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Peritoneal adhesions in modern surgery

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ABSTRACT

Adhesions are an urgent and unsolved problem in modern surgery. Any surgical intervention on the abdominal cavity inevitably leads to the formation of adhesions, which are fibrous cords between abdominal organs, resulting from trauma to the peritoneum of any etiology. Despite the improvement of surgical approaches and techniques, methods that prevent adhesiogenesis at its earliest stages and an integrated approach to rehabilitation in the postoperative period, as well as morbidity associated with the adhesive process of the abdominal cavity, remain widespread. The clinical presentation of the pathological process is polymorphic; treatment requires significant effort and resources; and adhesiogenesis-induced complications have a high medical and social significance, cause harm to the healthcare economy, and negatively affect the quality of life of patients.

At present, unified methods and classifications for assessing the severity and prevalence of adhesions in the abdominal cavity, concepts for preventing the formation of adhesions that affect the key links of pathogenesis, and noninvasive mechanisms for their early detection in the postoperative period, which determines the need for interdisciplinary multicenter studies in this field, have not been developed.

Keywords: adhesive disease; adhesive process; complications of adhesiogenesis; laparoscopic access; diagnostic methods.

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Проблема спаечной болезни брюшной полости в современной хирургии

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АННОТАЦИЯ

Спаечный процесс — это актуальная и нерешённая проблема современной хирургии. Любое оперативное вмешательство на органах брюшной полости, как известно, неизбежно приводит к формированию спаек — фиброзных тяжей между органами брюшной полости, формирующихся вследствие травматизации брюшины любой этиологии. Несмотря на совершенствование оперативных доступов и техники, разработку способов, предупреждающих адгезиогенез на самых ранних этапах его формирования, комплексного подхода к реабилитации в послеоперационном периоде, заболеваемость, связанная с адгезивным процессом брюшной полости, остаётся широко распространённой и в настоящее время. Клиническая картина патологического процесса полиморфна, лечение требует значительных сил и средств, а осложнения, вызванные спайкообразованием, имеют высокую медико-социальную значимость, наносят вред экономике здравоохранения и негативно влияют на качество жизни пациентов.

В настоящее время не разработаны единые методики и классификации для оценки тяжести и распространённости адгезивного процесса брюшной полости, концепции предупреждения формирования спаек, влияющие на ключевые звенья патогенеза, а также неинвазивные механизмы их раннего выявления в послеоперационном периоде, что и определяет необходимость проведения междисциплинарных многоцентровых исследований в данном направлении.

Ключевые слова: спаечная болезнь; адгезивный процесс; осложнения спайкообразования; лапароскопический доступ; методы диагностики.

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ЭКО•ВЕКТОР

Peritoneal adhesions as a complication of abdominal surgery were first described by surgeons of the 18th century. They suggested that fibrin, a protein that accumulated at sites of tissue damage, served as a substrate for adhesion formation. Consequently, the prevention of adhesive process was proposed as a potential strategy. Over the years, researchers have attempted to address the challenge, but the high incidence of complications arising from surgical wound infections has made adhesions associated with the severe postoperative course a secondary concern. In the Russian literature, V.P. Dobrovolsky was the first to describe the adhesive process in 1838, while G.M. Minkh developed the first classification of abdominal adhesions in 1970 [Cited by 1-2].

Adhesions are the most prevalent complication of abdominal surgery and one of the most significant challenges currently facing medical professionals [3].

It is difficult to determine the overall incidence of adhesions, as complications are heterogeneous and develop over a long period of time, accompanied by a wide range of symptoms. Despite the implementation of measures to reduce injury to the membranes that cover the internal organs and ensure adequate hemostasis, which are considered the primary factors in preventing adhesions, adhesion reformation occurs in 85% of patients even after adhesiolysis procedures, as reported by Diamond et al. and Monk et al. [4-5]. A number of studies have demonstrated that the incidence of postoperative adhesions following abdominal and pelvic surgeries ranges from 55% to 95% [6]. It is estimated that more than one-third of women with a history of laparotomy for gynecological problems seem to be readmitted on up to 20 occasions for adhesion-related complications within 10 years [7-8]. One of the late complications of adhesions is small bowel obstruction, which may require hospital admission for conservative or surgical treatment. In approximately 30% of cases, adhesive small bowel obstruction is an indication for surgical treatment, rendering it among the most common surgical emergencies [9]. In developed countries, approximately 60% of abdominal surgeries are redo surgeries. The potential risks and complications associated with adhesiolysis include intestinal injury, bleeding, and an intraoperative switch from a laparoscopic to an open abdominal approach [9-10].

Adhesions can also be responsible for female infertility. The Russian centers for reproductive medicine report that abdominal adhesions are a significant contributor to tubal or peritoneal infertility in 56% of cases, with 11.7% to 37.1% of cases caused by the postoperative involvement of the fallopian tubes [11]. Consequently, every fourth woman of reproductive age with a history of pelvic surgery seeks infertility treatment [2]. The study by de Wilde et al. estimated that one in seven women would be readmitted within five years after gynecological surgery, and one in seven women would be reoperated [12]. Among the postoperative complications, pain syndrome occurs in 20% of patients after abdominal surgery. Of these, 57% of cases are attributed to the adhesive process [13-14]. Despite the advances in surgery, the efficacy of adhesiolysis for chronic pain remains debatable. In most cases, patients are treated conservatively with only limited success [13-14].

The SCAR cohort study demonstrated that approximately one in four patients with a history of abdominal or pelvic surgery were readmitted within five years for adhesion-related causes or for an operation that was potentially complicated by adhesions. One-half of these readmissions were documented within two years following the initial surgery [7]. A review of international studies indicates that between 20% and 30% of postoperative patients require a redo surgery to eliminate adhesive intestinal obstruction. In some cases, these procedures result in fatal outcomes, with an incidence estimated at 3% [15-16].

A number of studies have demonstrated the advantage of laparoscopy in reducing the formation of adhesions compared to open surgery. The main advantage of laparoscopy is a lower incidence of adhesions along the incision lines. Despite a 30% reduction in readmission rates immediately related to adhesions following an endoscopic surgery compared to open surgery, this difference was not associated with a subsequent decline in the overall number of adhesions-related readmissions in the population. It is currently unclear whether laparoscopy has a beneficial effect on reducing adhesion-associated complications and overall postoperative morbidity. This is due to the lack of conclusive results from previous clinical trials comparing laparoscopy with open surgery [17].

Although laparoscopy has been widely used in conjunction with advanced surgical techniques, the morbidity associated with adhesions remains significantly high. In the retrospective SCAR update study, 27% of patients were readmitted for adhesion-related complications during the 5-year follow-up. The study showed that laparoscopy was associated with a lower incidence of adhesions compared to open surgery. However, the risk of adhesion-related complications following an extensive laparoscopic surgery correlated with that of laparotomy [18-20]. Ten Broek reported that among patients with a history of laparoscopy, readmissions were observed in approximately every sixth case, with complications potentially related to adhesions. In 1.7% of readmissions, complications were definitively attributed to adhesions [18-19].

A multicenter study aimed to assess the patients' awareness of postoperative adhesions in German and British clinics showed that less than 50% of patients were informed about adhesions, and even fewer were aware of potential adhesion-related complications. Lack of knowledge was identified as a significant barrier to health professionals informing patients about adhesions, with 46% of patients citing this as a reason [20]. Only 35% of general surgeons routinely made their patients aware of the potential risk of adhesions prior to laparoscopy. Among gynecologists, up to 40% of

practitioners commonly informed patients about the risk of postoperative adhesions. However, only 20% of health professionals included adhesion awareness in their preoperative routine before all surgeries [12]. Survey data indicates that approximately one-third of surgeons perceive themselves to be inadequately informed about adhesion pathogenesis and prevention measures. This may contribute to the prevalence of postoperative adhesions [20].

A review of the databases of the National Health Service of Scotland between 2014 and 2015 revealed a 40% increase in the proportion of readmissions identified as directly related to adhesions [21]. This trend may be attributed to an increased awareness of adhesions among medical professionals, rather than an actual increase in the rate of readmissions directly related to adhesions [20].

Postoperative adhesions contribute to longer operative times and can increase the risk of iatrogenic injury to hollow organs, with an incidence of 19% for laparotomy and 10–25% for laparoscopy [16].

Adhesions are associated with significant postoperative morbidity rates, imposing a significant burden on healthcare systems. The European Society of Gynaecological Endoscopy (ESGE) highlighted the heavy costs associated with adhesions for health services, patients, and society. According to the U.S. Department of Health, there are over 300,000 hospital admissions each year for complications associated with postoperative adhesions, with the treatment of adhesion-related disorders resulting in an annual cost of more than $1.3 billion in the USA. In Europe, the economic impact of adhesion-related complications has resulted in an 8-fold increase in admission expenses, with the estimated annual cost of treating adhesion-related complications being 67 million euros per 10 million people [7, 21-22]. Moreover, the actual cost of managing adhesion-related symptoms is considerably higher. This is because the data presented above do not reflect the expenses associated with outpatient cases of chronic pelvic pain caused by abdominal adhesions and reducing the quality of life [16, 23].

The majority of currently available approaches for assessing the morphology and prevalence of adhesions necessitate repeated surgical interventions for assessment purposes [24-27]. A number of studies have proposed the Clinical Adhesion Score (CLAS), a scoring system for measuring and monitoring postoperative adhesions by assessing the clinical consequences of the most common adhesion-associated complications: small bowel obstruction, difficulties with surgical access during redo surgery, chronic pelvic pain, and female infertility [29]. The proposed scoring system eliminates the necessity for redo surgery for adhesion assessment, evaluates clinical outcomes, and paves the way for novel prevention strategies in surgical procedures associated with a high risk of postoperative adhesions.

The visceral slide test is a non-invasive ultrasound-based method to assess abdominal adhesions by observing the abdominal organs sliding freely during normal respiration or with manual compression of the anterior abdominal wall [25, 26].

Currently, novel non-invasive approaches to assessing the severity of adhesions are emerging as routine clinical procedures, such as dynamic magnetic resonance imaging (CineMRI), an MRI sequence that monitors the relative position of abdominal organs over time in a specific body region. A literature review reveals that CineMRI has proven to be a valuable diagnostic tool in identifying postoperative adhesions. It can be employed in clinical practice at the preoperative stage to assess adhesions, thereby minimizing the risk of an iatrogenic injury to hollow organs during reoperation [13].

Repeated elective laparoscopy, or second-look laparoscopy (SLL), is considered the "gold standard" for the diagnosis and treatment of adhesions [27]. However, both the indications for SLL and their ethical considerations remain controversial. Indeed, the list of surgical interventions that are clinically justified for SLL is limited, posing a significant challenge in clinical trials aimed at assessing adhesion formation and the efficacy of pharmacological agents used to prevent adhesions [28-29].

To date, there is no unified protocol for minimizing the formation of postoperative adhesions. It is evident that establishing clear guidelines for the prevention of postoperative adhesions is critical. The absence of an up-to-date, clearly defined strategy for developing a unified, standardized methodology for the prevention of adhesions necessitates further investigations in this area.

ADDITIONAL INFO

Authors' contribution. All authors made a substantial contribution to the conception of the work, acquisition, analysis, interpretation of data for the work, drafting and revising the work, final approval of the version to be published and agree to be accountable for all aspects of the work. The concept and design of the study — Popov A.A., Fedorov A.A., Chechneva M.A.; collection and processing of the material — Fedorov A.A., Davydova Yu.D.; data analysis and interpretation — Fedorov A.A., Davydova Yu.D., Tyurina S.S., Sopova Yu.I.; writing of the text — Fedorov A.A., Davydova Yu.D.; final approval of the version for publication — Popov A.A., Fedorov A.A., Chechneva M.A., Tyurina S.S., Sopova Yu.I., Davydova Yu.D.

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ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Вклад авторов. Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией. Концепция и дизайн работы — Попов А.А., Фёдоров А.А., Чечнева М.А.; сбор и обработка материала — Фёдоров А.А.,

Давыдова Ю.Д.; анализ и интерпретация данных — Фёдоров А.А., Давыдова Ю.Д., Тюрина С.С, Сопова Ю.И.; написание текста — Фёдоров А.А., Давыдова Ю.Д.; окончательное утверждение версии для публикации — Попов А.А., Фёдоров А.А., Чечнева М.А., Тюрина С.С., Сопова Ю.И., Давыдова Ю.Д.

Финансирование. Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

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