Evidence Navigator: Partial nephrectomy

Systematic literature review & meta-analysis summary as of December 31, 2022

INTUITIVE

Purpose

The <u>Evidence Navigator</u> 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 <u>Global Access, Value and Economics (GAVE)</u>. It includes information that is available in the public domain. It is regarded as 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. It is intended to educate both internal and external stakeholders on the highest level of evidence that is currently available for a given surgical procedure. 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 standardized mean differences or weighted mean differences when describing continuous outcomes. Weighting is based on the study sample size and variability of the outcome. A fixed effect model is used if heterogeneity was not statistically significant or not applicable, and a random effect model is used if heterogeneity was statistically significant. Mantel Haenszel summary statistic is used for overall results. All calculations and forest plots are made 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, meta-analyses may contain some overlapping studies. A redundancy check is performed in order to minimize this overlap and bias due to over-reporting.

Glossary

95% CI	95% confidence interval	**MD**	mean difference
EBL	estimated blood loss	**OR**	odds ratio
HTA	health technology assessment	**PSM**	positive surgical margins
I²	test statistic for heterogeneity	**RAS**	robotic-assisted surgery
LNY	lymph node yield	**RCT**	randomized controlled trial
LOE	level of evidence	**SMD**	standardized mean difference
LOS	length of hospital stay	**WIT**	warm ischemia time

Evidence Navigator: Partial nephrectomy Summary Slides

Systematic literature review & meta-analysis summary as of December 31, 2022

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Systematic literature review & meta-analysis key points:
Literature search methods for partial nephrectomy

Inclusion criteria

Robotic-assisted partial nephrectomy performed with a da Vinci surgical system

January 1, 2010 – December 31, 2022

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

Partial nephrectomy data mixed with other procedures

Original research study does not provide quantitative results for at least one of the outcomes of interest

Original research publication includes redundant patient population and similar conclusions

33 publications including

Robotic-assisted patients: **87,675**

Laparoscopic patients: **23,021**

Open patients: **80,313**

Level of evidence

2	12	19

■ 1b ■ 2b ■ 2c

Systematic literature review & meta-analysis key points:
Robotic-assisted with da Vinci surgical system vs. open partial nephrectomy

Favors robotic-assisted

↓ Estimated blood loss by **93 mL**

↓ Blood transfusions by **49%**

↓ Intraoperative complications by **32%**

↓ Length of stay by **2 days**

↓ 30-day postoperative complications by **40%**

↓ 30-day readmissions by **38%**

↓ Risk of 30-day mortality

Comparable outcomes

≈ Warm ischemia time

Favors open

↓ Operative time by **32 min**

↓ Positive surgical margins by **44%**

Data collected through: December 31, 2022

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

Systematic literature review & meta-analysis key points:
Robotic-assisted with da Vinci surgical system vs. laparoscopic partial nephrectomy

Favors robotic-assisted

↓ Blood transfusions by **19%**

↓ Conversions by **54%**

↓ Length of stay by **0.6 days**

↓ 30-day readmissions by **22%**

↓ 30-day postoperative complications by **19%**

Comparable outcomes

≈ Operative time

≈ Estimated blood loss

≈ Warm ischemia time

≈ Intraoperative complications

≈ Positive surgical margins

≈ Risk of 30-day mortality

Favors laparoscopic

None

Data collected through: December 31, 2022

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

Evidence Navigator: Partial nephrectomy Technical Slides

Systematic literature review & meta-analysis summary as of December 31, 2022

INTUITIVE

Partial nephrectomy: Literature search methods
as of December 31, 2022

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 the Global Evidence Management team.

All robotic-assisted partial nephrectomies were performed with the da Vinci® surgical systems. Publications were identified according to inclusion and exclusion criteria described.
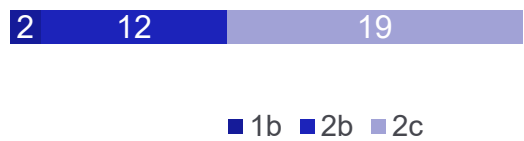
33 publications

87,675 patients who underwent RAS

23,021 patients who underwent laparoscopic surgery

80,313 patients who underwent open surgery

Level of evidence

2	12	19

■ 1b   ■ 2b   ■ 2c

| Criteria phase	Details
Identification phase	All unique PubMed, Scopus, and Embase references identified N=**6,846** December 31, 2022
Inclusion criteria 1. Robotic-assisted partial nephrectomy procedure	Robotic-assisted partial nephrectomy N=**3,028** (excluded N=3,818)
2. Year≥2010	Articles published≥2010 N=**3,028** (excluded N=0)
3. LOE=1b, 2b, 2c	Articles with LOE=1b, 2b, 2c N=**173** (excluded N=2,855)
4. Study is an RCT, prospective cohort study or large database study with comparative cohorts (robotic-assisted vs lap and/or open surgery) and n≥20	Comparator cohorts N=**155** (excluded N=18)
Exclusion criteria 1. Not in English 2. Paper reports on a pediatric population 3. Publication is an HTA that was not published in a peer-reviewed journal 4. Alternate technique/approach (e.g. single-port, hand-assist, etc.) 5. No stratified analysis by study arm (e.g. combines results from robotic, laparoscopic and/or open cohorts) 6. Partial nephrectomy data mixed with other procedures (e.g. data from multiple surgical procedures combined) 7. Original research study does not provide quantitative results for at least one of the findings relative to the outcomes of interest (i.e., operative time, conversions, estimated blood loss and/or transfusions, complications, length of hospital stay, mortality) 8. Original research publication includes redundant patient population and similar conclusions	**N=122 excluded publications:** N=0 (EC#1) N=1 (EC#2) N=0 (EC#3) N=0 (EC#4) N=83 (EC#5) N=4 (EC#6) N=27 (EC#7) N=7 (EC#8)

Partial nephrectomy publications: N=33

Robotic-assisted vs. open partial nephrectomy (1 of 2)

Summary as of December 31, 2022

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

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

- Significantly less estimated blood loss by an average of 93 mL

- Significantly shorter hospital length of stay by an average of 2 days

- Comparable warm ischemia time

- Significantly greater operative time by an average of 32 min
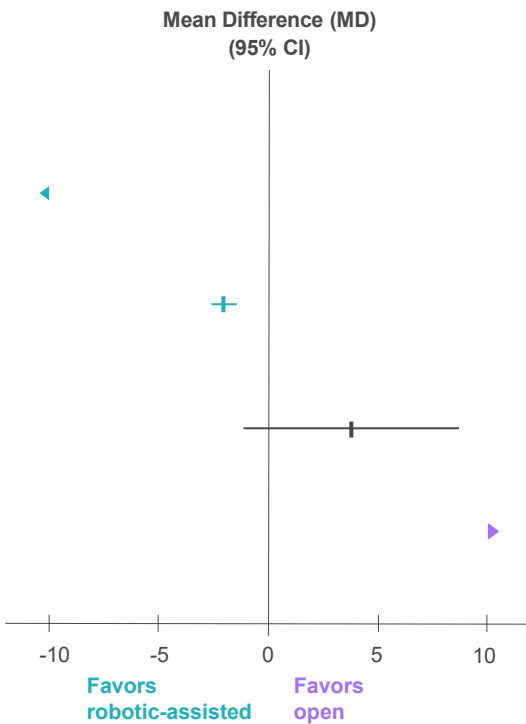
Mean Difference (MD) (95% CI)

-10   -5   0   5   10

Favors robotic-assisted   **Favors open**

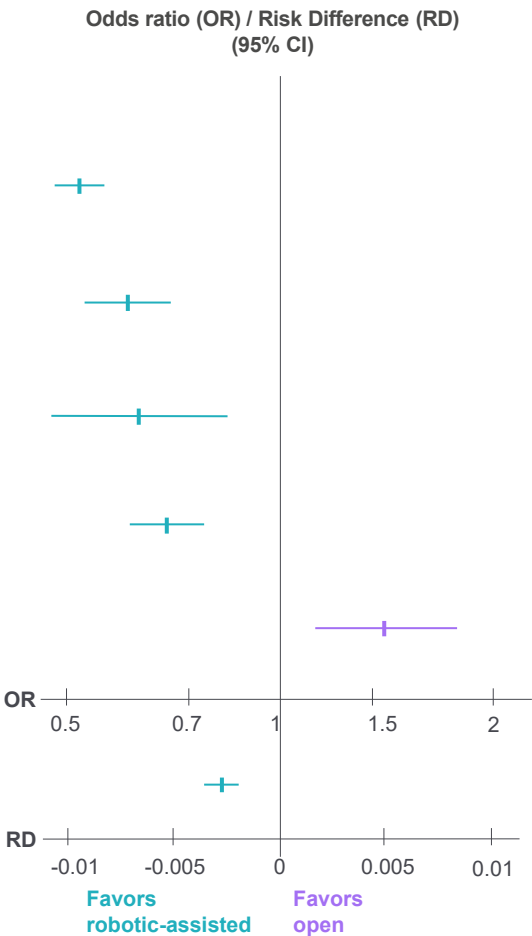| Outcomes	Robotic-assisted, n	Open, n	Effect Size 95% CI	P-value
Partial nephrectomy continuous variables (to December 31, 2022)				
EBL, mL [8, 12-14, 17, 19, 20, 24]				
Subtotal	856	1975	MD: -93.46 [-151.82, -35.10]	p<0.01
Random, Heterogeneity: p<0.01, I² = 72%				
LOS, days [4, 7, 8, 11, 14, 17, 19, 20, 22, 24, 26]				
Subtotal	32845	63987	MD: -2.01 [-2.56, -1.45]	p<0.01
Random, Heterogeneity: p<0.01, I² = 96%				
WIT, min [8, 12-14, 17, 19, 20, 24]				
Subtotal	829	1375	MD: 3.83 [-1.06, 8.72]	p=0.12
Random, Heterogeneity: p<0.01, I² = 97%				
Operative time, min [8, 10, 12, 13, 17, 19, 20]				
Subtotal	836	1565	MD: 31.77 [14.54, 48.99]	p<0.01
Random, Heterogeneity: p<0.01, I² = 91%				

Robotic-assisted vs. open partial nephrectomy (2 of 2)

Summary as of December 31, 2022

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

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

- • 49% less likely to receive a blood transfusion
- • 40% less likely to experience a postoperative complication within 30 days of surgery
- • 38% less likely to experience a readmission within 30 days of surgery
- • 32% less likely to experience an intraoperative complication
- • 44% more likely to experience a positive surgical margin
- • A significantly lower risk of mortality within 30 days of surgery

Odds ratio (OR) / Risk Difference (RD) (95% CI)

OR — 0.5   0.7   1   1.5   2

RD — -0.01   -0.005   0   0.005   0.01

Favors robotic-assisted   Favors open

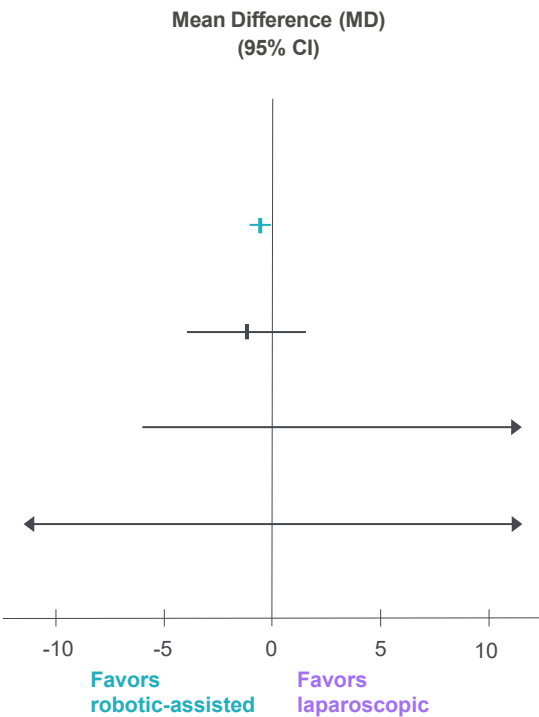| Outcomes	Robotic-assisted, n	Open, n	Effect Size 95% CI	P-value
Partial nephrectomy binary variables (to December 31, 2022)				
Transfusions, n (%) [6, 11, 14, 19, 20, 23, 26]				
Subtotal	15488	32869	OR: 0.51 [0.46, 0.55]	p<0.01
Fixed, Heterogeneity: p=0.45, I² = 0%				
Postoperative complications, n (%) [4, 11, 12, 14, 19, 20, 23, 26]				
Subtotal	32593	63804	OR: 0.60 [0.52, 0.69]	p<0.01
Random, Heterogeneity: p<0.01, I² = 83%				
Readmissions, n (%) [7, 23]				
Subtotal	2141	5564	OR: 0.62 [0.46, 0.83]	p<0.01
Random, Heterogeneity: p=0.1, I² = 64%				
Intraoperative complications, n (%) [11, 13, 20, 31]				
Subtotal	9283	26071	OR: 0.68 [0.60, 0.77]	p<0.01
Fixed, Heterogeneity: p=0.53, I² = 0%				
PSM, n (%) [2, 5, 8, 12-14, 17, 19, 20, 24, 30]				
Subtotal	8530	11467	OR: 1.44 [1.13, 1.83]	p<0.01
Random, Heterogeneity: p=0.07, I²=41% (random model was used to account for overrepresetation of database studies)				
Mortality, n (%) [11, 20, 23, 24]				
Subtotal	10820	28977	RD: -0.0027 [-0.0034, -0.0020]	p<0.01
Fixed, Heterogeneity: p=0.97, I² = 0%				

Robotic-assisted vs. laparoscopic partial nephrectomy (1 of 2)
Summary as of December 31, 2022

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

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

- Significantly shorter hospital length of stay by an average of 0.6 days

- Comparable warm ischemia time

- Comparable operative time

- Comparable estimated blood loss

**Mean Difference (MD)
(95% CI)**

Favors robotic-assisted   Favors laparoscopic

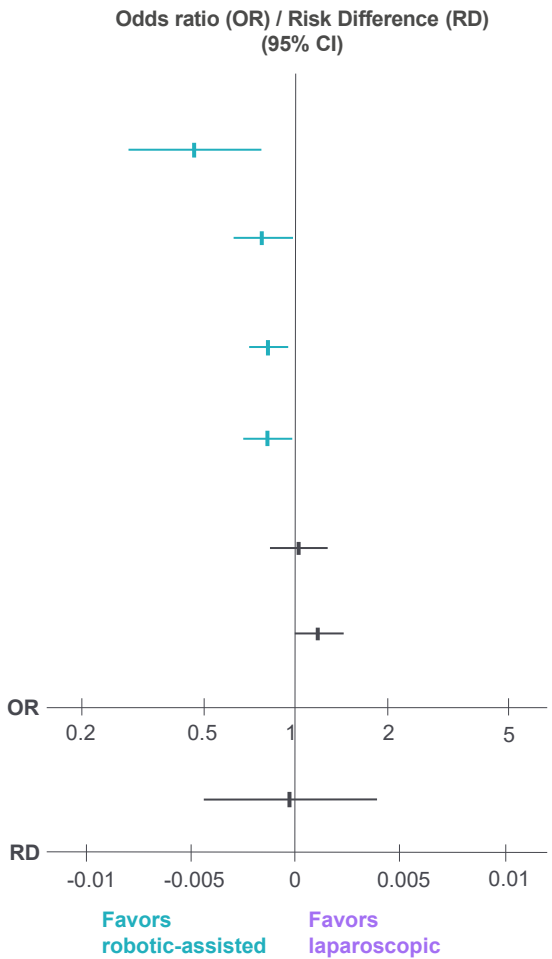| Outcomes	Robotic-assisted, n	Laparoscopic ,n	Effect Size 95% CI	P-value
Partial nephrectomy continuous variables (to December 31, 2022)				
LOS, days [1, 3, 4, 7, 9, 11, 15, 17, 18, 24, 32]				
Subtotal	32028	9094	MD: -0.57 [-0.97, -0.18]	p<0.01
Random, Heterogeneity: p<0.01, I² = 97%				
WIT, min [1, 9, 12, 13, 17, 18, 24, 32, 33]				
Subtotal	994	1107	MD: -1.20 [-3.83, 1.43]	p=0.37
Random, Heterogeneity: p<0.01, I² = 98%				
Operative time, min [1, 3, 12, 13, 17, 18, 32, 33]				
Subtotal	1125	1470	MD: 13.39 [-5.93, 32.71]	p=0.17
Random, Heterogeneity: p<0.01, I² = 98%				
EBL, mL [1, 9, 12, 13, 17, 18, 24, 33]				
Subtotal	960	1255	MD: 14.17 [-46.65, 74.98]	p=0.65
Random, Heterogeneity: p<0.01, I² = 98%				

Robotic-assisted vs. laparoscopic partial nephrectomy (2 of 2)

Summary as of December 31, 2022

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

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

- 54% less likely to convert to open surgery

- 22% less likely to be readmitted within 30 days of surgery

- 19% less likely to receive a blood transfusion

- 19% less likely to experience a postoperative complication within 30 days of surgery

- Comparable intraoperative complication rate

- Comparable positive surgical margins

- Comparable risk of mortality within 30 days of surgery

Odds ratio (OR) / Risk Difference (RD) (95% CI)

Favors robotic-assisted | Favors laparoscopic

Outcomes	Robotic-assisted, n	Laparoscopic, n	Effect Size 95% CI	P-value
Partial nephrectomy binary variables (December 31, 2022)				
Conversions, n (%) [1, 3, 7, 13, 16, 18, 24, 27, 32]				
Subtotal	25286	7418	OR: 0.46 [0.28, 0.76]	p<0.01
Random, Heterogeneity: p<0.01, I² = 73%				
Readmissions, n (%) [1, 7, 15, 23]				
Subtotal	3269	2009	OR: 0.78 [0.63, 0.97]	p=0.03
Fixed, Heterogeneity: p=0.99, I² = 0%				
Transfusions, n (%) [1, 9, 11, 18, 23, 32]				
Subtotal	11043	4338	OR: 0.81 [0.71, 0.93]	p<0.01
Fixed, Heterogeneity: p=0.75, I² = 0%				
Postoperative complications, n (%) [1, 3, 4, 9, 11, 12, 18, 23, 33]				
Subtotal	31933	8841	OR: 0.81 [0.68, 0.97]	p=0.02
Random, Heterogeneity: p<0.01, I² = 65%				
Intraoperative complications, n (%) [11, 13]				
Subtotal	9178	3700	OR: 1.02 [0.83, 1.25]	p=0.88
Fixed, Heterogeneity: p=0.22, I² = 33%				
PSM, n (%) [1, 2, 5, 12, 13, 17, 18, 24, 30, 32]				
Subtotal	8573	4155	OR: 1.19 [0.99, 1.43]	p=0.06
Random, Heterogeneity: p=0.37, I²=8% (random model was used to account for overrepresetation of database studies)				
Mortality, n (%) [18, 23, 24]				
Subtotal	1840	781	RD: -0.0003 [-0.0044, -0.0039]	p=0.9
Fixed, Heterogeneity: p=1, I² = 0%				

Partial nephrectomy: bibliography (1 of 2)
December 31, 2022

1. Alimi, Q., B. Peyronnet, P. Sebe, J. F. Cote, S. F. Kammerer-Jacquet, Z. E. Khene, B. Pradere, R. Mathieu, G. Verhoest, B. Guillonneau and K. Bensalah (2018). "Comparison of Short-Term Functional, Oncological, and Perioperative Outcomes Between Laparoscopic and Robotic Partial Nephrectomy Beyond the Learning Curve." J Laparoendosc Adv Surg Tech A 28(9): 1047-1052.

2. Ayangbesan, A., D. M. Golombos, R. Golan, P. O'Malley, P. Lewicki, X. Wu and D. S. Scherr (2019). "Surgical Approach Does Not Impact Margin Status After Partial Nephrectomy for Large Renal Masses." J Endourol 33(1): 50-60.

3. Azawi, N. H., M. Rohrsted, J. Poulsen, L. Lund, B. Kromann-Andersen and L. H. Olsen (2019). "Robotic versus laparoscopic urological surgery: incidence of reoperation and complications." Scand J Urol 53(1): 56-61.

4. Bahler, C. D., M. F. Monn, C. K. Flack, A. R. Gramm, T. A. Gardner and C. P. Sundaram (2018). "Assessing Cost of Robotic Utilization in Partial Nephrectomy with Increasing Utilization." J Endourol 32(8): 710-716.

5. Bansal, R. K., S. Tanguay, A. Finelli, R. Rendon, R. B. Moore, R. H. Breau, L. Lacombe, P. C. Black, J. Kawakami, D. Drachenberg, S. Pautler, O. Saarela, Z. Liu, M. A. S. Jewett and A. Kapoor (2017). "Positive surgical margins during partial nephrectomy for renal cell carcinoma: Results from Canadian Kidney Cancer information system (CKCis) collaborative." Canadian Urological Association Journal 11(6): 182-187.

6. Bernhard, J. C., G. Robert, S. Ricard, J. Rogier, C. Degryse, C. Michiels, G. Margue, P. Blanc, E. Alezra, V. Estrade, G. Capon, F. Bladou and J. M. Ferriere (2023). "Nurse-led coordinated surgical care pathways for cost optimization of robotic-assisted partial nephrectomy: medico-economic analysis of the UroCCR-25 AMBU-REIN study." World J Urol 41(2): 325-333.

7. Camp, C., J. O'Hara, D. Hughes and J. Adshead (2018). "Short-term Outcomes and Costs Following Partial Nephrectomy in England: A Population-based Study." Eur Urol Focus 4(4): 579-585.

8. Campi, R., F. Di Maida, B. R. Lane, O. De Cobelli, F. Sanguedolce, G. Hatzichristodoulou, A. Antonelli, S. Noyes, A. Mari, A. A. Grosso, O. Rodriguez-Faba, F. X. Keeley, J. Langenhuijsen, G. Musi, T. Klatte, M. Roscigno, B. Akdogan, M. Furlan, N. Karakoyunlu, M. Marszalek, U. Capitanio, A. Volpe, S. Brookman-May, J. E. Gschwend, M. C. Smaldone, R. G. Uzzo, M. Carini, A. Kutikov, A. Minervini and S. I. B. I. C. Members of the (2022). "Impact of surgical approach and resection technique on the risk of Trifecta Failure after partial nephrectomy for highly complex renal masses." Eur J Surg Oncol 48(3): 687-693.

9. Considine, S., O. Lynch, N. O'dwyer, U. Haroon and B. McGuire (2021). "Peri-operative and Pathologic Outcomes of Minimally Invasive Partial Nephrectomy (MIPN)." Irish Medical Journal 114(9).

10. Geldmaker, L. E., C. H. Hasse, B. A. Baird, C. A. Ericson, A. A. Myers, D. A. Haehn, A. N. Anyane-Yeboah, M. A. Wieczorek, C. T. Ball, T. D. Lyon, R. W. Pak and D. D. Thiel (2023). "Analysis of fixed and variable operating room (or) time point efficiency in partial nephrectomies: open versus robotic-assisted." J Robot Surg 17(3): 853-858.

11. Ghani, K. R., S. Sukumar, J. D. Sammon, C. G. Rogers, Q. D. Trinh and M. Menon (2014). "Practice patterns and outcomes of open and minimally invasive partial nephrectomy since the introduction of robotic partial nephrectomy: results from the nationwide inpatient sample." J Urol 191(4): 907-912.

12. Ghavimi, S., O. Saarela, F. Pouliot, R. A. Rendon, A. Finelli, A. Kapoor, R. B. Moore, R. H. Breau, L. Lavallee, L. Lacombe, A. Fairey, M. Jewett, Z. Liu, S. Tanguay and P. C. Black (2021). "Achieving the "trifecta" with open versus minimally invasive partial nephrectomy." World Journal of Urology 39(5): 1569-1575.

13. Hadjipavlou, M., F. Khan, S. Fowler, A. Joyce, F. X. Keeley and S. Sriprasad (2016). "Partial vs radical nephrectomy for T1 renal tumours: an analysis from the British Association of Urological Surgeons Nephrectomy Audit." BJU Int 117(1): 62-71.

14. Jelley, C. R., K. A. S. H. Kurukulaarachchi, L. Forster, H. Bardgett, R. Singh and S. K. Addla (2017). "Comparison of open and robotic nephron sparing surgery: a single centre experience." Journal of Clinical Urology 10(1): 28-35.

15. Kates, M., M. W. Ball, H. D. Patel, M. A. Gorin, P. M. Pierorazio and M. E. Allaf (2015). "The financial impact of robotic technology for partial and radical nephrectomy." J Endourol 29(3): 317-322.

16. Khanna, A., S. Campbell, P. B. Murthy, K. Ericson, Y. A. Nyame and R. Abouassaly (2020). "Unplanned Conversion from Minimally Invasive to Open Kidney Surgery: The Impact of Robotics." J Endourol 34(9): 955-963.

17. Luciani, L. G., S. Chiodini, D. Mattevi, T. Cai, M. Puglisi, W. Mantovani and G. Malossini (2017). "Robotic-assisted partial nephrectomy provides better operative outcomes as compared to the laparoscopic and open approaches: results from a prospective cohort study." J Robot Surg 11(3): 333-339.

18. Masson-Lecomte, A. B., K.; Seringe, E.; Vaessen, C.; de la Taille, A.; Doumerc, N.; Rischmann, P.; Bruyere, F.; Soustelle, L.; Droupy, S.; Roupret, M. (2013). "A prospective comparison of surgical and pathological outcomes obtained after robot-assisted or pure laparoscopic partial nephrectomy in moderate to complex renal tumours: results from a French multicentre collaborative study." BJU International 111(2): 256-263.

19. Masson-Lecomte, A., D. R. Yates, V. Hupertan, A. Haertig, E. Chartier-Kastler, M. O. Bitker, C. Vaessen and M. Rouprêt (2013). "A prospective comparison of the pathologic and surgical outcomes obtained after elective treatment of renal cell carcinoma by open or robot-assisted partial nephrectomy." Urologic Oncology: Seminars and Original Investigations 31(6): 924-929.

20. Minervini, A., G. Vittori, A. Antonelli, A. Celia, S. Crivellaro, D. Dente, V. Di Santo, B. Frea, M. Gacci, A. Gritti, L. Masieri, A. Morlacco, A. Porreca, B. Rocco, P. Parma, C. Simeone, S. Zaramella, M. Carini and S. Serni (2014). "Open versus robotic-assisted partial nephrectomy: a multicenter comparison study of perioperative results and complications." World J Urol 32(1): 287-293.

Partial nephrectomy: bibliography (2 of 2)
December 31, 2022

21. Minervini, A., R. Campi, B. R. Lane, O. De Cobelli, F. Sanguedolce, G. Hatzichristodoulou, A. Antonelli, S. Noyes, A. Mari, O. Rodriguez-Faba, F. X. Keeley, J. Langenhuijsen, G. Musi, T. Klatte, M. Roscigno, B. Akdogan, M. Furlan, N. Karakoyunlu, M. Marszalek, U. Capitanio, A. Volpe, S. Brookman-May, J. E. Gschwend, M. C. Smaldone, R. G. Uzzo, M. Carini and A. Kutikov (2020). "Impact of Resection Technique on Perioperative Outcomes and Surgical Margins after Partial Nephrectomy for Localized Renal Masses: A Prospective Multicenter Study." J Urol 203(3): 496-504.

22. Nabi, J., D. F. Friedlander, X. Chen, A. P. Cole, J. C. Hu, A. S. Kibel, P. Dasgupta and Q. D. Trinh (2020). "Assessment of Out-of-Pocket Costs for Robotic Cancer Surgery in US Adults." JAMA network open 3(1): e1919185.

23. Pak, J. S., J. J. Lee, K. Bilal, M. Finkelstein and M. A. Palese (2017). "Utilization trends and outcomes up to 3 months of open, laparoscopic, and robotic partial nephrectomy." J Robot Surg 11(2): 223-229.

24. Pignot, G., A. Mejean, J. C. Bernhard, P. Bigot, M. O. Timsit, J. M. Ferriere, M. Zerbib, A. Villers, P. Mouracade, H. Lang, K. Bensalah, J. P. Couapel, J. Rigaud, L. Salomon, L. Bellec, M. Soulie, C. Vaessen, M. Roupret, H. Baumert, P. Gimel, J. J. Patard and C. members (2015). "The use of partial nephrectomy: results from a contemporary national prospective multicenter study." World J Urol 33(1): 33-40.

25. Razdan, S., K. Okhawere, M. Wilson, W. Nkemdirim, T. Korn, K. Meilika and K. Badani (2022). "Conversion to Open Radical or Partial Nephrectomy Associated with Unplanned Hospital Readmission After Attempted Minimally Invasive Approach." J Laparoendosc Adv Surg Tech A 32(8): 823-831.

26. Rosiello, G., C. Palumbo, M. Deuker, L. F. Stolzenbach, T. Martin, Z. Tian, A. Larcher, U. Capitanio, F. Montorsi, S. F. Shariat, A. Kapoor, F. Saad, A. Briganti and P. I. Karakiewicz (2021). "Partial nephrectomy in frail patients: Benefits of robot-assisted surgery." Surgical Oncology 38: 101588.

27. 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.

28. Shah, Y. B., R. K. Simhal, K. R. Wang, H. Goldberg, C. D. Lallas and T. Chandrasekar (2022). "Patient Factors Impacting Perioperative Outcomes for T1b-T2 Localized Renal Cell Carcinoma May Guide Decision for Partial versus Radical Nephrectomy." J Clin Med 12(1).

29. Stensland, K. D., J. C. Delto, N. Ramesh, C. Robertson, J. P. Schober, P. Chang and A. A. Wagner (2022). "The effect of day of discharge on hospital readmission after minimally invasive partial nephrectomy." Can J Urol 29(2): 11080-11086.

30. Tabayoyong, W., R. Abouassaly, J. E. Kiechle, E. E. Cherullo, N. J. Meropol, N. D. Shah, S. Dong, R. H. Thompson, M. C. Smaldone, H. Zhu, S. Ialacci and S. P. Kim (2015). "Variation in Surgical Margins Status by Surgical Approach Among Patients Undergoing Partial Nephrectomy for Small Renal Masses." J Urol 194(6): 1548-1553.

31. Wunderle, M. F., N. Härtel, N. Wagener, K. F. Kowalewski, P. Nuhn, M. T. Walach and M. C. Kriegmair (2021). "Prospective geriatric assessment for perioperative risk stratification in partial nephrectomy." European Journal of Surgical Oncology 47(4): 913-919.

32. Würnschimmel, C., G. B. Di Pierro, M. Moschini, P. Grande, P. Baumeister, M. Roth, L. Mordasini and A. Mattei (2020). "Robot-Assisted Laparoscopic Partial Nephrectomy Vs Conventional Laparoscopic Partial Nephrectomy: Functional and Surgical Outcomes of a Prospective Single Surgeon Randomized Study." Journal of endourology 34(8): 847-855.

33. Zhou, N., X. Zhu and L. Man (2019). "Comparison of the efficacy between robot-assisted and conventional laparoscopic nephron-sparing surgery for early-stage renal cell carcinoma." International Journal of Clinical and Experimental Medicine 12(4): 3591-3601.

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) Da Vinci X & Xi Surgical Systems

The Intuitive Surgical Endoscopic Instrument Control Systems (da Vinci X and da Vinci Xi Surgical Systems) are intended to assist in the accurate control of Intuitive Surgical Endoscopic Instruments during urologic surgical procedures, general laparoscopic surgical procedures, gynecologic laparoscopic surgical procedures, general thoracoscopic surgical procedures, and trans-oral otolaryngology surgical procedures restricted to benign tumors and malignant tumors classified as T1 and T2, and for benign base of tongue resection procedures. The systems are indicated for adult and pediatric use (except for trans-oral otolaryngology surgical procedures). They are intended to be used by trained physicians in an operating room environment.

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