.86±4.06	10.271	<0.05
Physical function	78.81±8.55	84.62±9.57	8.335	<0.05
Somatic role	67.55±5.34	72.67±6.84	6.201	<0.05
Physical pain	72.93±7.18	76.20±7.43	7.149	<0.05
Life vitality	70.38±6.67	78.66±7.16	7.445	<0.05
Social function	86.45±7.02	92.57±8.18	10.276	<0.05
Emotional role	73.29±8.37	81.46±8.84	11.051	<0.05
Mental health	64.39±5.46	69.37±6.61	9.223	<0.05

Table VI. Adverse reactions of patients with submucous myoma of the uterus after treatment.

Adverse reaction	Case (n, %)
Mild abdominal pain	8/24 (33.33)
Pale complexion	1/24 (4.17)
Dizziness	2/24 (8.33)
Cold sweat	1/24 (4.17)
Slight vaginal bleeding	6/24 (25.00)
Increased secretion	7/24 (29.17)

and even do not need to be hospitalized (10-12). Clinical studies have pointed out that the application of absolute ethyl alcohol as the hardening agent in the treatment of myoma has a better clinical effect, but patients often suffer from serious adverse reactions after operation. Lauromacrogol, as a kind of ether compound, is mainly used in the treatment of varicose veins, organ damage and bleeding and vascular malformations. However, it causes the endothelial cells in cystic wall with secretion function to produce aseptic inflammation, followed by cystic adhesions, closure and gradual absorption, so it has been used in sclerotherapy of cysts in clinical practice in previous years.



Although the incidence rate of submucous myoma of the uterus is only 5-10%, it can cause more serious clinical symptoms, mainly including excessive menstruation, prolonged menstrual period, shortened menstrual cycle and dysmenorrhea, which can also lead to secondary anemia and infertility. In modified SHG under the guidance of conventional transvaginal ultrasound, the 18GPTC puncture needle tip is placed in the uterine cavity to slowly infuse appropriate amount of normal saline, and there is no echo liquid dark area in the uterine cavity, forming a good acoustic window and contrast area, effectively improving the display rate of overall lesion structure. Modified SHG is a kind of non-invasive interventional ultrasound technique (13-15), characterized by non-invasion, low cost and easy tolerance, which is of great clinical significance in the diagnosis and differential diagnosis of submucous myoma of the uterus. Modified SHG has a unique superiority in the typing of submucous myoma (16-18), which can avoid myoma surface bleeding and other complications due to blind curettage, assess the percentage of tumor towards the uterine cavity in the whole tumor and help select the appropriate clinical resection mode of myoma. After modified SHG and ultrasound-guided needle biopsy, 24 out of 25 cases were confirmed pathologically as the submucous myoma of uterus, and the diagnostic accordance rate was 96%.

In the present study, all the confirmed cases underwent ultrasound-guided sclerotherapy of myoma of uterus, and SHG was still needed before treatment for two reasons: i) The injection of appropriate amount of normal saline into the uterine cavity can separate the uterine cavity, and the source of myoma pedicle can be clearly displayed under the action of normal saline, which is helpful in the guidance of injection therapy; and ii) the normal saline injected into the uterine cavity also plays a role in protecting the endometrium, which can prevent a small amount of fluid infiltrating into the uterine cavity damaging the endometrium. After sclerotherapy, 6 cases of type 0 submucous myoma shrunk because the blood supply in pedicle was blocked, and the myoma completely disappeared later. A total of 18 cases of type I and II submucous myoma were significantly reduced. Before treatment, the maximum diameter of myoma of patients with submucous myoma of the uterus was  $3.25 \pm 0.47$  cm, and it was reduced to  $2.02 \pm 0.23$  cm after treatment. The volume of myoma was  $25.91 \pm 3.47$  cm<sup>3</sup> before treatment, and it was reduced to  $18.15 \pm 2.39$  cm<sup>3</sup> after treatment. A total of 14 cases of myoma were completely inactivated, while 4 were partially inactivated. After treatment, menstrual period and anemia, hemachrome level and blood flow grading of patients with submucous myoma of uterus were obviously improved compared before treatment ( $P < 0.05$ ). The destructive effect of lauromacrogol on blood vessels may be the mechanism of intratumor injection of lauromacrogol in the treatment of submucous myoma of the uterus: The destruction, coagulation and degeneration of myoma capsule of the uterus and endothelial cells in internal blood vessels lead to vascular embolization, finally causing obstacles in the blood supply of myoma tissues and aseptic inflammation (19). Further studies have pointed out that the adverse reactions of patients with renal cyst and liver cyst after the lauromacrogol sclerotherapy were superior to those after the treatment with absolute ethyl alcohol (20). It was found in the follow-up after treatment that

a small number of patients suffered from mild abdominal pain, increased secretion, slight vaginal bleeding, cold sweat, pale complexion, dizziness and other symptoms, which, however, disappeared after treatment for about 1 week. At present, it remains unknown whether the treatment with lauromacrogol will lead to the protein denaturation in cells of myoma of the uterus. Lauromacrogol is one of the ether compounds, and the local injection of lauromacrogol will produce slight anesthetic effect on the tissues of patients, which is helpful to alleviate the patient's postoperative pain and improve the patient's tolerance. In addition, the score of each dimension of patients with submucous myoma of the uterus after treatment was significantly higher than that before treatment, and the score of SF-36 was significantly different before and after treatment ( $P < 0.05$ ), indicating that the life quality of patients with submucous myoma of uterus was significantly improved.

In conclusion, the interventional ultrasonography can effectively diagnose submucous myoma of the uterus. The treatment of submucous myoma of the uterus with ultrasound-guided intratumor injection of lauromacrogol is characterized by simple operation, which can effectively reduce the tumor diameter and volume, improve the blood flow in patients, reduce the postoperative adverse reactions and alleviate the patient's pain, thus improving the quality of life, it is a new type of minimally invasive treatment method of submucous myoma of the uterus, and it is worthy of clinical promotion and application.

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#### Availability of data and materials

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

#### Authors' contributions

BL contributed significantly to writing the manuscript and analyzed pathological diagnosis of submucous myoma of the uterus. YGX and XPX helped with submucosal myoma of the uterus type and blood flow grading. CHH helped the conception of the study and performed statistical analysis. All authors read and approved the final manuscript.

#### Ethics approval and consent to participate

The study was approved by the Ethics Committee of The First Affiliated Hospital of Soochow University (Suzhou, China). Written informed consents were signed by the patients and/or guardians.

#### Consent for publication

Not applicable.

## Competing interests

The authors declare that they have no competing interests.

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