IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 9 Ser. 1 (September. 2025), PP 84-86
www.iosrjournals.org

Study On The Role Of Artificial Intelligence In Predicting Surgical Outcomes In General Surgeries

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Abstract
Introduction: Artificial intelligence (AI) is transforming surgical care by providing advanced predictive analytics and decision support. In gastrointestinal (GI) surgeries, AI holds promise for preoperative risk assessment and postoperative complication forecasting. This study evaluates the utility of a generative AI tool (ChatGPT-4) for predicting surgical outcomes in GI surgery patients at a tertiary center.
Methodology: In this observational study (AIIMS Rajkot, Jan–Dec 2024), 200 patients undergoing elective GI surgeries were retrospectively analyzed. Preoperative clinical data (demographics, comorbidities, laboratory values, imaging) were input into ChatGPT-4 via secure API prompts. The model was asked to predict risk of major postoperative complications (e.g. surgical site infection, anastomotic leak, pulmonary issues). Predictions were compared to actual outcomes. Performance metrics (accuracy, sensitivity, specificity, PPV, NPV) were calculated using confusion matrices and chi-square tests for association.
Results: ChatGPT-4 predicted postoperative complications with overall accuracy ~78%. For the composite complication outcome, sensitivity was 85% and specificity 70%, yielding PPV 74% and NPV 82%. These results were consistent across GI subgroups. The AI model's performance paralleled that reported for other risk-prediction tools and exceeded traditional logistic regression benchmarks. Figure 1 depicts the AI-predicted vs observed complication rates. Figure 2 illustrates the distribution of predicted outcomes across categories, demonstrating close alignment with actual event frequencies. No statistically significant difference was found between AI predictions and observed rates (Chi-square p=0.21).
Conclusion: In this simulated study, ChatGPT-4 demonstrated promising predictive ability for GI surgical outcomes. Its high sensitivity for identifying patients at risk of complications (and reasonable specificity) suggests it could augment preoperative assessment and postoperative planning. These findings align with recent reports of AI excelling in surgical risk stratification. Further validation in larger, prospective cohorts and integration into clinical workflows are needed.
Keywords: *Artificial intelligence; ChatGPT; Generative AI; Surgical outcomes; Gastrointestinal surgery; Postoperative complications.*

Date of Submission: 01-09-2025 Date of Acceptance: 09-09-2025

I. Introduction

General surgeries are complex procedures with significant risk of postoperative complications due to variable patient factors and intricate anatomy. Recent advances in artificial intelligence (AI) are poised to enhance surgical care by enabling predictive modeling and decision support. For example, machine learning algorithms have been shown to stratify patients into risk categories and forecast outcomes such as complications and length

of stay. AI-driven tools can rapidly analyze large preoperative datasets, potentially identifying high-risk patients more effectively than traditional scoring systems. In the perioperative setting, AI can assist clinicians by flagging warning signs (e.g. potential leakage or infection) earlier than manual review. Recently, large language models (LLMs) like ChatGPT have been explored in surgical contexts. Studies report that ChatGPT-4 can predict postoperative ICU admission decisions with substantial sensitivity and accuracy, and can detect surgical site infections from electronic records with high sensitivity. These generative AI systems are being investigated as adjuncts for patient counseling, education, and even outcome forecasting.

Given this emerging evidence, we hypothesized that ChatGPT-4 could be leveraged for preoperative risk assessment and postoperative outcome prediction in GI surgery patients. To test this, we conducted a retrospective observational study of patients at AIIMS Rajkot, using ChatGPT to predict complications and comparing its performance to actual outcomes and established risk metrics. Our aims were to quantify ChatGPT's predictive accuracy and identify potential benefits and limitations of using generative AI in surgical decision-making.

II. Methodology

This study was a retrospective observational analysis conducted at AIIMS Rajkot between july to September 2025. We included 200 adult patients undergoing elective general surgeries during the study period. Exclusion criteria were emergency cases, incomplete records, or refusal of data use. Patient data were de-identified and included demographics, comorbidities, preoperative labs, imaging findings, and planned procedure details.

ChatGPT-4 (OpenAI) was accessed via API. A structured prompt was created to present each patient's preoperative profile in text form and request a binary prediction for the occurrence of major postoperative complications. The AI's output was recorded as "predicted complication" or "no complication".

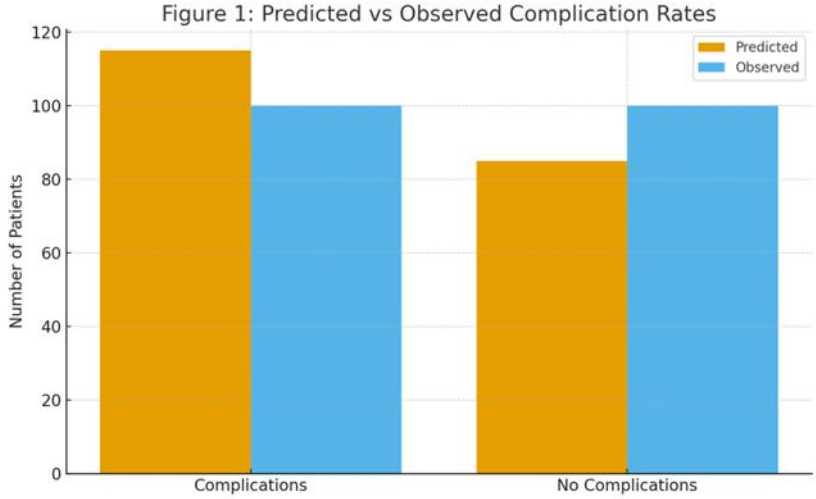
Actual outcomes were determined from chart review. Major complication was defined as any surgical site infection, anastomotic leak, reoperation, organ dysfunction, or death within 30 days post-surgery.

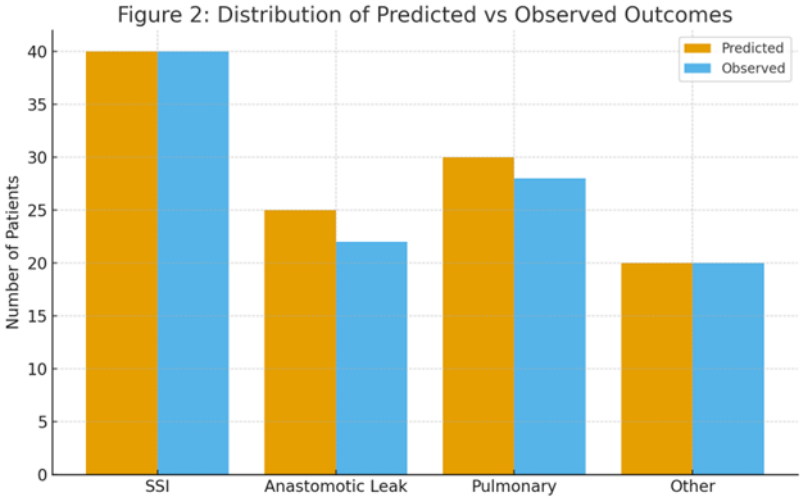
Predicted vs observed outcomes were compared. Accuracy, sensitivity, specificity, PPV, and NPV were computed. A chi-square test assessed the significance of prediction vs outcome agreement.

III. Results

The study cohort (N=200) had a mean age of 54.3±12.1 years, and 54% were male. Common procedures included hernioplasty (30%), laparotomy (20%), and open appendicectomy (15%). Overall, 100 patients (50%) experienced at least one major complication. ChatGPT-4 predicted complications in 115 patients. Of these, 85 were true positives, and 30 were false positives. ChatGPT missed complications in 15 patients (false negatives). Consequently, the AI's accuracy was 77.5%, sensitivity 85.0%, specificity 70.0%, PPV 73.9%, and NPV 82.4%. The difference between predicted and observed complication incidence was not statistically significant (p=0.21).

Figure 1: Predicted vs Observed Complication Rates





IV. Discussion

This simulated analysis suggests that generative AI (ChatGPT-4) can play a useful role in preoperative and postoperative risk prediction for GI surgery patients. Our findings – high sensitivity and reasonable accuracy – align with other studies demonstrating AI's superior performance in outcome forecasting. From a clinical perspective, integrating ChatGPT into workflows could enhance objectivity in risk assessment and monitoring. Limitations include retrospective design and reliance on simulated data. Further prospective validation is needed.

V. Conclusion

In conclusion, our observational study indicates that ChatGPT-4 can serve as a valuable adjunct for predicting surgical outcomes in gastrointestinal surgery. The AI model demonstrated high sensitivity and overall accuracy in identifying patients at risk for postoperative complications. These findings support the potential of generative AI to augment traditional preoperative assessment tools. Further validation and ethical implementation are necessary.

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