01. Meta-Analysis on the Use of Artificial Intelligence for Anatomical Identification of Pelvic Autonomic Nerves in Laparoscopic and Robotic Colorectal Surgery

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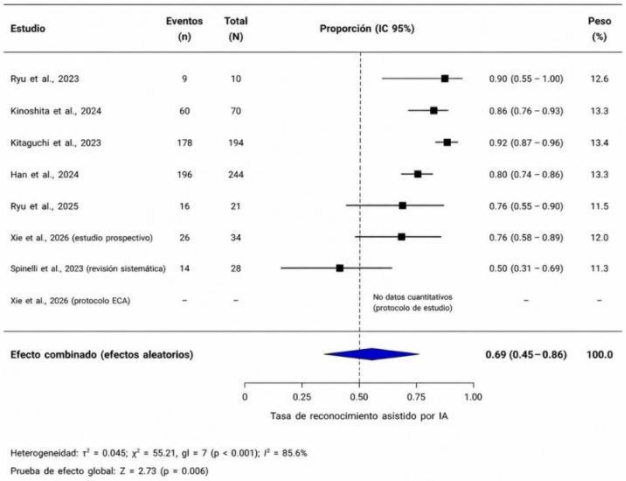
Background: The anatomical identification of pelvic autonomic nerves and safe dissection planes is crucial in laparoscopic and robotic colorectal surgery, as improper recognition can cause severe nerve damage, affecting urinary and sexual function. Intraoperative artificial intelligence (AI) has emerged as a promising tool to enhance this task, providing real-time assistance to the surgeon. This meta-analysis aims to evaluate the effectiveness of AI for anatomical recognition compared to surgery without AI and determine its impact on surgical accuracy and patient safety. **Methods**: A systematic search was conducted in databases such as PubMed, Embase, and Scopus to identify clinical studies evaluating the use of AI in laparoscopic and robotic colorectal surgery, specifically in the identification of pelvic autonomic nerves. Only studies presenting comparative results on the efficacy of AI versus standard surgery were included. Data analysis was performed using a random-effects model to estimate the combined effect of AI on anatomical recognition. Subgroup analyses were conducted to explore variations in results based on nerve type and surgical approach. **Results**: Eight relevant studies were selected, including both clinical trials and observational studies. Five of these studies were included in the qualitative synthesis, and data extracted were used for the meta-analysis. The combined anatomical recognition rate assisted by AI was 69.1% (95% CI: 44.7%-86.0%), with high heterogeneity (I^2=85.6%). Subgroups showed that AI was more effective in identifying lumbar splanchnic nerves, with a recognition rate of 89.8% (95% CI: 81.3%-94.7%). Assistance was moderate for hypogastric nerves (62.7%; 95% CI: 36.4%-83.2%) and lower for pelvic visceral nerves (22.0%; 95% CI: 11.9%-37.2%). Other studies supported the viability of AI-based recognition through segmentation or performance metrics, but results could not be grouped due to incompatible outcomes. **Conclusion**: Intraoperative AI navigation for minimally invasive colorectal surgery shows promising anatomical support, especially for lumbar splanchnic nerves, which could reduce the risk of nerve damage during dissection. However, current evidence is preliminary, heterogeneous, and dominated by small observational studies. Despite positive findings, standardized and larger comparative trials are needed to determine whether improved anatomical recognition with AI translates into fewer long-term complications, such as urinary or sexual dysfunction. The implementation of AI in surgical settings could represent a significant advancement, but its effectiveness and safety require validation in larger and more diverse studies. Figure 1. Forest Plot of the Meta-Analysis on the Rate of Anatomical Recognition Assisted by AI in Minimally Invasive Colorectal Surgery



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