Comparison of the Reproductive Outcomes of Patients With Incomplete and Complete Uterine Septum

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Abstract

Purpose To evaluate the effects of transcervical resection of the septum (TCRS) for two kinds of uterine septum on reproductive outcomes among women of reproductive age.

Methods In this retrospective cohort study, we evaluated the reproductive outcomes after TCRS of 57 women with incomplete uterine septum and 23 women with complete uterine septum from January 2010 to December 2018 at the Second Affiliated Hospital of Anhui Medical University.

Results In group A, the spontaneous abortion and embryo arrest rates were significantly reduced by TCRS ($P<0.001$), and the rate of term delivery was improved ($P<0.001$) after TCRS. In group B, the pregnancy rate was significantly increased (43.5% vs. 82.6%), the rate of spontaneous abortion was significantly reduced ($P<0.05$), and the rate of term delivery was significantly improved ($P<0.001$) after operation. The cesarean section rate was significantly higher in group B than in group A after operation (76.5% vs. 47.7%). The pregnancy rate was highest at approximately the 6th month in group A and at approximately the 12th month in group B after operation.

Conclusion We found that in patients who underwent TCRS, the rate of spontaneous abortion decreased, and the rates of pregnancy and full-term birth increased; however, the rates of cesarean section and placenta previa increased. Considering the high miscarriage and infertility rates before operation, TCRS seems effective. An incomplete uterine septum resection can lead to an earlier pregnancy than a complete uterine septum resection after surgery, thus ensuring the best time for pregnancy is not missed.

Introduction

Uterine septum is the most common uterine malformation. The partition between the two fused Müllerian ducts results in a septum that divides the uterine cavity. This unabsorbed degree may be due to partial involvement of the uterine cavity or complete separation of the uterine cavity and the cervical canal into two equal or unequal parts, namely, the incomplete uterine septum and complete uterine septum [1]. Most women with a uterine septum have effective reproductive function [2]; however, there is ample evidence that the uterine septum causes miscarriage and preterm delivery [3], and there is also some evidence that the septum may increase the risk of other adverse pregnancy outcomes, such as fetal position abnormality, intrauterine growth restriction, placental abruption, and perinatal death [4]. Due to the low pregnancy rate and high abortion rate of the uterine septum, studies have shown that surgical septum resection can significantly improve the pregnancy outcome [5, 6]. At present, transcervical resection of the septum (TCRS) is widely used for the treatment of uterine septum.

The aim of this study was to compare the reproductive outcomes of pregnant women before and after septum resections and obtain data on the differences between incomplete and complete uterine septum in terms of various parameters, including the optimum gestation time, complications, and delivery after TCRS.

Methods

A total of 134 patients with uterine septum who attended the Second Affiliated Hospital of Anhui Medical University were enrolled from January 2010 to December 2018. Fifty-four patients were lost to follow-up or did not meet the inclusion criteria during follow-up; for example, they had no intention of procreating. We followed up the included patients three years later. The patients involved in this study presented to the clinic with either spontaneous abortion or infertility, and all of them underwent an ultrasound examination wherein the uterine septum was discovered and surgical treatment was required (Figure 1). Among the 80 cases, 57 with incomplete uterine septum (group A) and 23 with complete uterine septum (group B) were followed up. In all cases, surgery was performed during the early proliferative phase of the menstrual cycle under general anesthesia without preoperative thinning of the endometrium with danazol or gonadotropin-releasing hormone (GnRH) agonists. Oral estrogen progesterone was recommended for 3 months after the operation. Postoperative contraception was performed in all cases of the uterine septum to varying degrees, for approximately 2 months in group A and approximately 4 months in group B.

We compared the preoperative and postoperative pregnancy outcomes of the patients with uterine septum, such as the pregnancy rate, spontaneous abortion rate, embryo arrest rate, fetal term birth rate, and premature birth rate, and compared the postoperative pregnancy outcomes of the complete and incomplete uterine septum groups, including the optimal postoperative pregnancy time, postoperative delivery mode, and postoperative pregnancy complications.

Statistical analysis was performed by using the Wilcoxon rank-sum test for parametric and nonparametric continuous variables. Continuous data are reported as the mean $\pm$ standard deviation (SD), and the χ^2 test or Fisher's exact test were used to assess categorical variables. $P < 0.05$ was considered statistically significant.

Surgical equipment and technique

The STORZ (Germany) hd hysteroscopy complete equipment was used. The dilation medium was 5% mannitol, the dilation pressure was set to 13.4 kPa, and the dilation liquid flow rate was set to 250 mL/min. Monopole electric cutting equipment (needlelike electrode and 90° electric cutting ring) was chosen during the operation and used at a power of 70 W.

Incomplete uterine septum: The septum was cut with needlelike electrodes from the caudal end, and the mediastinum was alternately cut horizontally and left to right along the imaginary plane of the bilateral oviduct opening.

Complete uterine septum: Some septum absorption could be seen above the endocervix, forming a small absence to allow bilateral uterine phase communication. We could use the missing septum as a starting point to cut the septum in the cephalic direction. For a complete uterine septum without septum absence to form bilateral uterine communication, it is difficult to select the site of septum incision. Hysteroscopy was performed on the side with the larger uterine cavity. Then, 3–5 mL normal saline was repeatedly

injected into and aspirated out with the Foley balloon catheter of the contralateral uterine cavity, and the septum could be observed by hysteroscopy. After the septum was defined, the septum was cut into the contralateral uterine cavity at the lower segment of the uterus. The septum was then cut in the same way as an incomplete uterine septum.

Under hysteroscopy, the septum was grayish white and lacked vascular dense tissue, which was the anatomic feature used to determine whether the mediastinum was completely resected. Additionally, the fundus muscle thickness was restored to normal uterine wall thickness.

Results

1| Basic data

There was no significant difference in age between the two groups (Table 1). The pregnancy rate of the patients with incomplete uterine septum was significantly higher than that of patients with complete uterine septum before operation (82.6% vs. 43.5% $P<0.001$), but there was no significant difference between the two groups after the operation. An incomplete uterine septum had a cavity length of 2.45 ± 0.91 cm and a cavity width of 2.33 ± 0.65 cm.

Table 1 Basic data of the patients with uterine septum				
target	incomplete uterine septum	complete uterine septum	$t(\chi^2)$	P
N	57	23		
age	28.53±4.98	26.96±3.02	1.409	0.163
pregnancy before surgery	47	10	12.15	<0.001
pregnancy after surgery	46	19	0.039	0.843

2| Obstetrical outcomes

The number of pregnancies in group A was almost the same before and after operation; however, the rates of spontaneous abortion and embryo arrest were significantly reduced (47.0% vs 13.1%, $P<0.001$; 30.4% vs 3.3%, $P<0.001$), and the rate of term delivery was significantly improved (72.1% vs 7.8%). Although the rate of preterm delivery was increased (0.9% vs. 8.2%), all the fetuses survived during follow-up. There were 8 cases of IVF (2 cases of unilateral fallopian tube obstruction, 3 cases of pelvic adhesion, 1 case of intrauterine adhesion, and 2 cases of no complications). (Table 2)

Table 2

Comparison of pregnancy characteristics before and after surgery with incomplete uterine septum

Group	Pregnancies	Ectopic gestation	Induced abortion	Spontaneous abortion	Embryo arrest	Term delivery	Preterm delivery
before surgery	115	1	15	54	35	9	1
after surgery	61	1	1	8	2	44	5
χ^2	*	*	6.272	20.006	17.703	78.316	4.36
P	*	0.647	0.012	<0.001	<0.001	<0.001	0.012

Comparison of pregnancy characteristics before and after surgery with complete uterine septum

Group	Pregnancies	Ectopic gestation	Induced abortion	Spontaneous abortion	Embryo arrest	Term delivery	Preterm delivery
before surgery	15	2	5	5	3	0	0
after surgery	24	1	1	1	3	17	1
χ^2	*	*	*	*	*	*	*
P	*	0.547	0.024	0.024	0.658	<0.001	1
N >= 40, T > 5, with Pearson's chi-square test; N>=40.1<T<5, with corrected chi-square test; N<40, T<1, with Fisher's exact probability method.							

The data for group B showed that surgical resection of the septum could significantly increase the pregnancy rate (43.5% vs. 82.6%) and increase the rate of term delivery (0 vs. 70.8%). There were 3 cases of IVF (1 case of polycystic ovary syndrome, 2 cases of no complications). (Table 2)

3| Complications of pregnancy after operation

During pregnancy and delivery, among all complications, the rate of threatened abortion in early pregnancy in group A was 51.2% (21/41), and the rate of placenta previa was 12.2% (5/41). The rate of threatened abortion in early pregnancy in group B was 55.6% (5/9), and the rate of placenta previa was 0%. The rates of threatened abortion in early pregnancy and placenta previa among patients with incomplete uterine septum were similar to those of patients with complete uterine septum. There was no significant difference in other complications, such as premature rupture of membranes and premature delivery. (Table 3)

Table 3

Complications of pregnancy after operation between incomplete uterine septum and complete uterine septum

target	incomplete uterine septum	complete uterine septum	χ^2	<i>P</i>
N	41 %	9 %		
threatened abortion	21 51.2	5 55.6	*	0.813▲
placenta previa	5 12.2	0 0.0	*	0.570▲
rupture of membranes	4 9.8	1 11.1	*	0.904▲
preterm delivery	5 12.2	1 11.1	*	0.927▲
fetal distress	2 4.9	0 0.0	*	0.503▲
hypertension during pregnancy	3 7.3	1 11.1	*	0.560▲
other reasons	1 2.4	1 11.1	*	0.331▲
▲Fisher's exact probability method.				

4| Delivery mode after operation

There were 44 cases of first pregnancy and delivery in group A after the operation, including 21 cases of cesarean section. In group B, there were 17 cases of first pregnancy and delivery after operation, including 13 cases of cesarean section. The cesarean section rates after operation were significantly increased, at 47.7% (21/44) in group A and 76.5% (13/17) in group B. In group A, there were 3 cases with a history of cesarean section, 3 cases of abnormal fetal position, 2 cases of fetal distress, 5 cases of complications (1 case of hypertensive disease during pregnancy, 3 cases of placenta previa, 1 case of hydramnios) 8 cases of other factors, and 23 cases of vaginal delivery. In group B, there were 2 cases of abnormal fetal position, 2 cases of macrosomia, 1 case of complications (hypertensive disease during pregnancy with macrosomia), 8 cases of other factors, and 4 cases of vaginal delivery. An incomplete uterine septum can increase the rate of cesarean section due to complications and other factors, while a complete uterine septum can increase the rate of cesarean section due to abnormal fetal position, macrosomia and other factors. Among the reasons for the high cesarean section rate, other factors were the main factors among patients with a complete uterine septum ($P=0.047$). Patients with an incomplete uterine septum were statistically more likely to have a vaginal delivery than those with a complete uterine septum ($P=0.043$) (Table 4).

Table 4

Causes of cesarean section after surgery in the incomplete uterine septum and complete uterine septum groups

target	incomplete uterine septum	complete uterine septum	χ^2	<i>P</i>
N	44 %	17 %		
history of cesarean section	3 6.8	0 0.0	*	0.553▲
abnormal fetal position	3 6.8	2 11.8	*	0.612▲
macrosomia	0 0.0	2 11.8	*	0.074▲
complication	5 11.4	1 5.9	*	0.869▲
fetal distress	2 4.5	0 0.0	*	0.375▲
other reasons	8 18.2	8 47.1	*	0.047▲
vaginal delivery	23 52.3	4 23.5	4.106	0.043
▲Fisher's exact probability method.				

5| The best time for pregnancy after operation

The pregnancy rate within 2 years was 90.3% (42/46) among 46 pregnancies in group A after operation. Most of the first pregnancies occurred between the 3rd and 12th months after operation, accounting for 63.0% (29/46) of the total number of pregnancies. There were 18 pregnancies in group B after operation, and the pregnancy rate within 2 years was 77.8% (14/18). Most of the first pregnancies occurred between the 6th and 24th months after operation, accounting for 72.2% (13/18) of all pregnancies. The pregnancy rate was highest at 6 months postoperatively in group A and at 12 months postoperatively in group B (Figure 2). The duration of pregnancy among patients with an incomplete uterine septum was significantly lower than that among patients with a complete uterine septum ($Z=-5.01$, $P<0.001$). (Table 5)

Table 5

Number of pregnancies over time (months) after the operation in patients with incomplete uterine septum and complete uterine septum

	incomplete uterine septum	complete uterine septum
3 months	4	1
6 months	16	3
12 months	13	6
24 months	9	4
>24 months	4	4
The duration of pregnancy in incomplete uterine septum was significantly lower than that in complete uterine septum. Analysis by Wilcoxon rank-sum test showed a significant difference between the two groups ($Z=-5.01$, $P<0.001$).		

Discussion

Patients with a uterine septum usually exhibit decreased fertility, an increased early spontaneous abortion rate, and an increased premature birth rate [7, 8]. The thickness of the uterine mediastinal tissue varies, and the muscle cells are arranged into nodules of different sizes. There are only a few capillaries in the muscle nodules, while the outer layer is distributed with medium-sized blood vessels [9]. Endometrial dysplasia affects embryo implantation, development, placental function and coordination of uterine contraction, leading to adverse pregnancy outcomes.

Frank proposed the feasibility of TCRS as early as 1981 [10]. At present, there are various methods used to treat the uterine septum, such as hysteroscopic cold scissors incision, unipolar or bipolar incision, and laser incision. Nicola Colacurci et al [11] proposed that there was no difference in reproductive outcomes, including the rate of premature birth or the incidence of spontaneous abortion, after unipolar, bipolar or cold-knife surgery. However, M. Cararach [12] proposed that cold-knife surgery had a higher pregnancy rate and delivery rate. Berta Esteban Manchado's study reported that the pregnancy rate after laser surgery was 78.9% [13]. The surgical method did not affect the pregnancy outcome, and the purpose was to remove the septum and improve the uterine cavity environment to make the uterine cavity more normal. To the best of our knowledge, there has been no published research evaluating the postsurgical reproductive outcomes of patients with an incomplete versus those with a complete uterine septum. This study showed that the conception rate did not obviously change between the two groups after operation, possibly because the resection of the septum increases the chances of sperm entering the contralateral fallopian tube, significantly increasing the rate of pregnancy. This study concluded that TCRS can significantly reduce the rate of spontaneous abortion and embryo arrest and improve the rate of full-term delivery, consistent with the findings of most studies, and TCRS has greater value for patients with a complete uterine septum.

Some studies indicated that pregnancy after operation of the uterine septum would have a decreased risk of spontaneous abortion [14]; however, this paper concludes that the rate of threatened abortion (abdominal pain or a small amount of vaginal bleeding) in early pregnancy among patients with a uterine septum increases significantly after operation, but with active treatment, the pregnancy could continue, with most being delivered at full term and few being delivered preterm. The high rate of threatened abortion may be due to the short repair time for the endometrial injury caused by the operation, the lack of recovery of normal function and zygote implantation in the septum. It is not clear whether appropriately prolonging the pregnancy duration after operation would reduce the risk of threatened abortion, so more data need to be collected. Placenta previa in patients with an incomplete uterine septum operation is related mainly to the high rate of spontaneous abortion and embryo arrest, which are caused by multiple uterine operations. If the uterine septum is found by ultrasound because of multiple spontaneous abortions or embryo arrest, the septum can be actively treated to prevent an increase in pregnancy complications such as placental abnormalities and threatened abortion. No significant relationship was found between other comorbidities and whether the uterine septum was operated on.

After TCRS, the rate of cesarean section is increased [15], but it is not clear how septum resection increases the risk of cesarean section. In this study, abnormal fetal position, placenta previa and fetal distress increased the rate of cesarean section after the operation of incomplete uterine septum. Although these reasons may also lead to an increased rate of cesarean section among patients with a complete uterine septum, other factors affecting the rate of cesarean section (cesarean section without a medical indication) are significantly higher. A complete uterine septum has a low preoperative pregnancy rate and a long postoperative pregnancy interval and is almost combined with a vaginal mediastinum and double cervix, which increases the psychological burden for pregnant women; thus, they choose cesarean section.

The difference between the postoperative uterine septum and other types of scarred uterus is not clear. After surgery, the residual septum may lead to a weaker uterine wall, further stretching during pregnancy and an increased risk of uterine rupture. Second, there are differences between septum histology and myometrium; during labor, the differences destroy uterine polarity, resulting in uterine weakness and increased postpartum bleeding or uterine rupture due to excessive uterine contraction. To avoid related complications during vaginal delivery, which may lead to poor pregnancy outcomes, cesarean section is chosen. Although the complications can be quite serious, the probability of their occurrence appears to be low. Some investigators [16] reported that there was no case of uterine rupture after the operation. Additionally, Vid Jansa's study showed that only 4 cases were found to have uterine rupture during cesarean section delivery [17].

Therefore, the high rate of cesarean section among patients with a complete uterine septum is due mainly to associated psychological factors. We can alleviate the fears of pregnant women early on and closely monitor the safety of the mother and child during labor, to prevent an unnecessary cesarean section.

After TCRS, endometrial wound healing reaches 100% within 2 months [18], but no study has calculated the optimal time for postoperative natural pregnancy. Panagiotis Bakas [19] reported that the highest pregnancy rate was within 15 months after surgery. A retrospective cohort study by Murat Berkkanoglu et al [20] found no differences in the pregnancy or miscarriage rates of 282 women who underwent IVF/ICSI at <9, 10–16, or > 17 weeks after surgery. During follow-up, the pregnancy rate of the patients with incomplete uterine septum was highest at the 6th month after surgery, while that of the patients with complete uterine septum was highest at the 12th month after surgery. Complete uterine septum is treated mostly because of associated infertility, although it is combined with the vaginal mediastinum, which does not seem to affect the woman's sex life. In this study, the longer pregnancy interval after operation may be due to the poor preoperative pregnancy outcome, with the patient refusing to have sex earlier because of her perception that the surgical trauma is high and that a long repair time is needed for complete uterine septum. Second, the conception rate of patients with complete uterine septum is low before operation, but the operation improves the pregnancy rate; however, we do not know the width or depth of the septum into the myometrium, and the lack of clarity on details regarding postoperative recovery of deep tissues may lead to a longer interval from surgery to postoperative pregnancy. Although those studies showed that mediastinal size does not affect the postoperative pregnancy outcomes of patients with incomplete uterine septum [21], we did not explore this effect in depth in this paper. It is not clear how many weeks there should be between operation of the uterine septum and delivery of the pregnancy. However, in this paper, we recommend that the achieving pregnancy in the 6th month after operation in patients with incomplete uterine septum and in the 12th month after operation in patients with complete uterine septum can increase pregnancy rate and avoid missing the optimal time for pregnancy. There are still adverse pregnancy outcomes, such as abortion and embryo arrest after surgery. Because there are no data on the exact time of abortion after TCRS, this study does not address the relationship between the abortion rate and postoperative pregnancy interval with the goal of avoiding an unintended pregnancy that ends in spontaneous abortion or embryo arrest.

The possible limitations of our series are the relatively small number of patients with a uterine septum, the inability to completely exclude other confounding infertility factors, and the retrospective nature of the study, which may cause some bias. This paper provides clinically useful data to assist and reveal the clinical diagnosis and determine treatment. We plan to conduct a randomized controlled trial in the future to objectively understand the impact of TCRS on reproductive outcomes. More data will be added in the future.

Conclusion

At present, there are differences in terms of the need for surgery in patients with a uterine septum. In this study, we found that in patients who underwent TCRS, the rate of spontaneous abortion decreased, and the rates of pregnancy and full-term birth increased; however, the rates of cesarean section and placenta previa increased, but these complications are acceptable pregnancy outcomes because they do not result in a high miscarriage rate and can better improve the pregnancy rate and full-term birth rate. We also report the best time for pregnancy to avoid an unintended pregnancy resulting in adverse pregnancy

outcomes after operation and suggest the 6th month of pregnancy after operation for patients with incomplete uterine septum and the 12th month of pregnancy after operation for patients with complete uterine septum.

Abbreviations

TCRS: transcervical resection of the septum

IVF/ICSI: in vitro fertilization/intracytoplasmic sperm injection

Declarations

Author contributions

Jian Yang, Congqing Li, and Jing Wang: Protocol/project development, data collection/management, data analysis, manuscript writing/editing; Wenjing Zhu, Jingxian Xia, Wei He and Qingyuan Wang: data collection/management, manuscript writing/editing; Wenyan Wang* and Bing Wei: manuscript writing/editing.

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Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflicts of interest or competing interests.

Ethical approval

This project was registered and approved by the Second Affiliated Hospital of Anhui Medical University. All patients gave informed consent and provided information, with full consideration of human rights policies. (No.YX2021-125)

Informed consent

All participants in the trial provided written informed consent. Patients were asked by phone or at regular visits to provide reproductive data.

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Figures

Figure 1

Legend not included with this version.

Figure 2

Legend not included with this version.