INTEGRATED DIGITAL APPROACH FOR EARLY RISK PREDICTION OF ABDOMINAL ADHESIVE DISEASE BASED ON IMMUNO-MOLECULAR MARKERS

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Background: Abdominal adhesive disease (AAD) remains a significant postoperative complication in abdominal surgery, contributing substantially to morbidity, recurrent intestinal obstruction, and healthcare burden worldwide. Despite advances in surgical techniques, current clinical strategies are largely empirical and do not adequately account for individual immunological variability.

Recent studies emphasize the critical role of cytokine imbalance, angiogenesis, and extracellular matrix remodeling in adhesion formation. However, the integration of these pathogenetic factors into a unified predictive model remains insufficiently developed, limiting early diagnosis and prevention strategies.

Objective: To develop and validate an integrated digital system for early prediction of abdominal adhesive disease based on combined immunological and molecular-genetic markers.

Materials and Methods: The study included 265 patients with abdominal adhesive pathology treated at a tertiary surgical center. A reference group consisted of 20 healthy individuals without prior abdominal surgery. The main cohort included 245 patients, divided into a control group (137 patients

receiving conventional treatment) and a study group (128 patients managed using a novel predictive algorithm).

The proposed system is based on a multifactorial model incorporating 11 key parameters, including cytokines (IL-6, TGF-β1, VEGF, IL-10), coagulation/fibrinolysis markers (fibrinogen, PAI-1, tPA), and molecular-genetic indicators (Col1a1, Tgfb1, Timp1, Serpine1). The algorithm utilizes weighted scoring and automated data processing.

Results: The developed predictive model demonstrated high diagnostic accuracy, with sensitivity of 86.8% and specificity of 84.5%. The ROC curve analysis showed strong predictive performance (AUC = 0.861), confirming the reliability of the integrated approach.

The combination of immunological and genetic markers allowed comprehensive assessment of both early inflammatory changes and long-term fibrotic remodeling processes. The use of digital scoring and automated analysis significantly improved:

prediction accuracy;

reproducibility of results;

standardization of clinical decision-making;

efficiency of data processing.

Conclusion: The proposed integrated digital system represents an effective tool for early prediction and risk stratification of abdominal adhesive disease. The combination of immunological and molecular-genetic parameters significantly enhances diagnostic accuracy and provides a foundation for personalized preventive strategies in abdominal surgery.

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