Evidence Navigator: Right Colectomy

Systematic literature review & meta-analysis
as of March 1, 2024

INTUITIVE

Purpose

The Evidence Navigator is a slide presentation representing a summary of the meta-analysis of the highest level of evidence available specific to a given procedure and published as of a particular date. It is created by the Global Evidence Management team within Global Access, Value and Economics (GAVE). It includes information that is available in the public domain. It is a systematic review and meta-analysis of the peer-reviewed literature based on a timeframe within which a literature search has been conducted according to a set of concise inclusion and exclusion criteria. The results of the meta-analysis are presented in the form of forest plots summarized for each outcome according to a comparator and surgical approach of interest. The summary results are reflective of a specific period in time and are subject to change with increasing literature. All of the robotic-assisted surgery procedures mentioned within the Evidence Navigator were performed using a da Vinci® surgical system.

Statistical analysis

All summary measures are shown as odds ratios, risk ratios or risk differences when describing binary outcomes, or as weighted mean differences or standardized mean differences when describing continuous outcomes. Weighting is based on the study sample size and variability of the outcome. A random effect model is used if heterogeneity is statistically significant, otherwise a fixed effect model is used. The Mantel Haenszel summary statistic is used for the overall results. The meta-analysis is performed with RevMan 5.4 (Review Manager, Version 5.4. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014) or R software (R Foundation for Statistical Computing, Vienna, Austria.URL https://www.R-project.org/).

Interpretation notes

When the effect size is measured as a standardized mean difference (SMD), or a risk difference (RD), it is not possible to provide a quantitative conclusion. In such cases, a qualitative conclusion is given with reference to its statistical significance. In some instances, studies may contain some overlapping patient populations. A redundancy check is performed in order to minimize this overlap and bias due to over-reporting.

Glossary

RAS	robotic-assisted surgery
Lap	laparoscopic surgery
LOE	level of evidence
HTA	health technology assessment
RCT	randomized controlled trial
OR	odds ratio
MD	mean difference

WMD	weighted mean difference
RD	risk difference
SMD	standardized mean difference
95% CI	95% confidence interval
I^2	test statistic for heterogeneity
EBL	estimated blood loss
LOS	length of hospital stay

Evidence Navigator: Right Colectomy Summary Slides

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WHAT DOES THE LITERATURE SHOW?

Systematic literature review:
Da Vinci robotic-assisted right colectomy

Inclusion criteria

Robotic-assisted right colectomy performed with a da Vinci surgical system

January 1, 2010 – March 1, 2024

Level of Evidence 1b, 2b, 2c

RCT, prospective cohort studies, or large database study (with n≥20 in each cohort)

Exclusion criteria

Not in English

Paper reports on a pediatric population

Publication is an HTA that was not published in a peer-reviewed journal

Alternate technique/approach (e.g. single-port)

No stratified analysis by study arm

Right colectomy data mixed with other procedures or benign/cancer data mixed

Original research study does not provide quantitative results for outcomes of interest

Original research publication includes redundant patient population and similar conclusions

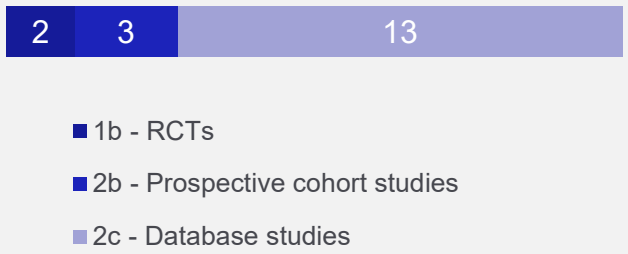
18 publications including:

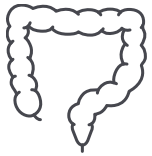
Robotic-assisted patients: **34,500**

Laparoscopic patients: **236,889**

Open patients: **190,029**

Level of evidence





WHAT DOES THE LITERATURE SHOW?

Systematic literature review key points: **Robotic-assisted vs. laparoscopic right colectomy**

Favors robotic-assisted

- ↑ Lymph node yield
- ↓ Estimated blood loss by **15.79 mL**
- ↓ Conversions by **43%**
- ↓ Ileus by **21%**
- ↓ Anastomotic leak by **11%**
- ↓ Length of stay by **0.48 days**

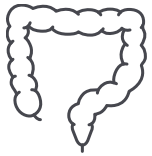
Comparable outcomes

- ≈ Blood transfusion
- ≈ Proximal resection margin
- ≈ Distal resection margin
- ≈ Surgical site infection
- ≈ Time to flatus
- ≈ 30-day postoperative complications
- ≈ 30-day readmissions
- ≈ 30-day reoperations
- ≈ 30-day mortality

Favors laparoscopic

- ↓ Operative time by **56 minutes**

Data collected: March 1, 2024



WHAT DOES THE LITERATURE SHOW?

Systematic literature review key points: **Robotic-assisted vs. open* right colectomy**

Favors robotic-assisted

- ↑ Lymph node yield
- ↓ Ileus by **36%**
- ↓ Length of stay by **2.5 days**
- ↓ 30-day reoperations by **15%**

Comparable outcomes

- ≈ 30-day mortality

Favors open

- ↓ Operative time by **85 minutes**

Data collected: March 1, 2024

*Limited data available on patients who underwent open surgery

Evidence Navigator: Right Colectomy Technical Slides

Systematic literature review & meta-analysis
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Right Colectomy: Literature search methods
as of March 1, 2024

Monthly searches were conducted in PubMed, Scopus and Embase.

All citations were exported into a reference management system. Duplications were removed. Titles, abstracts and keywords were reviewed for literature review inclusion by Global Evidence Management team.

All robotic-assisted right colectomies performed with da Vinci® surgical systems. Publications were identified according to inclusion and exclusion criteria described.

Meta-analysis was performed using RevMan or R software.

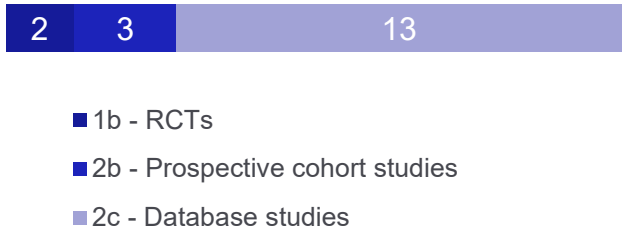
18 publications

34,500 patients who underwent RAS

236,889 patients who underwent laparoscopic surgery

190,029 patients who underwent open surgery

Level of evidence



Criteria phase	Details
Identification phase	All unique PubMed, Scopus, and Embase references identified N = 3,884 March 1, 2024
Inclusion criteria	
1. Robotic-assisted right-colectomy procedure	Robotic right colectomy N = 865 (excluded N = 3,019)
2. Year ≥ 2010	Articles published ≥ 2010 N = 865 (excluded N = 0)
3. LOE = 1b, 2b, 2c	Articles with LOE= 1b, 2b, 2c N = 154 (excluded N = 711)
4. RCT, prospective comparative study with comparative cohorts (robotic-assisted vs. laparoscopic and/or open surgery) and sample size ≥ 20 in each cohort	Comparator cohorts N = 135 (excluded N = 19)
Exclusion criteria	**N = 117 excluded publications:**
1. Not in English	N = 0 (EC#1)
2. Paper reports on a pediatric population	N = 0 (EC#2)
3. Publication is an HTA that was not published in a peer-reviewed journal	N = 0 (EC#3)
4. Alternate technique/approach (e.g., transanal, single-port)	N = 0 (EC#4)
5. No stratified analysis by study arm (e.g., combines results from robotic, laparoscopic, and/or open cohorts)	N = 48 (EC#5)
6. Benign/cancer data mixed and cancer not a majority, or right colectomy data mixed with other procedures	N =67 (EC#6)
7. Original research study does not provide quantitative results for the outcomes of interest	N = 2 (EC#7)
8. Original research publication includes redundant patient population and similar conclusions	N = 0 (EC#8)

Right colectomy publications: N = 18

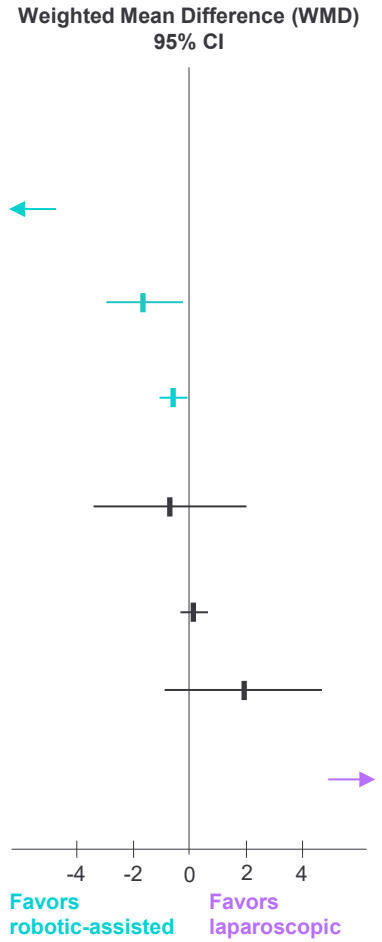
Robotic-assisted vs. laparoscopic right colectomy

Summary as of March 1, 2024

- Significant difference favoring robotic-assisted surgery
- No significant difference; comparable outcomes
- Significant difference favoring laparoscopic surgery

Compared to laparoscopic right colectomy, the evidence for **robotic-assisted right colectomy using the da Vinci surgical system** demonstrates:

- Significantly less estimated blood loss by an average of 15.79 mL
- Significantly difference in lymph node yield (LNY) by 1.15 lymph nodes
- Significantly shorter hospital length of stay by an average of 0.48 days
- Comparable proximal resection margin
- Comparable time to flatus
- Comparable distal resection margin
- Significantly longer operative time by an average of 56 minutes



Outcome	Robotic-assisted, n	Laparoscopic, n	Effect Size WMD, 95%CI	P-value
Right Colectomy Continuous Variables (to March 1, 2024)				
EBL, mL[6,12]				
Subtotal	394	753	-15.79 [-24.57, -7.001]	p<0.01
Fixed, Heterogeneity: p=0.32; I^2=0%				
LNY, n (L-R) [4,5,6,8,10,12,15,16,17]				
Subtotal	16331	145449	-1.15 [-2.19, -0.11]	p=0.03
Random, Heterogeneity: p<0.01; I^2=78%				
LOS, days [5,8,10,11,12,16]				
Subtotal	11695	27587	-0.48 [-0.83, -0.13]	P<0.01
Random, Heterogeneity: p<0.01; I^2=86%				
Proximal resection margin, cm [12,15]				
Subtotal	83	75	-0.69 [-3.51, 2.12]	p=0.63
Fixed, Heterogeneity: p=0.51; I^2=0%				
Time to flatus, days [12,15]				
Subtotal	83	75	0.14 [-0.29, 0.58]	p=0.52
Fixed, Heterogeneity: p=0.24; I^2=27%				
Distal resection margin, cm [12,15]				
Subtotal	83	75	1.92 [-0.82, 4.66]	p=0.17
Fixed, Heterogeneity: p=0.28; I^2=13%				
Operative Time, min [8,10,11,12,15]				
Subtotal	11339	15999	56.16 [25.16, 87.17]	p<0.01
Random, Heterogeneity: p<0.01; I^2=92%				

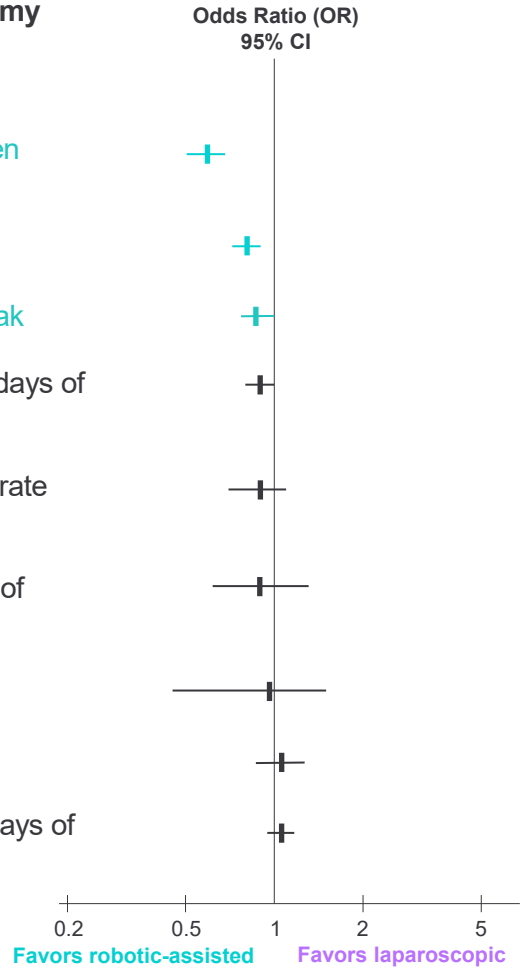
Robotic-assisted vs. laparoscopic right colectomy

Summary as of March 1, 2024

- Significant difference favoring robotic-assisted surgery
- No significant difference; comparable outcomes
- Significant difference favoring laparoscopic surgery

Compared to laparoscopic right colectomy, the evidence for **robotic-assisted right colectomy using the da Vinci surgical system** demonstrates:

- 43% less likely to have a conversion to open surgery
- 21% less likely to experience an ileus
- 11% less likely to have an anastomotic leak
- Comparable readmissions rate within 30-days of surgery
- Comparable postoperative complications rate within 30-days of surgery
- Comparable mortality rate within 30-days of surgery
- Comparable blood transfusions rate
- Comparable surgical site infection rate
- Comparable reoperations rate within 30-days of surgery



Outcome	Robotic-assisted, n	Laparoscopic, n	Effect size OR 95% CI	P-value
Right Colectomy Binary Variables (to March 1, 2024)				
Conversions, n [2,5,6,8,9,11,12,14,15,16,17]				
Subtotal	27461	168146	0.57 [0.50, 0.66]	**p<0.01**
Random, Heterogeneity: p=0.03; I^2=54%				
Ileus, n [5,8,9,10,11,12]				
Subtotal	11864	22475	0.79 [0.73, 0.85]	**p<0.01**
Fixed, Heterogeneity: p=0.28; I^2=21%				
Anastomotic Leaks, n [1,5,6,8,9,11,12,15,18]				
Subtotal	15358	44806	0.89 [0.81, 0.99]	**p=0.04**
Fixed, Heterogeneity: p=0.44; I^2=0%				
Readmissions 30-day, n [5,8,11,15]				
Subtotal	11354	17920	0.92 [0.84, 1.02]	p=0.12
Fixed, Heterogeneity: p=0.39; I^2=0%				
Postoperative complications 30-day, n [5,6,8,11,12]				
Subtotal	11713	19379	0.92 [0.78, 1.09]	p=0.35
Random, Heterogeneity: p=0.02; I^2=65%				
Mortality 30-day, n [5,6,8,10,11,12,15]				
Subtotal	11838	21146	0.92 [0.68, 1.25]	p=0.6
Fixed, Heterogeneity: p=0.17; I^2=37%				
Blood transfusions, n [6,8,10,12]				
Subtotal	2835	7862	0.97 [0.57, 1.65]	p=0.92
Random, Heterogeneity p=0.08; I^2=60%				
Surgical site infection, n [5,9,11,12,15]				
Subtotal	9470	15405	1.03 [0.87, 1.23]	p=0.7
Fixed, Heterogeneity: p=0.60; I^2=0%				
Reoperations 30-day, n [5,9,10,11,15]				
Subtotal	9522	17773	1.05 [0.93, 1.18]	p=0.46
Fixed. Heterogeneity p=0.77; I^2=0%				

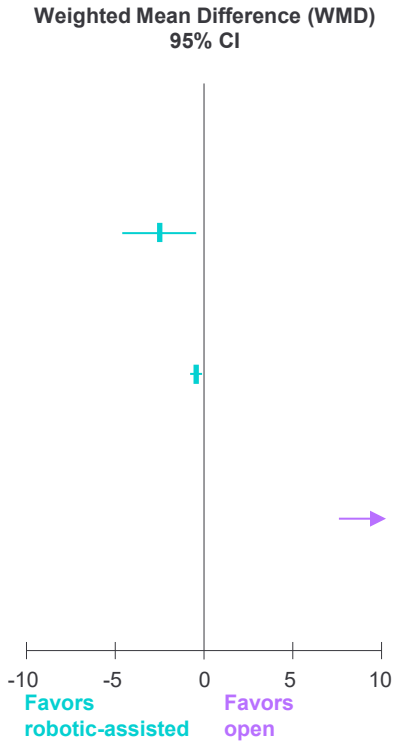
Robotic-assisted vs. open right colectomy

Summary as of March 1, 2024

- Significant difference favoring robotic-assisted surgery
- No significant difference; comparable outcomes
- Significant difference favoring open surgery

Compared to open right colectomy, the evidence for **robotic-assisted right colectomy using the da Vinci surgical system** demonstrates:

- Significantly shorter hospital length of stay by an average of 2.47 days
- Significantly difference in lymph node yield (LNY) by 0.4 lymph nodes
- Significantly longer operative time by an average of 85 minutes



Outcome	Robotic-assisted, n	Open, n	Effect Size WMD, 95%CI	P-value
Right Colectomy Continuous Variables (to March 1, 2024)				
LOS, days [10,11]				
Subtotal	8472	9407	-2.47 [-4.43, -0.51]	**p=0.01**
Random, Heterogeneity: p<0.01; I^2=97%				
LNY, n (L-R) [4,10,17]				
Subtotal	13125	161928	0.40 [0.21, 0.59]	**p<0.01**
Fixed, Heterogeneity: p=0.77; I^2=0%				
Operative Time, min [10,11]				
Subtotal	8472	9407	84.96 [18.61, 151.30]	p=0.01
Random, Heterogeneity: p<0.01; I^2=96%				

Robotic-assisted vs. open right colectomy

Summary as of March 1, 2024

- Significant difference favoring robotic-assisted surgery
- No significant difference; comparable outcomes
- Significant difference favoring open surgery

Compared to open right colectomy, the evidence for **robotic-assisted right colectomy using the da Vinci surgical system** demonstrates:

- 36% less likely to experience an ileus
- 15% less likely to be reoperated within 30-days of surgery
- Comparable mortality rate within 30-days of surgery

Outcome	Robotic-assisted, n	Open, n	Effect size OR 95% CI	P-value
Right Colectomy Binary Variables (to March 1, 2024)				
Ileus, n [10,11]				
Subtotal	8472	9407	0.64 [0.58, 0.69]	p<0.01
Fixed, Heterogeneity: p=0.81; I^2=0%				
Reoperations 30-day, n [10,11]				
Subtotal	8472	9407	0.85 [0.75, 0.96]	p=0.01
Fixed, Heterogeneity: p=0.41; I^2=0%				
Mortality, n [10,11]				
Subtotal	8472	9407	0.72 [0.49, 1.04]	p=0.08
Fixed, Heterogeneity: p=0.95; I^2=0%				

Robotic-assisted vs. Laparoscopic Right Colectomy

Weighted estimates based on 18 studies

Meta-analysis covering period
January 1, 2010 – March 1, 2024

This study analyzed continuous variables using weighted means and categorical variables using weighted rates with fixed or random effects models. This method gives more influence to studies with higher weights, providing a more accurate estimate of central tendency when combining results from multiple studies.

Outcomes that favor Robotic

Lymph node yield (n)	22.8 vs 21.7
Estimated blood loss	69.5 ml vs 85.3 ml
Conversions	6% vs 10%
Ileus	9.4% vs 11.5%
Anastomotic leak	4.8% vs 5.3%
Length of stay	4.5 days vs 5.0 days

Comparable outcomes

Blood transfusions	7.7% vs 6.9%
Proximal resection margin	15.4 vs 16.1
Distal resection margin	16.7 vs 14.8
Surgical site infection	3% vs 2.9%
Time to flatus	2.5 days vs 2.3 days
30-day postoperative complications	20.6% vs 21.7%
30-day readmissions	6.8% vs 7.3%
30-day reoperations	5.7% vs 5.4%
30-day mortality	0.7% vs 0.8%

Outcomes that favor Laparoscopic

Operative time	227.5 min vs 171.3 min

Disclaimer: The number of studies used to calculate the weighted estimates for each outcome varies

Robotic-Assisted vs. Open Right Colectomy

Weighted estimates based on 6 studies

Meta-analysis covering period
January 1, 2010 – March 1, 2024

This study analyzed continuous variables using weighted means and categorical variables using weighted rates with fixed or random effects models. This method gives more influence to studies with higher weights, providing a more accurate estimate of central tendency when combining results from multiple studies.

Outcomes that favor Robotic

Lymph node yield (n)	20.6 vs 20.1
Ileus	9.9% vs 14.7%
Length of stay	4.9 days vs 7.4 days
30-day reoperations	5.9% vs 6.9%

Comparable outcomes

30-day mortality	0.6% vs 0.8%

Outcomes that favor Laparoscopic

Operative time	250.7 min vs 165.7 min

Disclaimer: The number of studies used to calculate the weighted estimates for each outcome varies

Right colectomy: bibliography

March 1, 2024

1. Ahuja, V., L. G. Paredes, I. L. Leeds, M. F. Perkal and J. T. King, Jr. (2023). "Clinical outcomes of elective robotic vs laparoscopic surgery for colon cancer utilizing a large national database." Surg Endosc 37(9): 7199-7205.

2. Anania, G., F. Agresta, E. Artioli, S. Rubino, G. Resta, N. Vettoretto, W. L. Petz, C. Bergamini, A. Arezzo, G. Valpiani, C. Morotti, G. Silecchia and S. CoDIG (2020). "Laparoscopic right hemicolectomy: the SICE (Società Italiana di Chirurgia Endoscopica e Nuove Tecnologie) network prospective trial on 1225 cases comparing intra corporeal versus extra corporeal ileo-colic side-to-side anastomosis." Surg Endosc 34(11): 4788-4800.

3. Chen, S. Y., S. N. Radomski, M. Stem, B. D. Lo, B. Safar, J. E. Efron and C. Atallah (2023). "Safety and Feasibility of ≤24-h Short-Stay Right Colectomies for Primary Colon Cancer." World J Surg 47(9): 2267-2278.

4. Cheong, J. Y., C. J. Young and C. Byrne (2021). "Does the body mass index impact lymph node yield for colorectal cancer resection, and does operative approach influence this: a review of bi-national colorectal cancer audit database." ANZ Journal of Surgery 91(12): 2707-2713.

5. Clarke, E. M., J. Rahme, T. Larach, A. Rajkomar, A. Jain, R. Hiscock, S. Warrier and P. Smart (2022). "Robotic versus laparoscopic right hemicolectomy: a retrospective cohort study of the Binational Colorectal Cancer Database." J Robot Surg 16(4): 927-933.

6. Dohrn, N., M. F. Klein and I. Gogenur (2021). "Robotic versus laparoscopic right colectomy for colon cancer: a nationwide cohort study." Int J Colorectal Dis 36(10): 2147-2158.

7. Emile, S. H., N. Horesh, Z. Garoufalia, R. Gefen, P. Zhou, V. Strassman and S. D. Wexner (2023). "Robotic and laparoscopic colectomy: propensity score-matched outcomes from a national cancer database." Br J Surg 110(6): 717-726.

8. Farah, E., A. A. Abreu, B. Rail, J. Salgado, G. Karagkounis, H. J. Zeh, 3rd and P. M. Polanco (2023). "Perioperative outcomes of robotic and laparoscopic surgery for colorectal cancer: a propensity score-matched analysis." World J Surg Oncol 21(1): 272.

9. Gomez Ruiz, M., E. Espin-Basany, A. Spinelli, C. Cagigas Fernandez, J. Bollo Rodriguez, J. Maria Enriquez Navascues, T. Rautio, M. Tiskus and G. Mircast Study (2023). "Early outcomes from the Minimally Invasive Right Colectomy Anastomosis study (MIRCAST)." The British journal of surgery 110(9): 1153-1160.

10. Haskins, I. N., T. Ju, M. Skancke, X. Kuang, R. L. Amdur, F. Brody, V. Obias and S. Agarwal (2018). "Right Colon Resection for Colon Cancer: Does Surgical Approach Matter?" J Laparoendosc Adv Surg Tech A 28(10): 1202-1206.

11. Mlambo, B., I. F. Shih, Y. Li and S. M. Wren (2022). "The impact of operative approach on postoperative outcomes and healthcare utilization after colectomy." Surgery (United States) 171(2): 320-327.

12. Park, J. S., G. S. Choi, S. Y. Park, H. J. Kim and J. P. Ryuk (2012). "Randomized clinical trial of robot-assisted versus standard laparoscopic right colectomy." British Journal of Surgery 99(9): 1219-1226.

13. Park, J. S., H. Kang, S. Y. Park, H. J. Kim, I. T. Woo, I. K. Park and G. S. Choi (2019). "Long-term oncologic after robotic versus laparoscopic right colectomy: a prospective randomized study." Surg Endosc 33(9): 2975-2981.

14. Shah, P. C., A. de Groot, R. Cerfolio, W. C. Huang, K. Huang, C. Song, Y. Li, U. Kreaden and D. S. Oh (2022). "Impact of type of minimally invasive approach on open conversions across ten common procedures in different specialties." Surg Endosc 36(8): 6067-6075.

15. Sorgato, N., E. Mammano, T. Contardo, F. Vittadello, G. Sarzo and E. Morpurgo (2022). "Right colectomy with intracorporeal anastomosis for cancer: a prospective comparison between robotics and laparoscopy." Journal of Robotic Surgery 16(3): 655-663.

16. Sterk, M. F. M., R. Crolla, M. Verseveld, J. W. T. Dekker, G. P. van der Schelling, C. Verhoef and P. B. Olthof (2023). "Uptake of robot-assisted colon cancer surgery in the Netherlands." Surg Endosc 37(11): 8196-8203.

17. Williams, A. D., T. Sun, S. Kakade, S. L. Wong, L. N. Shulman and N. Z. Carp (2021). "Comparison of open and minimally invasive approaches to colon cancer resection in compliance with 12 regional lymph node harvest quality measure." Journal of Surgical Oncology 123(4): 986-996.

18. Wurtz, H. J., L. Bundgaard, H. B. Rahr and E. Frostberg (2022). "Anastomosis technique and leakage rates in minimally invasive surgery for right-sided colon cancer. A retrospective national cohort study." International Journal of Colorectal Disease 37(3): 701-708.

Disclosures

Important Safety Information

(US) Serious complications may occur in any surgery, including da Vinci surgery, up to and including death. Serious risks include, but are not limited to, injury to tissues and organs and conversion to other surgical techniques which could result in a longer operative time and/or increased complications. For summary of the risks associated with surgery refer to www.intuitive.com/safety.

Da Vinci Xi®/da Vinci X® system precaution statement
The demonstration of safety and effectiveness for the representative specific procedures did not include evaluation of outcomes related to the treatment of cancer (overall survival, disease-free survival, local recurrence), except for radical prostatectomy which was evaluated for overall survival, or treatment of the patient's underlying disease/condition. Device usage in all surgical procedures should be guided by the clinical judgment of an adequately trained surgeon.

(EU) Medical devices, CE 2460, refer to Instructions For Use for further information.

For product intended use and/or indications for use, risks, cautions, and warnings and full prescribing information, refer to the associated user manual(s) or visit https://manuals.intuitivesurgical.com/market.

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Individual outcomes may depend on a number of factors, including but not limited to patient characteristics, disease characteristics, and/or surgeon experience.

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