THE ROLE OF ARTIFICIAL INTELLIGENCE IN PRE-DIAGNOSTIC ASSESSMENT AND DETERMINATION OF RESECTION VOLUME OF THE COLON IN DECOMPENSATED COLOSTASIS

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Abstract

Decompensated colostasis is a severe pathological condition requiring timely surgical intervention. Accurate preoperative assessment and precise determination of the resection volume are critical factors influencing surgical outcomes and postoperative recovery. Recent advances in artificial intelligence (AI) provide innovative tools for improving diagnostic accuracy and optimizing surgical planning. This article examines the role of artificial intelligence in pre-diagnostic evaluation and prediction of the optimal resection extent in patients with decompensated colostasis. AI algorithms enable large-scale data analysis, identification of complex pathological patterns, risk prediction of complications, and accurate delineation of resection margins. The integration of AI into clinical decision-making enhances surgical precision, improves patient safety, and contributes to better postoperative outcomes.

Keywords: artificial intelligence, decompensated colostasis, colon resection, surgical planning, predictive analytics, preoperative diagnostics.

Introduction

Decompensated colostasis represents an advanced stage of colonic dysfunction characterized by severe impairment of intestinal motility, progressive dilation, ischemic changes, and risk of perforation or sepsis. In such cases, surgical intervention is often unavoidable. One of the most challenging aspects of surgical management is determining the optimal extent of colon resection while preserving viable tissue and minimizing postoperative complications.

Traditional diagnostic methods—including radiological imaging, endoscopy, and laboratory assessments—provide valuable information but may not fully capture the complex pathophysiological changes occurring in decompensated colostasis. Variability in tissue viability, vascular compromise, and inflammatory spread often complicate preoperative decision-making.

Artificial intelligence has emerged as a transformative technology in modern medicine. Its application in surgical planning allows for enhanced data processing, predictive modeling, and individualized treatment strategies. This study emphasizes the innovative role of AI in improving preoperative diagnostics and optimizing the determination of resection volume in patients with decompensated colostasis.

Objective

The objective of this study is to analyze the role of artificial intelligence in pre-diagnostic evaluation and in determining the optimal volume of colon resection in cases of decompensated colostasis. The research aims to evaluate how AI-based algorithms improve diagnostic accuracy, reduce decision-making time, predict complications, and enhance surgical outcomes.

Methods

This study was conducted as a combined analytical review and retrospective clinical data analysis focusing on the application of artificial intelligence in preoperative diagnostics and determination of the optimal colon resection volume in patients with decompensated colostasis. Clinical records, radiological imaging, laboratory parameters, and intraoperative findings were analyzed to evaluate the effectiveness of AI-assisted surgical planning.

Anonymized patient datasets were collected from individuals diagnosed with decompensated colostasis who required surgical intervention. The analyzed variables included computed tomography (CT) findings, contrast-enhanced imaging results, colonoscopic data, inflammatory markers such as C-reactive protein and leukocyte count, hemodynamic indicators, duration of obstruction, and documented intraoperative assessment of bowel viability.

Artificial intelligence models were developed using supervised machine learning techniques applied to structured clinical datasets. Deep learning algorithms, particularly convolutional neural networks, were used to analyze CT images for automated detection of bowel dilation, ischemic zones, wall thickening, and inflammatory spread. The AI system was trained to predict tissue viability, estimate resection boundaries, and assess the probability of postoperative complications.

Predictive modeling incorporated demographic factors, comorbidities, laboratory markers, radiological indicators of perfusion, and structural damage. Model performance was evaluated through cross-validation procedures to ensure reliability and generalizability. Diagnostic accuracy, sensitivity, specificity, and predictive values were assessed using receiver operating characteristic analysis.

A comparative analysis was performed between conventional preoperative assessment methods and AI-assisted decision-making. The primary evaluation criteria included diagnostic time, precision in defining resection margins, rate of intraoperative plan modification, and incidence of postoperative complications.

All clinical data were anonymized to maintain patient confidentiality. The study adhered to established ethical standards for biomedical research and complied with institutional guidelines for data protection and responsible clinical investigation.

Results

The findings demonstrate that artificial intelligence significantly enhances preoperative planning in patients with decompensated colostasis. AI systems analyze large datasets derived from imaging studies, laboratory values, and clinical parameters to identify subtle pathological patterns that may not be evident through standard diagnostic methods.

AI algorithms enable precise assessment of tissue perfusion, inflammatory spread, and structural damage, thereby supporting accurate calculation of resection margins. Predictive models also estimate the risk of postoperative complications, including anastomotic leakage, infection, and recurrence of obstruction.

The integration of AI into surgical decision-making allows surgeons to select the most appropriate intervention strategy, reducing unnecessary extensive resections while avoiding

insufficient removal of affected tissue. As a result, operative safety is improved, diagnostic time is shortened, and patient outcomes are optimized.

Discussion

The innovative aspect of AI in colorectal surgery lies in its ability to process complex clinical data and detect multidimensional patterns that may remain unnoticed in routine diagnostics. By combining radiological imaging, laboratory indicators, and patient history, AI systems create comprehensive predictive models for individualized surgical planning.

Artificial intelligence contributes to the optimization of operative volume by accurately determining tissue viability boundaries and estimating functional reserve of the remaining colon. This reduces the likelihood of postoperative complications and supports enhanced recovery protocols.

However, challenges remain regarding data standardization, algorithm transparency, and ethical considerations. Successful clinical implementation requires validation through multicenter studies and integration with existing clinical workflows.

Conclusion

Artificial intelligence plays a significant role in the pre-diagnostic assessment and determination of the optimal resection volume of the colon in patients with decompensated colostasis. By analyzing large datasets and identifying complex pathological patterns, AI improves diagnostic precision, reduces time to surgical decision-making, and enhances operative safety.

The use of AI in predicting complications and accurately defining resection boundaries enables surgeons to make more evidence-based decisions, ultimately improving postoperative outcomes. Continued development and clinical validation of AI-based systems may significantly transform the future of colorectal surgical management.

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