Evaluation of Robotic Versus Laparoscopic Surgery for Right Colon Cancer Treatment: Systematic Review and Meta-Analysis

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BACKGROUND

Right-sided colon cancer is a common form of colorectal disease, and minimally invasive surgery is now the standard approach. While robotic surgery offers greater precision, 3D visualization, and better ergonomics for surgeons, its true clinical advantage over laparoscopy is still debated, especially given its higher cost and longer operating times.

METHODS

A systematic literature search was conducted in PubMed, Scopus, and Web of Science. Comparative studies evaluating robotic and laparoscopic right colectomy were included.

ASSESSED OUTCOMES

~ Operative time
~ Length of hospital stay
~ Number of harvested lymph nodes
~ Intraoperative blood loss
~ Conversion rate
~ Postoperative wound complications
~ Readmission rate
~ Overall costs

Statistical analysis was performed using fixed or random-effects models, depending on heterogeneity.

RESULTS

A total of 46 studies including 36,868 patients were analyzed.
~ Operative time: Significantly **longer** in the robotic group
~ Hospital stay: Slightly shorter in robotic group
~ Harvested lymph nodes: **higher** number retrieved in robotic surgery
~ Blood loss: **Reduced** in robotic surgery
~ Conversion rate: **lower rates** in robotic approach
~ Costs: **lower** overall costs for laparoscopic procedures

1.2 Operation time

Study or Subgroup	RR Mean	RR SD	RR Total	LR Mean	LR SD	LR Total	Weight	Mean Difference IV, Random, 95% CI
Bin 2023	221	52.6	61	186	42.2	108	12.7%	35.00 [19.59, 50.41]
Ceccarelli 2021	217.7	67.2	26	170.8	39.6	29	8.1%	46.90 [17.32, 76.48]
Chen 2024	171.7	38.7	100	168.4	34.93	125	14.5%	3.30 [-6.45, 13.05]
Ngu 2019	180	7.2	11	157.5	18.75	12	14.0%	22.50 [11.07, 33.93]
Scotton 2018	253	46.7	207	210	64	160	13.9%	43.00 [31.22, 54.78]
Spinoglio 2018	279	80	100	236	68	100	10.9%	43.00 [22.42, 63.58]
Tian 2023	200.9	62.1	142	182.3	33.4	142	14.0%	18.60 [7.00, 30.20]
Zhang 2022	155	50	45	150	50	100	11.9%	5.00 [-12.59, 22.59]
Total (95% CI)			**692**			**776**	**100.0%**	**25.73 [13.75, 37.70]**

Heterogeneity: Tau² = 232.38; Chi² = 39.71, df = 7 (P < 0.00001); I² = 82%
Test for overall effect: Z = 4.21 (P < 0.0001)

Mean Difference IV, Random, 95% CI
-100 -50 0 50 100
Favours RR Favours LR

DISCUSSION

Robotic surgery demonstrates potential advantages in terms of surgical precision and postoperative recovery. Nonetheless, these benefits must be balanced against longer operative times and higher costs. The oncological adequacy of both approaches appears equivalent based on current evidence. Further high-quality randomized controlled trials are warranted to clarify long-term outcomes.

CONCLUSIONS

Robotic right colectomy represents a safe and effective alternative to laparoscopic surgery. While it may offer selected perioperative benefits, no significant differences were highlighted in overall patient recovery. Surgical approach selection should be guided by institutional resources and surgeon expertise.

Keywords

Right colon cancer • Robotic surgery • Laparoscopic surgery • Meta-analysis • Minimally Invasive Surgery