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THE IMPACT OF BARRIER ANTI-ADHESIVE PROPHYLAXIS ON EARLY AND FUNCTIONAL OUTCOMES OF RECONSTRUCTIVE LAPAROSCOPY FOR TUBAL-PERITONEAL INFERTILITY

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Abstract: Study Objective: To evaluate the impact of barrier anti-adhesive prophylaxis with Mesogel® gel as part of the postoperative protocol on the early dynamics of the adhesion process (second-look) and functional outcomes of reconstructive laparoscopy in patients with tubal-peritoneal infertility.

Material and Methods: A comparative clinical study (2023–2025, Med Lane Clinic, Urgench) was conducted. A total of 209 women aged 19–40 years with tubal-peritoneal infertility were included: 102 patients in the study group and 107 in the comparison group. All patients underwent diagnostic hysteroscopy and therapeutic and diagnostic laparoscopy with reconstructive interventions as indicated. In the main group, the barrier anti-adhesive prophylaxis Mesogel® was used according to a standardized regimen, while in the comparison group, standard postoperative care was used. The primary endpoint was the dynamics of the adhesion process according to second-look on days 5–7. Secondary endpoints: functional patency of the fallopian tubes (3 and 6 months), clinical pregnancy (6 months), pain dynamics according to VAS (24–48 hours, 3 and 6 months), and the rate of repeat laparo-/hysteroscopies (12 months). Statistical analysis: χ^2/Fisher's exact test, RR with 95% CI; $p<0.05$.

Results. According to second-look data, improvement in the condition was noted in 52.9% of patients in the main group versus 31.8% in the comparison group; no deterioration was registered. After 6 months, the functional patency of the fallopian tubes was 83.3% (85/102) in the main group and 57.9% (62/107) in the comparison group (RR=1.44; 95% CI 1.20–1.73; p=0.0003), with no significant differences after 3 months (p=0.278). The clinical pregnancy rate at 6 months was higher in the main group: 37.3% (38/102) versus 21.5% (23/107) (RR=1.73; 95% CI 1.12–2.69; p=0.043). Pain reduction according to VAS was more pronounced in the main group at all observation periods (p=0.038; 0.003; 0.001). The rate of repeat laparoscopy/hysteroscopy within 12 months was 8.8% versus 18.7% (p=0.119).

Conclusion. Barrier anti-adhesion prophylaxis with Mesogel® as part of the postoperative protocol after reconstructive laparoscopy for tuboperitoneal infertility is associated with more favorable early adhesion dynamics (second-look), a significant improvement in the functional patency of the fallopian tubes and an increase in the clinical pregnancy rate in the first 6 months of observation, as well as a more pronounced reduction in pain.

Keywords: tuboperitoneal infertility; laparoscopy; pelvic adhesions; anti-adhesion barrier; Mesogel®; second-look; fallopian tube patency; clinical pregnancy; VAS.

INTRODUCTION

Infertility remains one of the most significant medical and social problems in modern gynecology and reproductive medicine, as it impacts not only the individual reproductive prognosis of a couple but also demographic indicators, the psychoemotional well-being of the family, the woman's quality of life, and the economic burden on the healthcare system [1–4]. According to the WHO, the lifetime prevalence of infertility reaches "approximately 1 in 6," highlighting the scale of the problem and the need to expand accessible, effective, and reproducible treatment approaches [1,2]. Modern systematic syntheses also demonstrate comparable prevalence estimates, noting a significant dependence of indicators on the definitions and research methodology used [3].

In the structure of female infertility, the tuboperitoneal factor occupies a special place, remaining one of the leading limitations of natural fertility and forming a clinically "resistant" contingent of patients [5,6]. Tubal peritoneal infertility (TPI) combines a mechanical component (impaired patency and/or mobility of the fallopian tubes, hydrosalpinx, pelvic adhesions) and functional changes that create an unfavorable environment for gamete transport and subsequent implantation [5,6]. Infectious and inflammatory lesions of the pelvic organs play a key role in the pathogenesis of TPI; numerous studies indicate the role of genital infections and inflammatory diseases in the development of tubal dysfunction and adhesions [7–9].

Although reconstructive laparoscopy is naturally considered the primary organ-preserving tool for TPI, clinical practice demonstrates a critical bottleneck in its effectiveness: maintenance of the reconstructive result in the early postoperative period [10–12]. Adhesions are a natural consequence of tissue trauma and healing. However, in gynecological surgery, they can acquire significant clinical significance, leading to chronic pelvic pain, complicating repeat interventions, and acting as an independent factor in infertility [10–12]. According to review studies, intra-abdominal adhesions can form after most gynecological surgeries, creating a long-term clinical and economic burden for the patient and the healthcare system [11]. The ASRM position emphasizes that peritoneal adhesions can lead to infertility and pain, and also increase the technical complexity of subsequent surgeries [10].

That is why, in the modern logic of organ-preserving treatment for pelvic pelvic rupture, the surgical stage should be viewed as "creating a chance," while the postoperative stage should be viewed as "preserving a chance." In the early postoperative period (the first days and weeks), the most intense reparative remodeling occurs, and even short-term re-gluing of injured surfaces can re-form a mechanical barrier to gamete transport, negating technically successful reconstruction [10–12]. In practical terms, this means repeated diagnostic cycles, recurrence of pain, an increased frequency of repeat endoscopic interventions, and an accelerated transition to ART for the patient, which increases costs and psychoemotional stress [2,4,13].

One of the most rational ways to address the early stages of reconstruction loss is anti-adhesive prophylaxis, specifically the use of barrier agents that temporarily separate injured surfaces during the critical healing phase [11,12,14]. Systematic reviews and meta-analytic summaries of anti-adhesive barriers (including hyaluronic acid-based preparations and other barrier agents) indicate the possibility of reducing the severity/frequency of adhesions after gynecological interventions [14,15]. However, for patients with infertility, the clinical value of anti-adhesive prophylaxis should be confirmed not only by morphological changes, but also by functional outcomes: maintaining functional patency of the fallopian tubes, reducing pain, reducing the need for repeated interventions and, as an ultimate goal, increasing the likelihood of early pregnancy [10–12].

From a methodological perspective, the most sensitive marker of the early effectiveness of the anti-adhesion approach is the assessment of the dynamics of the adhesion process in the immediate postoperative period. Therefore, in the dissertation protocol, second-look monitoring on days 5–7 is of key importance, allowing for the recording of the direction of early repair and its pathogenetic link to subsequent outcomes (functional tubal patency at 3 and 6 months, pain dynamics according to the VAS, the frequency of repeat laparo- and hysteroscopies over 12 months) [16]. This approach forms a clinically important cause-and-effect chain: early adhesion dynamics → maintenance of functional patency → more stable results of organ-preserving treatment.

This comparative clinical study was conducted in 2023–2025. The study was conducted at the Med Lane Clinic (Urgench) and included 209 women aged 19–40 years with tuboperitoneal infertility: the main group consisted of 102 patients, and the comparison group consisted of 107. All patients underwent diagnostic hysteroscopy and therapeutic and diagnostic laparoscopy with reconstructive interventions as indicated. The difference between the groups was determined by the tactics of the postoperative stage: in the main group, barrier anti-adhesive prophylaxis with Mesogel® gel was used according to the unified scheme of the dissertation protocol, while in the comparison group, standard postoperative care was carried out. In this article, the central focus is on the early pathogenetic link—the dynamics of the adhesion process in the second-look—and its relationship with functional outcomes that determine the sustainability of the effect of reconstructive laparoscopy for tuboperitoneal infertility.

Materials and Methods

The study was conducted between 2023 and 2025 at the Med Lane Clinic (Urgench) and had a comparative clinical design. The analysis included 209 women aged 19–40 years with tuboperitoneal infertility: 102 patients in the study group and 107 in the comparison group. The groups were formed based on the postoperative management strategy after reconstructive laparoscopy.

Inclusion criteria: tuboperitoneal infertility, signs of chronic inflammation of the reproductive organs, and detection of infectious pathogens in specimens from various parts of the genital tract. Exclusion criteria: age >40 years, genital endometriosis (except for minor forms), no signs of chronic inflammation, PCOS, ovarian tumors, and somatic diseases that could cause infertility. All patients underwent a clinical and gynecological examination, transvaginal ultrasound, instrumental verification of tubal factor (hysterosalpingography on days 16-18 of the cycle and/or echohysterosalpingoscopy), diagnostic hysteroscopy, and therapeutic and diagnostic laparoscopy with reconstructive interventions as indicated. The study group received anti-adhesive prophylaxis with Mesogel® barrier gel according to the protocol, while the comparison group received standard postoperative care.

The primary endpoint was the dynamics of the adhesion process according to second-look data on days 5-7. Secondary endpoints included functional patency of the fallopian tubes (follow-up at 3 and 6 months), pain dynamics according to the VAS (24-48 hours, 3 and 6 months), and the frequency of repeat laparo- and/or hysteroscopies over 12 months. Statistical processing was performed in STATISTICA for Windows. The χ^2/Fisher's exact test was used to calculate the RR with 95% CI; $p < 0.05$ was considered statistically significant.

RESULTS

This section presents the results of a comparative evaluation of the effectiveness of a management protocol for patients with tuboperitoneal infertility after reconstructive laparoscopy. The analysis is based on the logic "early pathogenetic link → functional result → clinical outcome." The early dynamics of the adhesion process, based on second-look data on days 5–7, was used as a pathogenetic marker. Functional results were assessed by tubal patency at 3 and 6 months. Clinical significance was supplemented by clinical

pregnancy rates at 6 months, pain dynamics according to the VAS, and the frequency of repeat endoscopic interventions over 12 months.

Early dynamics of the adhesion process. As can be seen from Table 3, the groups differed in the direction of early repair already in the immediate postoperative period. According to second-look data (days 5–7), improvement in the condition was noted in 52.9% of patients in the main group (54/102) versus 31.8% in the comparison group (34/107), while "no change" was recorded in 47.1% and 68.2%, respectively; deterioration was not recorded in either group. Thus, patients using barrier anti-adhesive prophylaxis more often developed a favorable early healing trajectory, which pathogenetically corresponds to the goal of "preserving the reconstruction effect" in the critical postoperative window.

Table 3. Early adhesion dynamics by second-look (days 5–7)

Outcome Main group (n=102), n (%) Comparison group (n=107), n (%)

Improvement 54 (52.9) 34 (31.8)

No change 48 (47.1) 73 (68.2)

Worsening 0 (0) 0 (0)

Functional tubal patency. The functional results are presented in Table 2. After 3 months, tubal patency was 68.6% (70/102) in the main group and 57.9% (62/107) in the comparison group; no statistically significant differences were found (p=0.278). However, by the 6th month, the differences became more pronounced: tubal patency reached 83.3% (85/102) in the main group versus 57.9% (62/107) in the comparison group (RR=1.44; 95% CI 1.20–1.73; p=0.0003). This emphasizes that the advantage of a comprehensive approach manifests itself dynamically, when the sustainability of the surgical result and the prevention of functional "rollback" due to early adhesions become evident. Table 2. Functional tubal patency

Term Main (n=102), n (%) Comparison (n=107), n (%) RR (95% CI) p

3 months 70 (68.6) 62 (57.9) 1.18 (0.96–1.46) 0.278

6 months 85 (83.3) 62 (57.9) 1.44 (1.20–1.73) 0.0003

Clinical pregnancy at 6 months. The clinical outcome of efficacy is presented in Table 1. At 6 months, clinical pregnancy was registered in 37.3% (38/102) of patients in the main group and in 21.5% (23/107) in the comparison group (RR=1.73; 95% CI 1.12–2.69; p=0.043). The obtained effect reflects the practical significance of the protocol, since the 6-month period after reconstructive laparoscopy is a key time interval for implementing organ-preserving treatment without prematurely proceeding to repeat interventions or ART.

Table 1. Clinical pregnancy (6 months)

Indicator Main (n=102) Comparison (n=107) RR (95% CI) p

Clinical pregnancy, n (%) 38 (37.3) 23 (21.5) 1.73 (1.12–2.69) 0.043

Repeat endoscopic interventions within 12 months

Table 4 shows that, within 12 months, repeat laparoscopy and/or hysteroscopy were required in 8.8% (9/102) of patients in the main group and in 18.7% (20/107) of patients in the comparison group (p=0.119). Despite the lack of statistical significance, the direction of the effect is clinically relevant: a reduced need for repeat interventions reflects the potential durability of the result and a lesser severity of recurrent mechanical factors.

Table 4. Repeat Interventions (12 Months)

Parameter Main (n=102), n (%) Comparison (n=107), n (%) p

Repeat Laparoscopies/Hysteroscopies 9 (8.8) 20 (18.7) 0.119

Menstrual Function and Progesterone Profile. The physiological readiness of the reproductive system for implantation was assessed using cycle and progesterone parameters (Table 5). In the main group, regular cycles were observed in 77.5% of patients versus 64.5% in the comparison group (p=0.046). The proportion of patients with progesterone ≥10 ng/ml was 80.4% and 65.4%, respectively (p=0.018). The average progesterone level was higher in the study group (18.2±6.1 ng/ml) compared to the comparison group (15.0±6.2 ng/ml; p=0.011). These data complement the functional results, reflecting the contribution of the postoperative stage to the formation of a complete luteal phase. Table 5. Cycle and Progesterone

Parameter Main Comparison p

Regular cycle, % 77.5 64.5 0.046

Progesterone ≥10 ng/ml, % 80.4 65.4 0.018

Progesterone (M±SD), ng/ml 18.2±6.1 15.0±6.2 0.011

Pain dynamics according to VAS. Pain dynamics are presented in Table 6. Pain reduction was more pronounced in the study group already in the early stages (24–48 hours: –2.9±0.8 vs. –2.2±0.7; p=0.038) and maintained its advantage after 3 and 6 months (p=0.003 and p=0.001, respectively). This is clinically important, as the severity of pain and discomfort in the postoperative period affects the quality of recovery and patient adherence to the rehabilitation stage.

Table 6. Pain Dynamics VAS

Time ΔVAS (Main), M±SD ΔVAS (Comparison), M±SD p

24–48 h –2.9±0.8 –2.2±0.7 0.038

3 months –4.0±1.2 –2.9±1.3 0.003

6 months –4.6±1.1 –3.1±1.4 0.001

DISCUSSION

These results demonstrate that the key point in managing the effectiveness of reconstructive laparoscopy for TPN is the early postoperative period, when either stable recovery or recurrence of the mechanical factor occurs. In this study, this concept is supported by the consistency of outcomes: more favorable early dynamics in second-look are accompanied by a higher level of functional tubal patency by the 6th month and an increase in the clinical pregnancy rate at the same time.

The first, fundamentally important link is the second-look procedure on days 5–7. The increased proportion of patients with "improvement" (52.9% vs. 31.8%) indicates that anti-adhesive barrier prophylaxis intervenes precisely during the critical "window" of repair, where adhesion recurrence can negate a technically successful reconstruction. Significantly, no deterioration was observed in either group, suggesting that the differences are interpreted not as a "harm" of the standard approach, but as a deficiency in its protective potential in the early stages, when tissue surfaces are most vulnerable.

The second link is the functional patency of the tubes. The absence of statistically significant differences after 3 months (p=0.278) and a clear advantage after 6 months (p=0.0003) reflect the dynamic nature of the process: the early stage marks an intermediate phase of healing, while by the 6th month, the sustainability of the result becomes evident. From a practical perspective, this confirms an important idea: the success of TPN treatment cannot be accurately assessed "too early," as it is in the second trimester after surgery that the anti-adhesion strategy's contribution to maintaining functional patency becomes apparent.

The third link is clinical pregnancy. The increased clinical pregnancy rate at 6 months (37.3% vs. 21.5%; p=0.043) is consistent with improved functional substrate and is complemented by improved progesterone profile and cycle regularity. This is important because in TPN, anatomical restoration is not the only condition for success: implantation requires an adequate luteal phase and endometrial receptivity. The higher proportion of patients with progesterone ≥10 ng/ml and the higher mean progesterone level in the study group confirm the physiological viability of the postoperative route as part of a comprehensive strategy.

Pain scores according to the VAS and a trend toward fewer reoperations complete the picture of clinical effectiveness. The more pronounced pain reduction in the study group may reflect a more favorable postoperative course and less pronounced inflammatory-adhesive activity, which is important for quality of life and patient adherence to treatment. The reduction in the rate of repeat laparo- and/or hysteroscopies (8.8% vs. 18.7%) with p>0.05 should be correctly interpreted as a clinically significant trend consistent with pathogenetic and functional outcomes; the lack of statistical significance for this indicator may be due to limited sample power or heterogeneity in the initial severity of adhesions and the extent of reconstructive interventions.

Overall, the dissertation protocol materials demonstrate the practical value of the "surgery + guided fertility rehabilitation" concept, where barrier anti-adhesive prophylaxis protects early healing and promotes the maintenance of functional results, while subsequent management ensures conditions for implantation. In real-world clinical practice, this means a higher chance of achieving the effect of reconstructive laparoscopy in the first 6 months—a period that is key for organ-preserving strategies in patients with tuboperitoneal infertility.

CONCLUSIONS

1. The use of a comprehensive management strategy for patients with tuboperitoneal infertility after reconstructive laparoscopy is accompanied by a statistically significant increase in the clinical pregnancy rate in the first 6 months of follow-up: 37.3% (38 of 102) versus 21.5% (23 of 107); RR = 1.73 (95% CI 1.12–2.69), p = 0.043.

2. Functional restoration of tubal patency after 6 months with a comprehensive strategy reaches 83.3% (85 of 102) and significantly exceeds the rates of standard management - 57.9% (62 of 107); RR=1.44 (95% CI 1.20–1.73), p=0.0003, with no statistically significant differences after 3 months (p=0.278), indicating the formation of an effect in the dynamics of postoperative repair.

3. Early dynamics of the adhesion process according to second-look data (days 5–7) provides pathogenetic confirmation of the protocol's effectiveness: the proportion of patients with an improvement in their condition is higher in the main group — 52.9% versus 31.8%; no deterioration was recorded in either group.

4. The integrated tactics ensures more favorable physiological conditions for implantation: a regular menstrual cycle was noted in 77.5% of patients in the main group versus 64.5% in the comparison group (p=0.046); Adequate progesterone profile (≥10 ng/ml) — in 80.4% versus 65.4% (p=0.018); average progesterone level was higher (18.2±6.1 versus 15.0±6.2 ng/ml; p=0.011).

5. Postoperative recovery, as measured by subjective pain assessment (VAS), was more favorable with the integrated approach: the reduction in VAS in the study group was statistically significantly greater at 24–48 hours, 3 months, and 6 months (p=0.038; p=0.003; p=0.001, respectively).

6. Over 12 months of follow-up, a trend toward a decrease in the rate of repeat laparo- and/or hysteroscopies with the combined approach was noted: 8.8% versus 18.7% (p=0.119), reflecting a clinically significant effect size and requiring further confirmation in larger samples.

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