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REVIEW

## Pelvic adhesions and fertility: Where are we in 2018?

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**Summary** Peritoneal adhesions remain a major public health problem despite the development of laparoscopy. The rules of microsurgery must be known and followed during any pelvic surgery, even in patients who no longer have a desire for pregnancy. Anti-adhesion products are numerous. All have interest, confirmed by anatomical studies showing a smaller extent or a lesser severity of adhesions associated with their use. No studies, however, show clinical benefit in terms of improved pain or postoperative fertility. Pneumoperitoneum parameters, humidification, and lower abdominal pressure should be optimized to limit peritoneal trauma. Peri-operative corticosteroids, whose benefit has been demonstrated in at least one randomized trial, should be systematically used.

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### Introduction

Peritoneal adhesions remain a major public health problem. The interventions that they impose in the event of complications and the sometimes-considerable difficulties they induce during these re-interventions result in numerous hospitalizations. The financial costs are very high, and the human costs are even more significant.

We deal here only with peritoneal adhesions, but we recognize that surgically induced retroperitoneal fibrosis can be at the origin of pains due to nerve entrapment or severe retractive scarring. Similarly, retroperitoneal fibrosis makes iterative surgical gestures difficult and, sometimes extremely difficult. Regrettably, there are few effective treatments and research on this topic.

The advent of laparoscopy raised great hopes of major improvements with the problems of adhesions. Laparoscopic adhesiolysis for infertility was one of the first techniques adopted in gynecological surgery. The early results in this field have been close to those obtained by classical microsurgery techniques via laparotomy, whereas the technical constraints were much simpler (Bruhat et al. [1]). Despite these very favorable initial results and the generally accepted clinical impression that it is easier to re-operate on a patient post-laparoscopy than post-laparotomy, the results of Lower et al. in 2004 concluded that, with the exception of tubal sterilization procedures, procedures performed by laparotomy and laparoscopy were followed by identical rates of re-admissions due to post-operative adhesion complications [2]. Similarly in a study of diagnostic laparoscopy after laparoscopic treatment of severe endometriosis, we observed a nearly 90% rate of adhesion reformation after laparoscopic adhesiolysis [3].

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Thus laparoscopy is not a magic approach, despite its clear advantage of decreased peritoneal trauma (confirmed by molecular studies that show that after laparoscopy the ratio between plasminogen activators and inhibitors of these activators is in favor of a lower risk of adhesion) [4]. Adhesions remain a difficult problem. Initial adhesion formation and reformation after previous adhesiolysis are different problems [5], which treatment studies have rarely taken into account.

## Adhesions and laparoscopic surgery

Recent studies by Trew et al. have confirmed that adhesions remain a problem in gynecological surgery [6,7]. The control groups of these two studies devoted to the evaluation of anti-adhesion products showed that the formation or the reformation of adhesions is very frequent. In Trew et al.'s preliminary work on a hydrogel that behaves like a biodegradable bio-barrier, *de novo* formation of adhesions in the control group and of adhesion reformation in the adhesiolysis group was observed [6]. These phenomena are partly prevented by the use of the barrier. More interesting is the Gynaecological ENdoscopic EValuation of Adept (GENEVA) study by Trew et al. of the use of 4% icodextrin® in endometriosis and leiomyoma surgery [7]. This study included 330 patients who underwent second-look laparoscopy; it found no difference in the frequency of *de novo* adhesions between the RL group and the Icodextrin® group. Above all, it showed an increased frequency of *de novo* adhesions directly related to the increased duration of the intervention, the number of uterine incisions to perform myomectomies, and the number of knots used to close the uterus. There was a threshold effect beyond six knots. These notions emphasize the importance of surgical technique, but also the limitations in adhesion prevention when the surgical procedure is complex and prolonged.

One can, of course, evoke the surgeon's role in the formation of adhesions, but the fact remains that if multiple bulky myomas are present, it is likely that several uterine incisions and the use of more than six sutures will be required and the intervention will be prolonged, regardless of the skills of the individual surgeon. Detailed analysis of adhesions to the posterior surface of the uterus showed that adhesion severity was lower in the group that received 4% icodextrin®. This remains a positive element because adhesiolysis, when simple, is more often than not crowned with success [1,7]. This study argues for several elements: a rigorous and a traumatic surgical technique, the use of anti-adhesion products, measures to reduce the severity of adhesions even if their frequency is not changed, and finally the utility of performing a second-look laparoscopy after a difficult myomectomy in young women who want future fertility. It should be noted that the lesser severity of the observed adhesions confirmed the work of Brown et al. whose study of icodextrin® to prevent adhesion reformation in 402 patients had shown a decrease in reformed adhesion scores [8]. These differences were statistically significant. The question of the clinical significance of this improvement is not resolved since the differences were not major and improvement in fertility was not confirmed.

All of these studies involving cases performed by experienced fertility surgeons have confirmed that the benefit of laparoscopy for prevention of adhesions is not as evident

as the widespread clinical impressions and results of early laparoscopic adhesiolysis would suggest [1]. These initial results were obtained by surgeons specialized in infertility surgery and involved the treatment of simple adhesions since complex laparoscopic procedures were rare at that time or impossible due to the technological limitations of endoscopic surgery. These positive results have not been confirmed in the treatment of severe and dense adhesions. Similarly, the prevention of *de novo* adhesions adjacent to the operating site is not satisfactory after complex and hemorrhagic procedures. Lunderoff et al. recently proposed a list of ten factors that predispose to a high risk of postoperative adhesions [9]. Pneumoperitoneum parameters were not considered in any of these recent studies, although clinical and experimental data suggest that the pressure and humidification of the gas for pneumoperitoneum are parameters that need to be adjusted to improve clinical results [10,11]. Finally, among the current limitations of surgery, patient-related factors in the risk of postoperative adhesions must be mentioned. In re-interventions on patients with severe adhesions, the peritoneal concentration of Plasminogen Activator Inhibitor-1 at the onset of the procedure was ten times higher than in patients with few or no adhesions [12].

## The rules of microsurgery for infertility

All learned societies with an interest in infertility stress the importance of following the established rules of microsurgery [13,14]. These rules, initiated by Swolin and Gomel in the 1970s, were based on common sense and empiricism; they resulted in improved results of fertility surgery at a time when in-vitro fertilization was not yet an alternative in the treatment of mechanical sterility [15–17]. These rules have been somewhat forgotten with the development of laparoscopic surgery, but, as we have seen above, laparoscopy is not the miraculous panacea that we had hoped for because it does not solve the problem of postoperative adhesion formation. It is therefore essential to remember these old rules. Some have been maintained, while others have been forgotten or even abandoned. Not all gynecologic and digestive surgeons regularly follow them. It is not uncommon to see the use of cloth sponges in the operative field during operative demonstrations, whereas one of the advantages of laparoscopy was that it was impossible to use these foreign bodies that traumatize the peritoneum! Sponges certainly have "practical" uses, but their use implies a less meticulous hemostasis than microsurgeons would think desirable and to "forgetfulness" or non-compliance with the rules of humidification and minimizing peritoneal trauma.

Gomel offers the following set of "rules":

- Tissues must be handled delicately and energy sources (electrosurgery or laser) must be used judiciously.

Remember that microsurgical forceps are less than 1 mm in diameter. Effective atraumatic forceps should be used. Nothing is more traumatic to the peritoneum than a forceps that slips because it grips tissue poorly. The moment of force increases in laparoscopy when the intra-abdominal portion of the forceps is shorter than the extra-abdominal portion. To avoid trauma, the surgeon must be willing to move slowly to limit the mechanical stresses applied to the tissues. Devices that allow the temporary suspension of organs (transparietal

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