

Robotic Versus Laparoscopic Colorectal Surgery: A Systematic Review and Meta-Analysis of 259,476 Patients

Karla D Chávez, Alejandra Vásquez-Bolaños, Víctor A Mañuico, Andrea Beltran-De la Fuente, Andy A Vega-Hernandez, Iran Alonso, Roberta Faudoa, Jorge I Leiva, MD, Diego C Marines-Copado, MD.
Houston Methodist Willowbrook Hospital

INTRODUCTION

Robotic colorectal surgery is increasingly adopted, yet its advantages over laparoscopy remain uncertain. We performed a meta-analysis comparing robotic vs laparoscopic colorectal surgery on perioperative outcomes: SSI, conversion to open surgery, overall morbidity and mortality, anastomotic leak, postoperative ileus, readmissions, reoperations, and complication severity (Clavien–Dindo).

Why This Matters

- **Robotic** colorectal surgery is rapidly increasing
- Promises better precision and ergonomics



But true clinical benefit remains debated

METHODS:

Study Design



Databases searched

PubMed | Embase | Scopus
Web of Science | Cochrane



Studies included: 32



Total patients: 259,476



Analysis: Random-effects meta-analysis

Data extraction followed PRISMA guidelines. Analyses were performed in RevMan 5.4 using random-effects models. Dichotomous outcomes are reported as RR (95% CI) and continuous outcomes as MD or SMD. Significance was set at $p < 0.05$, and heterogeneity was assessed with Cochran's Q and I^2 .

MD = (Mean in robotic) – (Mean in laparoscopic)

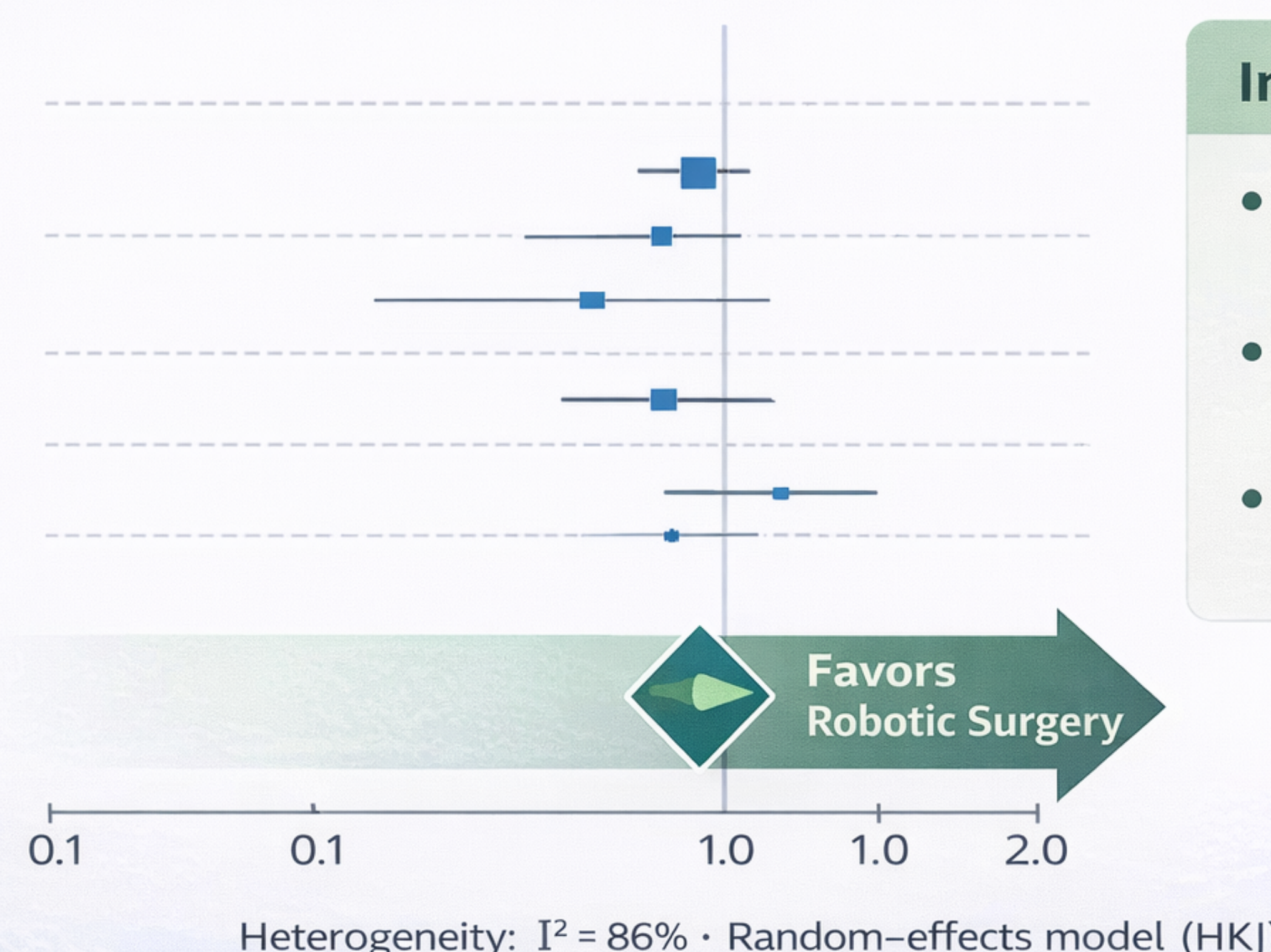
SMD = (Mean difference) / (Pooled standard deviation)

REFERENCES

1. Ozawa N, Yamaguchi T, Kozu T, Noguchi T, Sakamoto T, Matsui S, et al. Bowel preparation and surgical site infections in laparoscopic and robot-assisted right-sided colon cancer surgery with intracorporeal anastomosis: A retrospective study. *Ann Gastroenterol Surg*. 2025;9:711–8. <https://doi.org/10.1002/ags3.12896>
2. Koeller E, Luhrs AR, Giorgi M. Changes in utilization of robotic bariatric surgery and effect on patient outcomes from 2015–2020. *J Robot Surg*. 2023;17:2041–5. <https://doi.org/10.1007/s11701-023-01611-0>
3. Ahuja V, Paredes LG, Leeds IL, Perkal MF, King JT. Clinical outcomes of elective robotic vs laparoscopic surgery for colon cancer utilizing a large national database. *Surg Endosc*. 2023;37:7199–205. <https://doi.org/10.1007/s00464-023-10215-6>
4. Miller PE, Dao H, Paluvoi N, Bailey M, Margolin D, Shah N, et al. Comparison of 30-Day Postoperative Outcomes after Laparoscopic vs Robotic Colectomy. *J Am Coll Surg*. 2016;223:369–73. <https://doi.org/10.1016/j.jamcollsurg.2016.03.041>
5. Huang Z, Li T, Zhang G, Zhou Z, Shi H, Tang C, et al. Comparison of open, laparoscopic, and robotic left colectomy for radical treatment of colon cancer: a retrospective analysis in a consecutive series of 211 patients. *World J Surg Oncol*. 2022;20:345. <https://doi.org/10.1186/s12957-022-02796-8>

Robotic surgery significantly reduces conversion to open surgery

Pooled OR **0.46** (95% CI 0.35–0.61) • $p < 0.001$



Interpretation

- **Robotic surgery reduced conversion risk by 54%**
- Effect remained significant despite heterogeneity
- Strongest perioperative advantage observed

Robotic Surgery Showed Clear Perioperative Advantages

✓ SIGNIFICANTLY LOWER with Robotic Surgery

- Conversion to open surgery
- Overall morbidity
- Surgical site infections

✓ NO SIGNIFICANT DIFFERENCE

- Mortality
- Anastomotic leak
- Postoperative ileus
- Complication severity

✓ SLIGHTLY HIGHER

- Readmissions
- Reoperations

CONCLUSION

Robotic colorectal surgery provides meaningful perioperative benefits — particularly lower conversion and complication rates — while maintaining comparable safety to laparoscopy.

Further randomized trials are needed.