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RESTORATION OF REPRODUCTIVE FUNCTION IN WOMEN WITH UTERINE SEPTUM AND REPRODUCTIVE DISORDERS USING DIFFERENT TYPES OF METROPLASTY TECHNIQUES AND DIFFERENT TYPES OF ELECTRIC SURGICAL ENERGY

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Abstract

The purpose: to compare the effectiveness of restoring reproductive function in women with uterine septum and reproductive disorders with various metroplasty techniques using monopolar and bipolar surgical energy. **Material and methods.** 153 patients with a uterine septum (group US) and reproductive disorders were under prospective observation, of which 75 patients (group M) underwent metroplasty using a monopolar hysteroscopic resectoscope, 78 patients (group B) underwent a bipolar hysteroscopic resectoscope. In groups M and B, 2 groups were allocated: group MD - 39 women who underwent hysteroscopic monopolar dissection of the uterine septum; group MR - 36 women who underwent hysteroscopic monopolar resection of the uterine septum; BD group - 37 women who underwent hysteroscopic bipolar dissection of the uterine septum; group BR - 41 women who underwent hysteroscopic bipolar resection of the uterine septum. The observation of operated women was carried out for 2 years after metroplasty. **Results.** When using various types of electrical surgical energy and various

techniques for performing metroplasty in women with reproductive disorders against the background of the uterine septum, when using bipolar removal of the septum, the overall frequency of pregnancy termination by childbirth and term delivery was the highest and exceeded similar indicators: with monopolar incision 2.20 times (OR 13.30 [3.95–44.72], $p < 0.01$) and 2.85 times (OR 16.20 [5.10–51.50], $p < 0.01$), with unipolar septum removal – 1.20 times (OR 2.40 [0.64-9.02], $p > 0.05$) and 1.37 times (OR 3.44 [1.06-11.20], $p < 0.04$), with bipolar incision of the septum - by 1.26 times (OR 3.43 [0.97-12.09], $p < 0.05$) and 1.35 times (OR 3.90 [1, 23-12.36], $p < 0.02$). The overall frequency of childbirth in women with initial infertility was the highest among patients with bipolar removal of the septum - 95.24% and exceeded the same indicator in women with monopolar incision of the septum (35.29%) by 2.70 times (OR 36.67 [3, 90-344.85], $p < 0.01$) and with bipolar dissection of the intersection (66.67%) by 1.43 times (OR 10.00 [1.07-93.44], $p < 0.04$) and had no probable differences with those in patients with monopolar septum removal (81.25%) ($p > 0.05$). The total number of births in women with initial miscarriage after bipolar incision was 2.17 times higher than that after unipolar incision (78.95% vs. 36.36%; OR 4.50 [1.13-17.99], $p < 0.04$), with bipolar resection was 2.34 times greater than that with monopolar incision (85.00% versus 36.36%; OR 6.80 [1.54–30.08], $p < 0.02$). **Conclusion.** The technique of choice when performing hysteroresectoscopic metroplasty in women with uterine septum and reproductive disorders is bipolar removal of the septum, which leads to a probable increase in the termination of pregnancy by urgent delivery and live births both in the general group and in the group of patients with initial infertility.

Key words: reproductive disorders; uterine septum; metroplasty; bipolar energy; monopolar energy; reproductive results.

The uterine septum (septate uterus) is a congenital defect in the development of the female genital tract. It is defined as a deviation from normal anatomy as a result of embryological maldevelopment of the Müller ducts, which leads to the presence of a median septum in the uterine cavity [1]. Embryological defects in the fusion of the Müllerian ducts and absorption of their connective tissue, which appear to be responsible for the uterine septum, occur before the 20th embryonic week (ASRM) [2]. The uterine septum can divide the uterine cavity partially, above the level of the internal opening of the cervix, or completely, up to the level of the internal opening of the cervix [1]. Uterine septum is a benign condition and the most common uterine abnormality in women with poor reproductive outcomes [3-5]. It is common in 2-4% of women of reproductive age and is associated with

infertility, miscarriage and other reproductive problems. A uterine septum is also associated with a higher risk of perinatal complications and lower live birth rates [4]. Although uterine septum appears to affect reproductive outcome in women of reproductive age, many women do not experience any reproductive difficulties [2, 4].

Treatment of the uterine septum includes hysteroscopic dissection or resection of the septum (hysteroscopic metroplasty/septoplasty) under laparoscopy or an abdominal metroplasty procedure. However, conflicting data and limited data on reproductive outcomes after metroplasty in women with a uterine septum make it difficult to make clear recommendations regarding treatment options [2]. Indications for uterine septal surgery are variable, and current guidelines contain different recommendations. ASRM and NICE (2015) [6] guidelines recommend removal of the uterine septum, while ESHRE (2018) [7] and RCOG (2011) [8] recommend no surgery and suggest that this procedure be evaluated in future studies.

In an international multicenter, open-label, randomized controlled trial (RCT) in women with a uterine septum, J. F. W. Rikken et al. (2021) [9] showed that septal resection did not improve live birth rates compared with expectant management. There was also no evidence of a difference in other reproductive outcomes such as pregnancy, pregnancy loss and preterm birth. During the resection of the septum, one of the treatment complications occurred - uterine perforation [9].

Consideration of septal resection may have potential benefits after counseling about the potential risks of the procedure for women [5]. In addition, modern technologies are used in hysteroscopy with good results. These new technological advances in the treatment of uterine septum have demonstrated sufficient efficacy in terms of reproductive outcomes [5].

The purpose of the study is to compare the restoration of reproductive function in women with a uterine septum and reproductive failure with different metroplasty techniques using monopolar and bipolar surgical energy.

Research material and methods

153 patients with a uterine septum (group US) and reproductive failure were under prospective observation, of which 75 patients (group M) underwent metroplasty using a monopolar hysteroresectoscope, 78 patients (group B) underwent a bipolar hysteroresectoscope. In groups M and B, 2 groups were distinguished: group MD - 39 women who underwent hysteroscopic monopolar dissection of the uterine septum; MR group – 36 women who underwent hysteroscopic monopolar resection of the uterine septum; BR group – 37 women who underwent hysteroscopic bipolar dissection of the uterine septum; group BR –

41 women who underwent hysteroscopic bipolar resection of the uterine septum. Control group K consisted of 30 fertile, healthy women who applied for introduction of LNG-IUD.

Exclusion criteria from the US group: women with a uterine septum and accompanying endocrine factors of infertility, endometriosis, fallopian tube obstruction, pathospermia in a man, in order to exclude the influence of endocrine disorders on reproductive results.

Hysteroscopic metroplasty was performed under the control of laparoscopy under general anesthesia. After dilation of the cervix using Hegar dilators to No. 10.5 mm, a monopolar hysteroresectoscope (Karl Storz, Tuttlingen, Germany) or a bipolar hysteroresectoscope (Tontarra Medizintechnik GmbH, Germany) of 9 mm with a viewing angle of 30° was inserted into the cervical canal. When using a monopolar electrode, current indicators did not exceed 80 W for resection and 30 W for coagulation. During metroplasty using a bipolar electrode surgical system, the cutting current was set at 80 to 100 W, for coagulation 30-40 W. The uterine cavity was distended with a solution containing 1 ml of sorbitol 27 mg and mannitol 5.4 mg or saline (0.9% NaCl) delivered through an electronic irrigation and aspiration system (Endomat, Karl Storz, Tuttlingen, Germany). Continuous flow control of 200–350 ml/min, suction under a negative pressure of 0.2 bar and a positive pressure of 80–120 mmHg were established, receiving a uterine pressure of approximately 80 mmHg during the entire metroplasty. All surgical procedures were performed by the same expert surgeon.

Dissection/resection was started from the lower edge of the septum with the help of a bipolar electrode and was carried out perpendicular to the axis of the uterus along the midline in the cranial direction. We focused on the middle line in the horizontal plane of the septum, which minimizes the incision of the myometrium and preserves most of the superficial muscle fibers. Whether the metroplasty should be completed was judged by several parameters obtained by hysteroscopy, laparoscopy, or intraoperative ultrasound: visualization of a pink vascularized myometrium rather than a white avascular septum; the relationship between the resection area and the fallopian tubes; the proximity of the resection area to the serous septum of the uterus. Metroplasty was considered completed when the eyes of the fallopian tubes were visible without any formations that form a dividing line between them. After dissection of the septum, the uterine cavity increased in size, its shape normalized, but a tissue comb from the dissected parts of the peritoneum was noted along the front and back walls. After removal of the septum, the uterine cavity looked normal during a panoramic examination, its bottom was easily visualized throughout, including between the eyes of the fallopian tubes,

the front and back walls looked almost flat. In the presence of a complete septum, a gentle resection of its cervical area was performed and the septum was preserved below the internal opening of the cervix in order to minimize the risk of isthmic-cervical insufficiency during the next pregnancy.

Patients were discharged on the day of surgery 4-5 hours after completion of metroplasty. Three months after metroplasty and if there are indications, it was recommended to plan pregnancy naturally or, if necessary, with ART. All operated patients were under observation for 2 years.

In the postoperative period, a drug containing 2.0 mg of estradiol for 14 days, then 2.0 mg of estradiol and dydrogesterone for 14 days for three MCs was prescribed for normal epithelization of endometrium; rectal suppositories with 15,000 IU streptokinase and 1,250 IU streptodornase for 3 days - 1 sup. three times a day, 3 days - 1 sup. 2 times a day, 3 days - 1 sup. 1 time a day. All patients were advised to use contraception for 3 months after the procedure.

Statistical data processing was carried out using the "Microsoft Excel" application program package (Microsoft Corporation, USA). Descriptive statistics methods for quantitative traits included estimation of the arithmetic mean (M), error of the standard deviation (\pm SE). Absolute frequency (n) and relative frequency (%) were determined for binomial signs. For multiple intergroup comparisons, Pearson's χ^2 test with degrees of freedom (df) was used. The critical level of significance for testing the null hypothesis was $p < 0.05$. To compare non-parametric indicators, odds ratio (OR), 95% confidence interval (CI), which was presented as OR [CI], were calculated.

Results and their discussion

When conducting the clinical and anamnestic characteristics of the studied groups, it was established that the average age of the patients of the US group was (30.18 ± 0.15) years, the MD group – (29.92 ± 0.34) years, the MR group – (30.31 ± 0.22) years, the BD group – (30.19 ± 0.30) years, the BR group – (30.29 ± 0.34) years, the K group – (30.33 ± 0.52) years and probably between did not differ between groups ($p > 0.05$).

According to anthropometric indicators, the studied groups were also homogeneous: body weight in the US group was equal to (57.50 ± 0.74) kg, in the MD group - (58.21 ± 1.69) kg, in the MR group - (57.00 ± 1.67) kg, in the BD group – (58.32 ± 1.52) kg, in the BR group – (56.51 ± 1.21) kg, in the K group – (57.87 ± 0.90) kg ; height, respectively – (1.64 ± 0.01) m, (1.64 ± 0.01) m, (1.63 ± 0.01) m, (1.65 ± 0.01) m, (1.64 ± 0.01) m, (1.63 ± 0.01) m; body

mass index – (21.38 ± 0.28) kg/m², (21.70 ± 0.69) kg/m², (21.42 ± 0.62) kg/m², $(21.35 \pm 0, 51)$ kg/m², (21.07 ± 0.46) kg/m², (21.81 ± 0.46) kg/m².

The studied groups MD, MR, BD, BR were homogeneous in terms of the type of septum (complete/incomplete), age of menarche, duration of menstruation, duration of the menstrual cycle (MC), number of MCs per year, nature of menstruation, indicators of reproductive history, average duration of infertility, specific the weight of transferred urogenital infections, the number of inflammatory diseases of the pelvic organs, the frequency of comorbid somatic pathology, the number and nature of transferred surgical interventions.

The clinical and anamnestic differences of women with a uterine septum and reproductive failure from healthy fertile women are: longer duration of menstruation - (5.92 ± 0.10) versus (4.97 ± 0.16) days ($p < 0.01$); greater frequency of painful menstruation (71.24% vs. 36.67%, OR 3.49 [1.55-7.85]) and heavy menstruation (74.51% vs. 23.33%, OR 9.60 [3, 82-24,112]) and a lower frequency of moderate menstruation (21.57% vs. 70.00%, OR 0.12 [0.05-0.28]); 22.35 times more miscarriages – 74.51% vs. 3.33% (OR 84.77 [11.17-643.09]); infertility in 47.06% of people, including primary infertility in 52.78% of female patients and secondary infertility in 47.22% of women; presence of urogenital infections in history in 64.71% ($p < 0.01$).

The analysis of the obtained data of the hormonal profile of the peripheral blood serum of women of the US group with reproductive disorders against the background of the uterine septum showed the absence of a statistically significant difference from that of healthy fertile women of the K group.

The analysis of the indicators of restoration of reproductive function during natural conception within 2 years after metroplasty showed that the onset of pregnancy was statistically significantly different only in the BR and MD groups -75.6 1% vs. 48.72% (OR 3.26 [1.26-8 .43], $p < 0.02$) (Table 1).

As can be seen from the table. 5.2, the number of women with miscarriages after natural conception was the largest with monopolar dissection of the septum - 20.51%, which was more than in the MR group (13.89%) by 1.48 times ($p > 0.05$) than in in the BD group (13.51%) – by 1.52 times ($p > 0.05$) and in the BR group (4.88%) – by 4.20 times (OR 5.03 [1.00-25.42], $p < 0.05$).

The overall frequency of termination of pregnancy by delivery and term delivery after natural conception was the highest in women with bipolar removal of the septum – 70.73% and 70.73%, which exceeded similar indicators in the MD group (28.21% and 17.95%) – in 2.51 times (OR 6.15 [2.33-16.21], $p < 0.01$) and 3.94 times (OR 11.05 [3.83-31.86], $p < 0.01$),

in the MR group (44.44% and 41.67%) – 1.59 times (OR 2.72 [1.05-7.04], $p < 0.04$) and 1.70 times (OR 3.06 [1.18-7.95], $p < 0.03$), in the BD group (48.65% and 45.95%) – 1.45 times (OR 2.55 [1.00 -6.48], $p < 0.05$) and 1.54 times (OR 2.84 [1.12-7.23], $p < 0.03$).

Table 1 – Indicators of recovery of reproductive function in women with natural conception depending on the hysteroscopic metroplasty technique used within 2 years after the operation, n (%)

| Indicator | Group MD, n=39 | Group MR, n=34 | Group BD, n=37 | Group BR, n=41 |
|---|--------------------------|------------------------------|----------------------|--------------------------|
| Onset of pregnancy with natural conception | 19 (48.72) ^{br} | 21 (58.33) | 23 (62.16) | 31 (75.61) ^{md} |
| Miscarriages | 8 (20.51) ^{br} | 5 (13.89) | 5 (13.51) | 2 (4.88) ^{md} |
| Childbirth | 11 (28.21) br | 16 (44.44) br | 18 (48.65) md, br | 29 (70.73) md, mr, bd |
| Premature birth | 4 (10.26) | 1 (2.78) | 1 (2.70) | 0 (0.00) |
| Term delivery | 7 (17.95) mr, bd, br | 15 (41.67) ^{6B, md} | 17 (45.95) md, br | 29 (70.73) md, mr, bd |
| Note. ^{md, mr, bd, br} - statistically significant difference with indicators of groups MD, MR, BD, BR ($p < 0.05$). | | | | |

At the same time, as can be seen from the table. 5.2, no statistically significant difference was registered between groups MD, MR, BD and BD after natural conception in the frequency of premature birth (10.26%, 2.78%, 2.70% and 0.00%).

If women in the postoperative period after natural conception had a miscarriage during the year, or pregnancy did not occur, then 38.46% of women in the MD group, 44.44% of patients in the MR group, 37.84% of people in the BD group, and 24.39% of women in the group BRs sought treatment in assisted reproductive technology (ART) programs. Among the groups of women who underwent artificial insemination, no significant difference was observed between the frequency of pregnancy (MD group - 23.08%, MR group - 36.11%, BD group - 29.73%, BR group - 21.95%), the specific weight of miscarriages (10.26%, 5.56%, 5.41% and 2.44%); childbirth (12.82%, 30.56%, 24.32% and 19.51%); premature births (0.00%, 8.33%, 5.41% and 2.44%); term deliveries (12.82%, 22.22%, 18.92%, 17.07%); according to the effectiveness of ART programs (pregnancy onset) (60.00%, 81.25%, 78.57% and 90.00%). Live birth after ART programs in the BR group was 72.73%, which was 2.18 times higher than the similar indicator in the MD group (OR 8.00 [1.21-52.69], $p < 0.04$), unlikely more in the MR group by 1.73 times (OR 1.82 [0.28-11.87], $p > 0.05$) and in the BD group by 1.13 times (OR 2.22 [0.33-14.80], $p > 0.05$) (Table 2).

Table 2 – Indicators of recovery of reproductive function in women in ART programs depending on the hysteroscopic metroplasty technique used within 2 years after the operation, n (%)

| Indicator | Group MD, n=39 | Group MR, n=34 | Group BD, n=37 | Group BR, n=41 |
|---|------------------------|---------------------|----------------|--------------------|
| Treatment in ART programs | 15 (38.46) | 16 (44.44) | 14 (37.84) | 10 (24.39) |
| The number of women with the onset of pregnancy in ART programs | 9 (23.08) | 13 (36.11) | 11 (29.73) | 9 (21.95) |
| Miscarriages | 4 (10.26) | 2 (5.56) | 2 (5.41) | 1 (2.44) |
| Childbirth | 5 (12.82) | 11 (30.56) | 9 (24.32) | 8 (19.51) |
| Premature birth | 0 (0.00) | 3 (8.33) | 2 (5.41) | 1 (2.44) |
| Term delivery | 5 (12.82) | 8 (22.22) | 7 (18.92) | 7 (17.07) |
| Effectiveness of ART programs | 9/15 (60.00) | 13/16 (81.25) | 11/14 (78.57) | 9/10 (90.00) |
| Live birth after ART programs | 5/15 (33.33) mr, br | 11/16 (42.11) md | 9/14 (64.29) | 8/10 (72.73) md |
| Note. ^{md, mr, bd, br} - statistically significant difference with indicators of groups MD, MR, BD, BR (p < 0.05). | | | | |

The assessment of the general indicators of recovery of reproductive function in women with an uterine septum depending on the hysteroscopic metroplasty technique used within 2 years after the operation revealed that the total number of women with the onset of pregnancy was the lowest with monopolar dissection of the septum - 66.67%, which was less than in in the MR group (88.89%) by 1.33 times (OR 0.125 [0.026-0.605], p < 0.01) than in the BD group (86.49%) by 1.30 times (OR 0.313 [0.099- 0.991], p < 0.05) and in the BR group (92.68%) by 1.39 times (OR 0.158 [0.041-0.610], p < 0.01) (Table 3).

As can be seen from the table. 3, the total number of miscarriages in the BR group with bipolar removal of the septum (4.88%) was 6.31 times less than this indicator in the MD group (30.77%) (OR 0.115 [0.024-0.558], p < 0,01), in the MR group (19.44%) – 3.98 times (OR 0.198 [0.038-1.026], p > 0.05) and in the BD group – 3.88 times (18.92%) (OR 1.82 [0.28-11.87], p > 0.05).

However, in women with bipolar removal of the septum, the overall frequency of termination of pregnancy with delivery and term delivery was the highest – 90.24% and 87.80%, which exceeded similar indicators in the MD group (41.03% and 30.77%) – in 2, 20 times (OR 13.30 [3.95-44.72], p < 0.01) and 2.85 times (OR 16.20 [5.10-51.50], p < 0.01), in

the MR group (75.00% and 63.89%) – 1.20 times (OR 2.40 [0.64-9.02], $p > 0.05$) and 1.37 times (OR 3.44 [1.06-11.20], $p < 0.04$), in the BD group (72.97% and 64.86%) – 1.26 times (OR 3.43 [0.97-12.09], $p < 0.05$) and 1.35 times (OR 3.90 [1.23-12.36], $p < 0.02$).

Table 3 – General indicators of recovery of reproductive function in women with a uterine septum depending on the hysteroscopic metroplasty technique used within 2 years after the operation, n (%)

| Indicator | Group MD, n=39 | Group MR, n=34 | Group BD, n=37 | Group BR, n=41 |
|---|--------------------------|----------------------|----------------------|--------------------------|
| The total number of cases of pregnancy | 26 (66.67) mr, bd, br | 32 (88.89) md | 32 (86.49) md | 38 (92.68) md |
| Miscarriages | 12 (30.77) br | 7 (19.44) | 7 (18.92) | 2 (4.88) md |
| Childbirth | 16 (41.03) mr, bd, br | 27 (75.00) md | 27 (72.97) md, br | 37 (90.24) md, mr, bd |
| Premature birth | 4 (10.26) | 4 (11.11) | 3 (8.11) | 1 (2.44) |
| Term delivery | 12 (30.77) mr, bd, br | 23 (63.89) md, br | 24 (64.86) md, br | 36 (87.80) md, mr, bd |
| Note. ^{md, mr, bd, br} - statistically significant difference with indicators of groups MD, MR, BD, BR ($p < 0.05$). | | | | |

There was no statistically significant difference between the MD, MR, BD and BR groups regarding the overall frequency of premature birth (10.26%, 11.11%, 8.11% and 2.44%).

An analysis of recovery of reproductive function was carried out depending on the type of reproductive disorders prior to surgical intervention.

In women with initial infertility within 2 years after the operation, the lowest frequency of pregnancy was noted in the group with monopolar dissection of the uterine septum - in 52.94% of cases, which was less than in patients with monopolar septum removal (87.50%) in 1, 65 times (OR 0.161 [0.028-0.935], $p < 0.05$) and bipolar removal of the septum (95.24%) – 1.80 times (OR 0.056 [0.006-0.519], $p < 0.02$) (table 4).

Similarly, the onset of pregnancy with natural conception in women with initial infertility in the MD group was 23.53%, which was incredibly lower than in the MR (50.00%) and BD (50.00%) groups by 2.12 times ($p > 0.05$), and statistically significantly lower than in the BR group (76.19%) by 3.24 times (OR 0.096 [0.021-0.433], $p < 0.01$) (see Table 4).

Table 4 – Indicators of restoration of reproductive function among women with initial infertility depending on the hysteroscopic metroplasty technique used within 2 years after the operation, n (%)

| Indicator | Group MD, n=17 | Group MR, n=16 | Group BD, n=18 | Group BR, n=21 |
|---|---------------------------|------------------------------|------------------------------|------------------------------|
| Onset of pregnancy | 9 (52.94) mr, br | 14 (87.50) md, br | 15 (83.33) mr | 20 (95.24) md |
| Onset of pregnancy with natural conception | 4 (23.53) ^{br} | 8 (50.00) ^{bd} | 9 (50.00) ^{mr} | 16 (76.19) ^{md} |
| Treatment in ART programs | 8 (47.06) | 9 (56.25) | 9 (50.00) | 6 (28.57) |
| Onset of pregnancy in ART programs | 5 (29.41) | 7(38.89) | 7 (38.89) | 5 (23.81) |
| Effectiveness of ART programs | 5/8 (62.50) | 7/9 (77.78) | 7/9 (77.78) | 5/6 (83.33) |
| Live birth after ART programs | 2/8 (25.00) ^{br} | 6/9 (66.67) | 6/9 (66.67) | 5/6 (83.33) ^{md} |
| Miscarriages | 3 (17.65) | 3(18.75) | 4 (22.22) | 1 (4.76) |
| Childbirth | 6 (35.29) mr, br | 13 (81.25) md, bd | 12 (66.67) mr, br | 20 (95.24) md, bd |
| Premature birth | 1 (5.88) | 2 (12.50) | 1 (5.56) | 0 (0.00) |
| Term delivery | 5 (29.41) mr, br | 11 (68.75) ^{mp, bd} | 11 (61.11) ^{mr, br} | 20 (95.24) ^{mp, bd} |
| Note. ^{md, mr, bd, br} - statistically significant difference with indicators of groups MD, MR, BD, BR ($p < 0.05$). | | | | |

The frequency of pregnancy in women with initial infertility during treatment in DRT programs did not depend on the metroplasty technique and was equal to 29.41% in the MD group, 38.89% in the MB group, 38.89% in the BD group, and 23% in the BR group .81%. Still, the live birth rate after fertilization in DRT programs was the lowest in the MD group - 25.00%, which was statistically insignificantly less than in the MR (66.67%) and BD (66.67%) groups by 2.67 times and probably less than in the BR group (83.33%) by 3.33 times (OR 0.067 [0.005-0.970], $p < 0.05$) (see Table 4).

The frequency of miscarriages in women with initial infertility and metroplasty did not have significant differences between groups MD (17.65%), MR (18.75%), BD (22.22%) and BR (4.76%) ($p > 0.05$) (see Table 4).

The overall frequency of childbirth in women with initial infertility was the highest among patients with bipolar septum removal - 95.24% and exceeded the similar indicator in women with monopolar septum dissection (35.29%) by 2.70 times (OR 36.67 [3, 90-344.85], $p < 0.01$) and with bipolar septum dissection (66.67%) by 1.43 times (OR 10.00 [1.07-93.44],

$p < 0.04$) and there was no significant difference with a similar indicator in patients with monopolar by removing the septum (81.25%) ($p > 0.05$) (see Table 4).

The specific weight of term deliveries in women with initial infertility was also the highest among patients with bipolar septum removal - 95.24% and exceeded the similar indicator in women with monopolar septum dissection (29.41%) by 3.24 times (OR 48.00 [4.99-461.49], $p < 0.01$), and with bipolar dissection of the septum (61.11%) by 1.56 times (OR 12.73 [1.38-117.27], $p > 0.05$) and had no significant difference with a similar indicator in patients with monopolar removal of the septum (68.75%) ($p > 0.05$) (see Table 4). The frequency of preterm birth in women with initial infertility and metroplasty did not have significant differences between groups MD (5.88%), MB (12.50%), BD (5.56%) and BR (0.00%) ($p > 0.05$) (see Table 4).

The analysis of the restoration of reproductive function within 2 years after surgical intervention in women with initial miscarriage showed that there were no significant differences in the frequency of pregnancy between the MD, MR, BD and BR groups (77.27%, 95.00%, 89, 47%, 90%), pregnancy in the natural cycle (68.18%, 65.00%, 73.68%, 75.00%), participation in ART programs (31.82%, 35.00%, 26, 32 %, 20.00 %), onset of pregnancy in ART programs (18.18 %, 30.00 %, 21.05 %, 20.00 %), live birth after ART (42.86 %, 71.43 %, 60.00%, 75.00%) (Table 5).

The frequency of miscarriages in women with initial miscarriage was the highest among patients in the MD group - 40.91% and exceeded the similar indicator in women in the BR group (5.00%) by 8.18 times (OR 13.54 [1.48-116, 73], $p < 0.03$) and had no significant differences with a similar indicator in patients of the MR group (20.00 %) ($p > 0.05$) and the BD group (15.79 %) ($p > 0.05$) (see table 5).

In women with initial miscarriage, there were significant differences between the total number of deliveries in the BD and MD groups (78.95% vs. 36.36%; OR 4.50 [1.13-17.99], $p < 0.04$), in the BR and MD groups (85.00% vs. 36.36%; OR 6.80 [1.54-30.08], $p < 0.02$), as well as between the number of term deliveries in the MD group (31.82 %) compared to the MR group (65.00%; OR 13.54 [1.48-116.73], $p < 0.03$), the BD group (68.42%; OR 6.80 [1.54- 30.08], $p < 0.02$) and the BR group (80.00%; OR 4.80 [1.21-19.08], $p < 0.03$).

The data obtained in our study regarding the frequency of recovery of reproductive function coincide with the data of Z. Lan et al. (2023) [10], who conducted a single-center retrospective study. The cases of women who underwent hysteroscopic septal resection were divided into three groups: group A was the recurrent miscarriage group, group B had a history of pregnancy with no more than one spontaneous miscarriage, and group C was the primary

infertility group. The frequency of postoperative pregnancies in the three groups was 71.4%, 82.4% and 75.0%; live birth rates were 50.0%, 74.3% and 71.7%; and the frequency of spontaneous abortions was 21.4, 17.6% and 13.3%. 62 patients had a complete uterine septum, 114 – partial. For patients with a complete uterine septum, the preoperative pregnancy rate was 54.84%, and after the operation, the pregnancy rate increased to 85.48%; at the same time, the frequency of preoperative and postoperative pregnancy in patients with a partial uterine septum was close (from 71.9% to 72.8%) [10].

Table 5 – Indicators of restoration of reproductive function in women with initial miscarriage depending on the metroplasty technique used within 2 years after the operation, n (%)

| Indicator | Group MD, n=22 | Group MR, n=20 | Group BD, n=19 | Group BR, n=20 |
|---|------------------------------|-------------------|--------------------------|--------------------------|
| Onset of pregnancy | 17 (77,27) | 19 (95,00) | 17 (89,47) | 18 (90,00) |
| Onset of pregnancy with natural conception | 15 (68,18) | 13 (65,00) | 14 (73,68) | 15 (75,00) |
| Treatment in ART programs | 7 (31,82) | 7 (35,00) | 5 (26,32) | 4 (20,00) |
| Onset of pregnancy in ART programs | 4 (18,18) | 6 (30,00) | 4 (21,05) | 4 (20,00) |
| Effectiveness of ART programs | 4/7 (57,14) | 6/7 (85,71) | 4/5 (80,00) | 4/4 (100) |
| Live birth after ART programs | 3/7 (42,86) | 5 /7 (71,43) | 3/5 (60,00) | ¾ (75,00) |
| Miscarriages | 9 (40,91) ^{br} | 4 (20,00) | 3 (15,79) | 1 (5,00) ^{md} |
| Childbirth | 10 (36,36) ^{bd, br} | 15 (75,00) | 15 (78,95) ^{md} | 17 (85,00) ^{md} |
| Premature birth | 3 (13,64) | 2 (10,00) | 2 (10,53) | 1 (5,00) |
| Term delivery | 7 (31,82) mr, bd, br | 13 (65,00) md | 13 (68,42) md | 16 (80,00) md |
| Note. ^{md, mr, bd, br} - statistically significant difference with indicators of groups MD, MR, BD, BR (p < 0.05). | | | | |

The results of the conducted study also coincide with the data of a recent meta-analysis by M. Noventa et al. (2022) [11] 38 RCTs in which: (i) septum versus no septum: lower pregnancy and live birth rates were associated with uterine septum compared to controls (OR 0.45 [0.27-0.76] ; p < 0.0001; and OR 0.21 [0.12-0.39]; p<0.0001); a greater proportion of miscarriages and premature births was associated with uterine septum compared to the control group (OR 4.29 [2.90–6.36]; p<0.0001; OR 2.56 [1.52–4.31]; p = 0.0004); (ii) operated and unoperated septum: the frequency of pregnancy and preterm birth did not differ between removed and unremoved septum (OR 1.10 [0.49–2.49]; p = 0.82 and OR 0.81 [0.35–1.86]; p = 0.62); a lower proportion of miscarriages was associated with a removed

compared to an unremoved septum (OR 0.47 [0.21–1.04]; $p = 0.001$); (iii) before-after removal of the septum: the proportion of live births was higher after removal of the septum (OR 49.58 [29.93–82.13]; $p < 0.0001$), and the proportion of miscarriages and premature births was lower after removal of the septum (OR 0.02 [0.02-0.04]; $p < 0.0001$ and OR 0.05 [0.03-0.08]; $p < 0.0001$). Conclusions from the meta-analysis of M. Noventa et al. (2022) [11]: the results show a detrimental effect of the uterine septum on pregnancy rates, live births, miscarriages, and preterm births. Its treatment reduces the frequency of miscarriages.

Conclusions

The technique of choice when performing hysteroscopic metroplasty in women with a uterine septum and reproductive failure is bipolar removal of the septum, which leads to a probable increase in the termination of pregnancy with term delivery and live birth both in the general group and in the groups of patients with initial infertility and miscarriage.

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References:

1. Grimbizis GF, Gordts S, Di Spiezio Sardo A, Brucker S, De Angelis C, Gergolet M, et al. The ESHRE/ESGE consensus on the classification of female genital tract congenital anomalies. *Hum Reprod.* 2013 Aug;28(8):2032-44. doi: 10.1093/humrep/det098.
2. Practice Committee of the American Society for Reproductive Medicine. Electronic address: ASRM@asrm.org; Practice Committee of the American Society for Reproductive Medicine. Uterine septum: a guideline. *Fertil Steril.* 2016 Sep 1;106(3):530-40. doi: 10.1016/j.fertnstert.2016.05.014.

3. Salim R, Regan L, Woelfer B, Backos M, Jurkovic D. A comparative study of the morphology of congenital uterine anomalies in women with and without a history of recurrent first trimester miscarriage. *Hum Reprod.* 2003 Jan;18(1):162-6. doi: 10.1093/humrep/deg030.
4. Rikken J, Leeuwis-Fedorovich NE, Letteboer S, Emanuel MH, Limpens J, van der Veen F, et al. The pathophysiology of the septate uterus: a systematic review. *BJOG.* 2019 Sep;126(10):1192-1199. doi: 10.1111/1471-0528.15798.
5. Chang Y, Shen M, Wang S, Guo Z, Duan H. Reproductive outcomes and risk factors of women with septate uterus after hysteroscopic metroplasty. *Front Endocrinol (Lausanne).* 2023 Jun 8;14:1063774. doi: 10.3389/fendo.2023.1063774.
6. Nice. Nice: hysteroscopic metroplasty of a uterine septum for primary infertility. *Inf Dent.* 2015:1–8. Available at: <https://www.nice.org.uk/guidance/ipg509/resources>.
7. ESHRE Guideline Group on RPL; Bender Atik R, Christiansen OB, Elson J, Kolte AM, Lewis S, et al. ESHRE guideline: recurrent pregnancy loss. *Hum Reprod Open.* 2018 Apr 6;2018(2):hoy004. doi: 10.1093/hropen/hoy004.
8. RCOG . The investigation and treatment of couples with recurrent firsttrimester and second-trimester miscarriage. *Green-top Guideline.* 2011: 17: 1–18.
9. Rikken JFW, Kowalik CR, Emanuel MH, Bongers MY, Spinder T, Jansen FW, et al. Septum resection versus expectant management in women with a septate uterus: an international multicentre open-label randomized controlled trial. *Hum Reprod.* 2021 Apr 20;36(5):1260-1267. doi: 10.1093/humrep/deab037.
10. Lan Z, He R, Long Y, Zhou S, Xia G, Jing F, et al. Reproductive outcomes after uterine septum resection in patients with recurrent miscarriage or infertility: a retrospective study in Chinese women. *Arch Gynecol Obstet.* 2023 Feb;307(2):609-617. doi: 10.1007/s00404-022-06794-9.
11. Noventa M, Spagnol G, Marchetti M, Saccardi C, Bonaldo G, Laganà AS, et al. Uterine Septum with or without Hysteroscopic Metroplasty: Impact on Fertility and Obstetrical Outcomes-A Systematic Review and Meta-Analysis of Observational Research. *J Clin Med.* 2022 Jun 8;11(12):3290. doi: 10.3390/jcm11123290.