

# Reproductive Outcomes of Patients with Septate Uterus After Hysteroscopic Septoplasty: A Retrospective Study in Chinese Women

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## Research Article

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## Abstract

## Objective

Septate uterus is the most common structural uterine anomaly, which is related to the adverse pregnancy outcomes in women of childbearing age. At present, there are still controversies about the surgical treatment of septate uterus both nationally and internationally. This article provides a retrospective review of hysteroscopic uterine septum resection performed in our hospital during recent years, focusing on the patients with recurrent miscarriage and infertility.

## Methods

This is a single-center retrospective cohort study. Cases of women who underwent hysteroscopic septum resection at West China Second Hospital of Sichuan University from January 2014 to December 2019, retrieved through the medical record system, were divided into three groups: Group A was the recurrent miscarriage group, Group B had a history of pregnancy with spontaneous abortion once at most; Group C was the primary infertility group. Each patient was followed up by telephone about further pregnancy, miscarriage, and live birth for at least 1 year.

## Results

A total of 176 surgical patients were included in this study. The overall pregnancy rate increased from 65.91–77.27% after surgery, the live birth rate increased from 7.95–67.61%, and the spontaneous abortion rate decreased from 46.59–17.05%. The postoperative pregnancy and spontaneous abortion rates in Group A were not significantly different from the other two groups, but the live birth rates were still significantly lower. For patients with complete uterine septum, the preoperative pregnancy rate was 54.84%, which was significantly lower than patients with partial uterine septum (71.93%). After hysteroscopic metroplasty, the pregnancy rate increased to 85.48% in patients with complete uterine septum, and 72.81% in the partial uterine septum group, but no statistical difference was observed.

## Conclusions

After uterine septum resection, the overall pregnancy rate and live birth rate increased, and the spontaneous abortion rate decreased. However, the postoperative live birth rate and term delivery rate of RSA patients were significantly lower than other two groups. Patients with complete uterine septum may benefit more from surgery. The surgical indications should be carefully and strictly evaluated.

## Introduction

Septate uterus is the most common congenital uterine anomaly, accounting for more than half of all cases<sup>[1]</sup>. It is caused by complete or partial failure of resorption after the fusion of the two Müllerian ducts during embryonic development<sup>[2]</sup>, and is mainly related to poor pregnancy outcome in women of childbearing age, such as recurrent spontaneous abortion (RSA), premature birth, fetal malpresentation, stillbirth, fetal malformation, fetal growth restriction, placental abruption, etc.<sup>[3]</sup>, the rate of full-term delivery is only 40%<sup>[4, 5]</sup>.

The exact mechanism of adverse reproductive outcomes caused by septate uterine is still unknown. There is a general consensus that uterine mediastinum may influence the embryos implantation because the absence of local endometrial vascular endothelial growth factor (VEGF) receptor results in maldevelopment of placenta<sup>[6, 7]</sup>. Some scholars believe that the muscle fibers of uterine mediastinum has lower sensitive to steroid hormones<sup>[8]</sup>, and the uncoordinated contraction of muscle fibers can also lead to miscarriage<sup>[9]</sup>.

A number of retrospective studies have shown<sup>[10–12]</sup> that removal of the uterine septum and restoration of the normal uterine architecture can help reduce the rate of spontaneous miscarriage and increase the rate of live births, especially for women with a history of adverse pregnancy outcomes. However, there is a lack of high-quality evidence-based medical evidence for these benefits. In recent years, several newly published multi-center clinical studies have brought this traditional belief into question<sup>[13, 14]</sup>, Hence, the controversy about the “overtreatment” of the septate uterus is endless<sup>[15]</sup>. In China, rich experience has been accumulated in the surgical treatment of the septate uterus with the widespread application of hysteroscopic. Therefore, this study reviewed and summarized the clinical information from 176 patients who underwent this procedure at our hospital in the past recent years and their subsequent pregnancy outcomes were traced. We aimed to explore the value of hysteroscopic resections of the uterine septum, especially focusing on the patients with recurrent miscarriage and infertility.

## Methods

### Study population

The present study was a single-center retrospective study. Women who underwent Septum resection at West China Second Hospital of Sichuan University from 2014 to 2019 were retrieved by searching the electronic medical record system, and basic information such as age, BMI, and history of pregnancy and childbirth were collected. The preoperative diagnosis primarily based on imaging<sup>[3, 16]</sup> (ultrasound, magnetic resonance imaging, or hysterosalpingography). The exclusion criteria for the cases were: Case exclusion criteria: 1. aged >45 years; 2. Patients with pelvic abscess, pelvic tuberculosis, premature ovarian

insufficiency, premature ovarian failure, amenorrhea. 3. Recurrent spontaneous abortion caused by factors such as immunity, endocrine, genetic abnormalities, infection, etc. 4. Women without reproductive requirements; 5. Patients who lost to follow-up.

According to the preoperative fertility status, the included cases were divided into three groups: Group A is the recurrent miscarriage group, defined as 2 or more consecutive pregnancy losses according to the American Society of Reproductive Medicine (ASRM)<sup>[17]</sup> and the European Society of Human Reproduction and Embryology (ESHRE)<sup>[18]</sup>; Group B has a history of pregnancy but spontaneous abortions happened no more than once; Group C has no history of pregnancy, which means primary infertility. This study was granted the ethical committee approval from the hospital's medical ethics committee and all patients signed the informed consent.

## Surgical Technique

Hysteroscopy is performed during the follicular phase of the menstrual cycle. The day before the operation, misoprostol or a disposable cervical dilator is used to soften the cervix. Hysteroscopy combined with laparoscopy was performed for patients with unclear diagnosis of uterine malformations, infertility, space-occupying lesions of the uterine adnexa and secondary dysmenorrhea<sup>[19]</sup>. The hysteroscopic metroplasty is performed under general anaesthesia and can be monitored by ultrasound imaging. According to the ESHRE/ESGE classification system<sup>[20]</sup>, the standard for complete resection of the uterine mediastinum is that the thickness of the myometrium of the uterine fundus returned to the normal range. A combination of estrogens, Foley balloon or T-shaped intrauterine device is used to prevent postoperative intrauterine adhesions. In accordance with the intraoperative and postoperative situation, hysteroscopic operations should be performed again if necessary.

## Follow Up And Case-control Study

After surgery each participant was followed up by telephone to collect the information of first pregnancy, the mode of delivery, the gestational age, the number of miscarriages etc, and to determine whether the patient had received any form of assisted reproduction technology for conception. The minimum follow-up duration was 12 months for all patients.

Then a retrospective case-control study is performed to search the possible influence factors on different pregnancy outcomes of the included cases: Women with septate uterus combined with primary infertility are divided into postoperative pregnancy group and postoperative infertility group, the exposure factors evaluated were age, BMI, menstrual status, septum size, surgical method, endometriosis, endometrial polyps and postoperative adjuvant treatment.

Similarly, patients with septate uterus combined with recurrent miscarriage are divided into live birth group and non-live birth group, according to the reproductive outcome after hysteroscopic metroplasty. The exposure factors include the number of preoperative pregnancy, the number of spontaneous abortions, age, BMI, menstruation, septum size, surgical methods, endometriosis, endometrial polyps, and postoperative adjuvant treatment.

## Statistical analysis

Measurement data such as age and BMI were expressed as mean  $\pm$  standard deviation (SD) and were compared using simple t-test; Mc Nemar test was applied to compare the differences in pregnancy outcomes before and after surgery; Chi-square test was used for subgroup analysis. The statistical software is SPSS version 13.0 (SPSS, Chicago, Illinois, USA), and a value with a P value less than 0.05 is considered to be statistically different.

## Result

### Baseline characteristics

As shown in Figure 1, a total of 176 surgical patients were included in this study, and all cases had no complications such as uterine perforation or water intoxication. Among the included cases, 42 patients had a history of recurrent miscarriage (Group A), 60 patients were diagnosed as primary infertility (Group C) before surgery, and a total of 71 patients had a history of secondary infertility. A total of 35 patients underwent secondary surgical exploration, accounting for 19.89% of the all cases. The basic characteristics of the included cases are shown in Table 1. There were no significant differences in age, BMI, reoperation rate, live birth rate, or postoperative adjuvant treatment among the three groups. In Group A, women with complete uterine septum accounted for 21.43%, while in Group C, complete uterine septum accounted for 46.67%, there was a significant difference between the two groups. In the choice of surgical modalities, the numbers of hysteroscopy combined with laparoscopic exploration in the three groups were 6 (14.29%), 36 (48.65%), and 49 (81.67%), respectively, with statistical differences.

Table 1  
Basic characteristics of the included patients.

	Total (n=176)	Group A 42 (23.86%)	Group B 74 (42.05%)	Group C 60 (34.09%)	Group Avs.B P value	Group Avs.C P value	Group Bvs.C P value
Age (mean, SD)	27.94±3.83	28.62±4.07	28.16±4.05	27.18±3.26	0.56	0.05	0.13
BMI (kg/m <sup>2</sup> )	21.51±3.02	21.84±3.19	21.34±2.94	21.51±3.02	0.39	0.59	0.74
Reoperation n.(%)	35 (19.89%)	11 (26.19%)	11 (14.86%)	13 (21.67%)	0.14	0.6	0.31
<b>Endometriosis</b>							
Yes	43/91 (47.25%)	2/6 (33.33%)	16/36 (44.44%)	25/49 (51.02%)	0.95	0.7	0.55
No	48/91 (52.75%)	4/6 (66.67%)	20/36 (55.56%)	24/49 (48.98%)			
<b>Infertility</b>							
Primary	60/131 (45.80%)	/	/	60 (100%)	/	/	/
Secondary	71/131 (54.20%)	27 (64.29%)	44 (59.46%)	/	0.608	/	/
<b>Menstruation</b>							
Irregular	17 (9.66%)	7 (16.67%)	5 (6.76%)	5 (8.33%)	0.17	0.33	0.99
Regular	159 (90.34%)	35 (83.33%)	69 (93.24%)	55 (91.67%)			
<b>Classification</b>							
Partial septate uterus	114 (64.77%)	33 (78.57%)	49 (66.22%)	32 (53.33%)	0.16	0.01	0.13
Complete septate uterus	62 (35.23%)	9 (21.43%)	25 (33.78%)	28 (46.67%)			
<b>Operation</b>							
Hysteroscope	85 (48.30%)	36 (85.71%)	38 (51.35%)	11 (18.33%)	0	0	0
Hysteroscopy+laparoscopy	91 (51.70%)	6 (14.29%)	36 (48.65%)	49 (81.67%)			
<b>Adjuvant therapy</b>							
IUD	70/117 (59.83%)	15/31 (48.39%)	25/43 (58.14%)	30/43 (69.77%)	0.41	0.06	0.26
Balloon	47/117 (40.17%)	16/31 (51.61%)	18/43 (41.86%)	13/43 (30.23%)			
*							

## Reproductive Outcomes

The overall pregnancy outcome of the included cases is shown in Table 2: The preoperative pregnancy rate was 65.91%, the postoperative rate was 77.27%; the preoperative spontaneous abortion rate was 46.59%, and the postoperative rate was 17.05%; the preoperative live birth rate was only 7.95%, the postoperative live birth rate reached 67.61%. Although the preterm birth rate increased from 1.70% before surgery to 10.23%, the preterm live birth rate also increased from 1.14–8.52%. According to Table 3, the pregnancy rate, spontaneous abortion rate, premature birth rate, and cesarean section rate of RSA patients (Group A) after hysteroscopic metroplasty were not significantly different from the other two groups, but the live birth rate and term birth rate were significantly lower.

Table 2  
Comparison of reproductive outcome before and after hysteroscopic septoplasty

n=176	Before septum resection	After septum resection	P value	RR	OR
Pregnant	116 (65.91%)	136 (77.27%)	0.02	1.17	1.76
Spontaneous abortion	82 (46.59%)	30 (17.05%)	0.00	0.37	0.24
Live birth	14 (7.95%)	119 (67.61%)	0.00	8.50	24.16
Term delivery	13 (7.39%)	104 (59.09%)	0.00	8.00	18.11
Preterm birth	3 (1.70%)	18 (10.23%)	0.00	6.00	6.57
Preterm live births	2 (1.14%)	15 (8.52%)	0.00	7.50	8.11

Table 3  
Obstetric outcome after hysteroscopic septoplasty in three group

After septum resection	GroupA n=42	GroupB n=74	GroupC n=60	Group Avs.B P value	Group Avs.C P value	Group Bvs.C P value
Pregnant	30 (71.43%)	61 (82.43%)	45 (75.00%)	0.17	0.69	0.29
Live birth	21 (50.00%)	55 (74.32%)	43 (71.67%)	0.01	0.03	0.73
Abortions	9 (21.43%)	13 (17.57%)	8 (13.33%)	0.61	0.28	0.50
Term delivery	16 (38.10%)	52 (70.27%)	36 (60.00%)	0.00	0.03	0.21
Preterm births	7 (16.67%)	3 (4.05%)	8 (13.33%)	0.05	0.64	0.10
Preterm live births	5 (11.90%)	3 (4.05%)	7 (11.67%)	0.22	1.00	0.18
Cesarean section	16/23 (69.57%)	45/55 (81.82%)	32/44 (72.73%)	0.23	0.79	0.28

## Subgroup Analyses

Table 4 categorizes the fertility status of the included cases before and after surgery according to factors such as age, septum size, endometriosis, surgical methods, and infertility types: the preoperative live birth rate of septate uterus patients younger than 30 years old was only 4.07% (5/123), which was significantly lower than that of patients older than 30 (16.98%, 9/53,  $p=0.01$ ). But after hysteroscopic uterine septum resection, the live birth rate of patients younger than 30 has a very significant boost, reaching 73.17% (90/123,  $p=0.02$ ).

Table 4  
Subgroup analysis

	Before septum resection						After septum resection					
	n.	Pregnancy	P	Life birth	P	Abortions	P	Pregnancy	P	Life birth	P	Abortions
<b>Age</b>			0.08		0.01		0.92		0.05		0.02	
<30	123	76(61.79%)		5(4.07%)		57(46.34%)		100(81.30%)		90(73.17%)		20(16.26%)
≥30	53	40(75.47%)		9(16.98%)		25(47.17%)		36(67.92%)		29(54.72%)		10(18.87%)
<b>Classification</b>			0.02		0.16		0.06		0.06		0.09	
Partial septate	114	82(71.93%)		12(10.53%)		59(51.75%)		83(72.81%)		72(63.16%)		20(17.54%)
Complete septate	62	34(54.84%)		2(3.23%)		23(37.10%)		53(85.48%)		47(75.81%)		10(16.13%)
<b>Endometriosis</b>			0.44		0.15		0.49		0.39		0.33	
Yes	43	18(41.86%)		1(2.33%)		9(20.93%)		33(76.74%)		31(72.09%)		6(13.95%)
No	48	24(50.00%)		6(12.50%)		13(27.08%)		33(68.75%)		30(62.50%)		6(12.50%)
<b>Operation</b>			0.00		0.89		0.00		0.12		0.87	
H	85	74(87.06%)		7(8.24%)		60(70.59%)		70(82.35%)		58(68.24%)		18(21.18%)
H+L	91	42(46.15%)		7(7.69%)		22(24.18%)		66(72.53%)		61(67.03%)		12(13.19%)
<b>Adjuvant therapy</b>			0.10		1.00		0.06		0.44		0.11	
IUD	70	40(57.14%)		4(5.71%)		28(40.00%)		59(84.29%)		53(75.71%)		15(21.43%)
Balloon	47	34(72.34%)		2(4.26%)		27(57.45%)		37(78.72%)		29(61.70%)		10(21.28%)
<b>Infertility</b>			0.00		0.00		0.00		0.74		0.24	
Primary	60	0(0.00%)		0(0.00%)		0(0.00%)		45(75.00%)		43(71.67%)		8(13.33%)
Secondary	71	71(100.00%)		11(15.49%)		51(71.83%)		55(77.46%)		44(61.97%)		16(22.54%)

Table 5  
Case-control study for patients combined with primary infertility or RSA

Primary infertility n=60	Postoperative pregnancy group (n=45)	Postoperative infertility group (n=15)	P value
Age (y)	26.96±3.31	27.87±3.11	0.35
BMI (kg/m <sup>2</sup> )	21.69±3.12	20.94±2.70	0.41
Complete septate uterus	24 (53.33%)	4 (26.67%)	0.07
Endometriosis	19 (42.22%)	6 (40.00%)	0.88
Endometrial polyps	19 (42.22%)	4 (26.67%)	0.28
Laparoscope	37 (82.22%)	12 (80.00%)	1.00
Reoperation	10 (22.22%)	3 (20.00%)	1.00
IUD	23 (51.11%)	7 (46.67%)	0.77
Balloon	11 (24.44%)	2 (13.33%)	0.59
RSA n=42	Postoperative live birth group (n=21)	Postoperative Non-live birth group (n=21)	P value
Pregnancy (n)	2.57±0.87	3.29±1.27	0.04
Abortions (n)	2.33±0.66	2.71±0.90	0.13
Age (y)	28.19±3.33	29.05±4.74	0.50
BMI (kg/m <sup>2</sup> )	21.32±2.23	22.35±3.91	0.30
Complete septate uterus	5 (23.81%)	4 (19.05%)	1.00
Endometriosis	2 (9.52%)	0 (0.00%)	0.47
Endometrial polyps	3 (14.29%)	3 (14.29%)	1.00
Laparoscope	4 (19.05%)	2 (9.52%)	0.66
Reoperation	7 (33.33%)	4 (19.05%)	0.29
IUD	8 (38.10%)	7 (33.33%)	0.75
Balloon	7 (33.33%)	9 (42.86%)	0.53

For patients with complete uterine septum, the preoperative pregnancy rate was 54.84% (34/62), which was significantly lower than that of patients with partial uterine septum (71.93%, P=0.02). After surgery, the pregnancy rate of patients with complete uterine septum increased to 85.48% (53/63), however, there were no statistical differences compared to the patients with partial uterine septum.

Among the included cases, 85 cases (48.30%) underwent hysteroscopic uterine septum resection, 91 cases (51.70%) underwent hysteroscopy combined with laparoscopy. For patients who underwent only hysteroscopic surgery, the preoperative pregnancy rate and miscarriage rate were both significantly higher than the other group. However there was no statistical difference was observed in the pregnancy rate and miscarriage rate between the two groups after the operation.

## Case-control Study

In the 60 patients with primary infertility, 15 were still unsuccessful conceived during the follow-up after the operation, the remaining 45 were successful pregnancy; Early miscarriages occurred in 8 women after the operation, and there were 43 live births, including 7 preterm births and 36 full-term births; The cesarean section rate was 76.74% (33/43). Univariate analysis found that there were no significant differences in age, BMI, septum size, surgical methods, endometriosis, and endometrial polyps between the postoperative pregnancy group and the postoperative infertility group.

Among 42 patients with recurrent miscarriage, the postoperative live birth rate was 50% (21/42), including 5 preterm births and 16 full-term births, and the cesarean section rate was 76.19% (16/21). Early miscarriages occurred in 9 women after surgery. Univariate study found that the number of pre-operative pregnancies in the RSA live birth group was significantly less than that in the RSA non-live birth group (p=0.04). The remaining factors like number of miscarriages, age, BMI, septum size, surgical methods, and endometriosis or endometrial polyps showed no significant differences between the two groups.

## Discussion

Since 1970, hysteroscopic uterine septum resection has become the first-line therapy for septate uterus<sup>[21]</sup> and has been widely performed in many countries<sup>[22]</sup>. Compared with traditional laparotomy, hysteroscope offers benefits such as small trauma, quick recovery, and shorter postoperative

contraceptive time<sup>[23]</sup>; its main complications include intraoperative bleeding, uterine perforation, water poisoning, intrauterine adhesions and increase the risk of uterine rupture when pregnancy again<sup>[19]</sup>. It is necessary to strictly assess the risk and benefit of surgery<sup>[24]</sup>. At present, there is still a controversy for the surgical indications for septate uterus, considering there are probably no obvious symptoms for such patients, which was incidentally detected at cesarean section or physical examination. Often, this disease is mainly related to the adverse pregnancy outcomes, however, some patients with septate uterus can also experience a normal pregnancy and spontaneous delivery<sup>[19]</sup>.

In my country, surgical treatment can be performed for patients with uterine septum who have fertility requirements and have a history of infertility and poor maternal outcome, according to the Chinese expert consensus on the diagnosis and treatment of female genital tract anomalies (2015). However, foreign literature reported that there is no sufficient evidence to prove that the uterine septum can cause infertility<sup>[3]</sup>. In the present study, primary infertility accounted for 34.09% (60/176), of which 49 patients performed hysteroscopic + laparoscopic surgery. Table 1 shows that the proportion of patients with primary infertility to perform laparoscopic surgery was significantly higher than patients with fertility histories; this is because laparoscopic surgery can simultaneously check the patency of the fallopian tubes, pelvic endometriosis, adnexal masses, etc<sup>[25]</sup>. Although the pregnancy rate of these 49 patients was as high as 75.51% (37/49) and the live birth rate was 71.43% (35/49) after surgery, it is difficult to determine whether the improvement in pregnancy outcome is caused by the removal of the mediastinum, due to the impact of confounding factors. 11 patients with primary infertility underwent hysteroscopic surgery only. After the operation, 8 patients were successfully conceived and delivered (pregnancy and live birth rate 72.73%), including 2 premature births and 6 full-term births. It is suggested that uterine septum resection may still have some positive significance for patients with primary infertility, which is consistent with the findings of Panagiotis Bakas et al.<sup>[26]</sup>. Similarly, a recent retrospective cohort study found that mediastinal resection in patients with primary infertility can reduce the spontaneous abortion rate after IVF/ICSI<sup>[27]</sup>.

Septate uterus with a history of recurrent miscarriage is a recognized surgical indication<sup>[28]</sup>, and even some studies have pointed out that surgical treatment is only recommended for such patients<sup>[29]</sup>. A prospective study by Li-Hong Pang et al.<sup>[30]</sup> confirmed that septum resection can significantly increase the pregnancy rate and term delivery rate of RSA patients, and reduce the rate of miscarriage and preterm birth, compared with the control group. In this study, the live birth rate of 42 RSA patients increased from 7.14–50% after surgery, but it was still significantly lower than non-RSA patients (73.13%). Since the etiology of RSA is multifactorial and has not been clearly elucidated yet, and related to the factors like uterus anomalies, chromosomal abnormalities, endocrine, infection, thrombophilia, immunity, etc.<sup>[31]</sup> suggesting that the influence of these factors should be excluded before uterine septum resection in patients with RSA. The univariate analysis found that the live birth rate in RSA patients might relate to the number of preoperative pregnancy, but this result needs to be verified by expanding the sample size.

The traditional belief is that surgical removal of the uterine septum can improve reproductive outcome by recovering the normal anatomical structure of the uterus. This is mainly based on a series of retrospective cohort studies published in the early years<sup>[32]</sup>. However, most of these studies with a before-and-after design may exaggerate the surgery effect, therefore this view is currently questioned. Opponents argue that hysteroscopic metroplasty could increase the risk of obstetric complications<sup>[33]</sup>, and the risks of surgery outweigh the benefits. Among the 176 cases included in the present study, severe obstetric complications were experienced in only 1 patient (uterine rupture) and the cesarean section rate was as high as 76.23%(93/122).

A Cochrane review<sup>[34]</sup> published in 2017 summarized 9 previously published literature, of which 3 studies showed that the pregnancy rate after uterine septum resection was significantly higher than expecting treatment group, while 6 studies found that there was no significant difference in pregnancy outcomes between the two groups. In 2020, an international multicentre cohort study<sup>[14]</sup> included 257 patients with septate uterus, 151 patients underwent septum resection and 106 patients received expectant treatment. The results showed that the reproductive outcomes between the two groups have no significant difference. However, retrospective cohort study design clustered by the severity of the disease and reproductive history may weaken the effect of surgical treatment to some degree. Therefore, the same research team conducted another multicenter randomized controlled study with a sample size of 80 cases<sup>[13]</sup> and also obtained the same conclusion. But due to the limitation of sample size, no further studies have been conducted on patients with different types of infertility or combined recurrent miscarriages. Regrettably, another randomized controlled study in the United Kingdom has been suspended due to difficult patient recruitment (ISRCTN28960271). It is hoped that more well-designed, large-sample, multicenter studies will be conducted in the future to provide higher-quality evidence.

## Conclusions

Although this retrospective study made the bias hardly be avoided and suffered from a high rate of lost follow-up, the overall pregnancy rate and live birth rate increase and the spontaneous abortion rate decreases after surgical removal of the uterine septum, according to the existing data. After septum resection, the live birth rate and term delivery rate of RSA patients were significantly lower than those of other two groups, but the pregnancy rate, spontaneous abortion rate, premature birth rate, and cesarean section rate were not significantly different from other patients. Women with complete uterine septum have a more significant increase in postoperative pregnancy rates. For patients had combined primary infertility, hysteroscopy combined with laparoscopy is recommended, which can explore the fallopian tube and pelvic cavity at the same time helping to increase the pregnancy rate.

## Declarations

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**Ethics approval:** This is an observational study. The Medical Ethics Committee of West China Second Hospital has confirmed that no ethical approval is required.

**Informed Consent:** Informed consent was obtained from all individual participants included in the study.

#### Author Contribution

**Zhu Lan:** Formal analysis, Visualization, Writing - Original Draft

**Run He:** Software, Resources, Investigation (collect the medical data)

**Shanshan Zhou and Guangji Xia:** Investigation (telephone follow-up)

**Ying Long:** Data Curation

**Mingrong Xi:** Validation

**Jing Fu:** Methodology

**Yunwei Ouyang:** Conceptualization, Supervision, Review and Editing

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## Figures

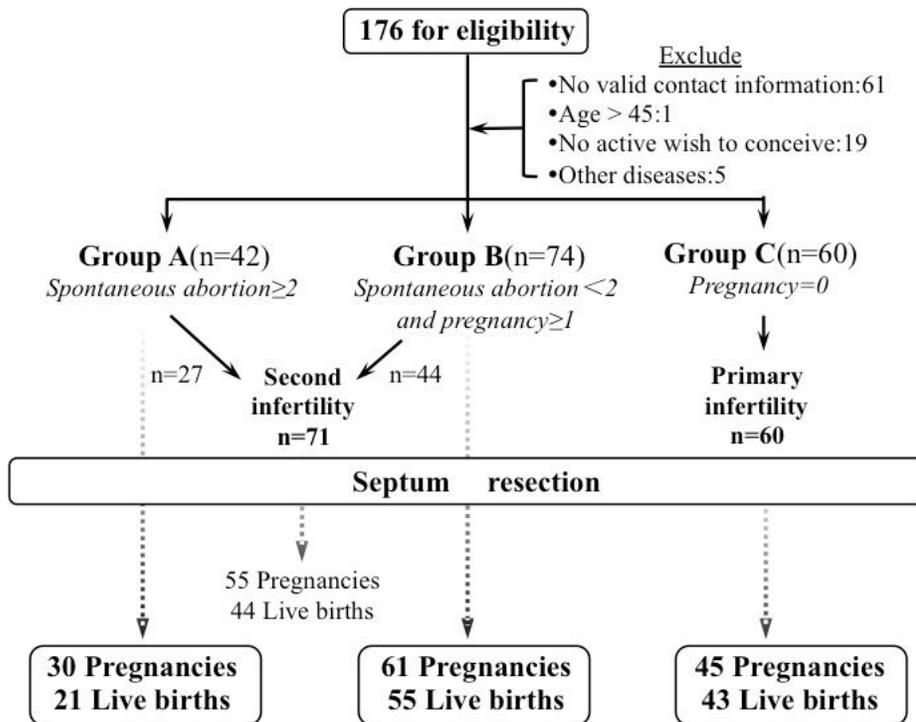


Figure 1

Flow diagram of reproductive outcomes.