

statistical differences in surgical outcomes between the 3-arm and 4-arm technique. The difference in ischemia time was minimal and not likely to affect renal function. Margin positivity was higher in the 4-arm group and likely not due to the addition of the arm. For surgeons experienced in robotic surgery routine addition of the fourth robotic arm in RPN is not necessary.

**Acknowledgements.** None

## References

- Campbell S, Uzzo RG, Allaf ME, et al. Renal mass and localized renal cancer: AUA guideline. *J Urol*. 2017;198:520–529.
- Pierorazio PM, Patel HD, Feng T, Yohannan J, Hyams ES, Allaf ME. Robotic-assisted versus traditional laparoscopic partial nephrectomy: comparison of outcomes and evaluation of learning curve. *Urology*. 2011;78(4):813–819.
- Ghani KR, Sukumar S, Sammon JD, Rogers CG, Trinh QD, Menon M. 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*. 2014;191(4):907–912.
- Pierorazio PM, Johnson MH, Patel HD, et al. Management of renal masses and localized renal cancer: systematic review and meta-analysis. *J Urol*. 2016;196(4):989–999.
- Rogers CG, Laungani R, Bhandari A, et al. Maximizing console surgeon independence during robot-assisted renal surgery by using the Fourth Arm and TilePro. *J Endourol*. 2009;23(1):115–121.
- Ludwig WW, Gorin MA, Allaf ME. Reducing the cost of robotic partial nephrectomy through innovative instrument use. *Eur Urol*. 2015;67(3):594–595.
- Bhayani SB. da Vinci robotic partial nephrectomy for renal cell carcinoma: an atlas of the four-arm technique. *J Robot Surg*. 2008;1(4):279–285.
- Cabello J, Benway B, Bhayani J. Robotic-assisted partial nephrectomy: surgical technique using a 3-arm approach and sliding-clip renorrhaphy. *Int Braz J Urol*. 2009;35(2):199–204.
- Wang L, Lee BR. Robotic partial nephrectomy: current technique and outcomes. *Int J Urol*. 2013;20(9):848–859.
- Kaouk JH, Khalifeh A, Hillyer S, Haber GP, Stein RJ, Autorino R. Robot-assisted laparoscopic partial nephrectomy: step-by-step contemporary technique and surgical outcomes at a single high-volume institution. *Eur Urol*. 2012;62(3):553–561.
- Kutikov A, Uzzo RG. The R.E.N.A.L. nephrometry score: a comprehensive standardized system for quantitating renal tumor size, location and depth. *J Urol*. 2009;182(3):844–853.
- Clavien PA, Barkun J, de Oliveira ML, et al. The Clavien-Dindo classification of surgical complications: five-year experience. *Ann Surg*. 2009;250(2):187–196.
- Wu Z, Mingmin L, Bing L, et al. Robotic versus open partial nephrectomy: a systematic review and meta-analysis. *PLoS One*. 2014;9(4):e94878.
- Borghesi M, Schiavina R, Gan M, Novara G, Mottrie A, Ficarra V. Expanding utilization of robotic partial nephrectomy for clinical T1b and complex T1a renal masses. *World J Urol*. 2013;31(3):499–504.
- Rogers CG, Metwalli A, Blatt AM, et al. Robotic partial nephrectomy for renal hilar tumors: a multi-institutional analysis. *J Urol*. 2008;180(6):2353–2356. discussion 2356.
- Patel HD, Mullins JK, Pierorazio PM, et al. Trends in renal surgery: robotic technology is associated with increased use of partial nephrectomy. *J Urol*. 2013;189(4):1229–1235.
- Sivarajan G, Taksler GB, Walter D, Gross CP, Sosa RE, Makarov DV. The effect of the diffusion of the surgical robot on the hospital-level utilization of partial nephrectomy. *Med Care*. 2015;53(1):71–78.

- Mano R, Schulman A, Hakimi AA, et al. Cost comparison of open and robotic partial nephrectomy using a short postoperative pathway. *Urology*. 2015;85(3):596–603.
- Wang Y, Chen YW, Leow JJ, Levy AC, Chang SL, Gelpi FH. Cost-effectiveness of management options for small renal mass: a systematic review. *Am J Clin Oncol*. 2016;39(5):484–490.
- Martin O, Heilen B, Marcos A, et al. Determinant factors for chronic kidney disease after partial nephrectomy. *Oncoscience*. 2018;25(5):13–20.
- Hyams ES, Mullins JK, Pierorazio PM, Partin AW, Allaf ME, Matlaga BR. Impact of robotic technique and surgical volume on the cost of radical prostatectomy. *J Endourol*. 2013;27(3):298–303.
- Lee S, Oh J, Hong SK, Lee SE, Byun SS. Open versus robot-assisted partial nephrectomy: effect on clinical outcome. *J Endourol*. 2011;25(7):1181–1185.
- Alemozaffar M, Chang SL, Kacker R, Sun M, DeWolf WC, Wagner AA. Comparing costs of robotic, laparoscopic, and open partial nephrectomy. *J Endourol*. 2013;27(5):560–565.
- Laydner H, Isac W, Autorino R, et al. Single institutional cost analysis of 325 robotic, laparoscopic, and open partial nephrectomies. *Urology*. 2013;81(3):533–538.

## EDITORIAL COMMENT



We congratulate the authors for asking a very pragmatic clinical question (does the addition of a fourth arm during robotic partial nephrectomy improve clinical outcomes) and designing a study that attempts to answer that question. Indeed, as surgeons who frequently perform this procedure, we have often debated the relative merits of “adding or routinely using a fourth arm.” The results of the current study suggest no advantage. So is the debate over? Can the good-natured argument frequently awash in testosterone and beer be put to rest? As Lee Corso would say...“not so fast my friend.”

The current study suggests a negligible difference in the majority of surgical endpoints including overall operative time, estimated blood loss, complications, and length of hospitalization. The only statistically significant differences were seen in warm ischemia time (25.6 vs 20.5 minutes,  $P = .02$ ) and margin positivity (0% vs 10%,  $P = .03$ ), the former favoring a 4-arm approach and the later favoring a 3-arm approach. These findings are not unexpected. However, the retrospective nature of the study design limits the generalizability of its findings. As the decision to utilize a 3-arm vs a 4-arm approach was based on surgeon preference, the margin difference likely reflects surgeon experience, tumor complexity not reflected by nephrometry score, or other difficult to enunciate confounders. And while ischemia time was significantly different, this finding is not clinically meaningful and again more likely a statistical anomaly rather than a statistical fact.

What is not reflected in this study and may be challenging to prove statistically are the intangibles that a 4-arm approach can offer. First, we have yet to meet a patient who has complained about the aesthetics of an extra port...so let's get that out of the way. Anecdotally, addition of a fourth arm affords dynamic liver retraction when the right kidney is severely retrohepatic, helps stabilize the kidney when a posterior hilar mass is being approached transperitoneally, takes some of the frustration out of dealing with copious perirenal fat, and can be a “kidney saver” when a complex hilum is encountered. Certainly, an experienced surgeon can accomplish all of the above using a 3-arm

approach. An experienced surgeon should likewise practice surgical humility. Perhaps these intangibles may best serve the surgeon in their learning curve. Novice or expert, the ease of port configuration, and the flexibility of port exchange with the newest Xi platform should lower our threshold for adding a fourth arm and leaving our pride at the scrub sink.

Ultimately, the current study has significant limitations and cannot be used to judge the superiority of a 3-arm vs a 4-arm approach. The question the authors ask is nevertheless completely relevant. As surgeons, we must be mindful to practice cost effectiveness and to seek opportunities to improve quality and efficiency through elimination of waste. We must likewise avoid becoming so inflexible with our approach that pragmatism is disregarded. We challenge the authors, and all of us who perform robotic partial nephrectomy with regularity, to consider a prospective, randomized trial that helps to better answer the debate. Until that time, the bar argument will continue.

**John S. Fisher, M.D., David T. Thiel, M.D., Wesley M. White, M.D.**, Department of Urology, The University of Tennessee Medical Center, Knoxville, TN; Department of Urology, Mayo Clinic, Jacksonville, FL; Division of Urologic Surgery, The University of Tennessee Medical Center, Knoxville, TN

<https://doi.org/10.1016/j.urology.2018.06.069>  
UROLOGY 123: 144–145, 2019. © 2018 Elsevier Inc.

---

## AUTHOR REPLY



We whole-heartedly agree that the statistically different outcomes in warm ischemia time and margin positivity noted in this study are more likely an anomaly rather than statistical fact. We appreciate and acknowledge the “intangibles” of surgical technique, but to claim them as an advantage requires scientific

proof. The commenters offer no evidence of this aside from anecdote. We have never encountered an issue retracting the liver with a 3 mm subxiphoid port which is decidedly less morbid than 8 mm robotic arm port. We likewise have no trouble manipulating the kidney with 1 arm once appropriately dissected. While it is rare for a patient to complain of the cosmesis of a single port over other ports, port-site hernias are a real and significant complication, even for 8 mm ports. Any port reduction offers a benefit, and the commenters cannot claim noninferiority without data to substantiate it.

We are unaware how a static and uncontrolled fourth arm acts as a “kidney saver,” but if an acute renal hilar injury occurs, we feel the fourth arm is unlikely to salvage an otherwise lost renal unit. The hilum should be dissected with grace and care regardless of the number of arms. We likewise have found no advantage of the Xi platform in our surgical technique or port placement.

Safely and effectively performing a surgical procedure with reduced cost and less morbidity is to the benefit of the patient and the health care system. The commenters evocation of it being a matter of “pride” and “humility” is nonsensical. Perhaps the commenters ought to leave their credit cards at the scrub sink when justifying the use of the fourth arm without evidence of improving outcomes?

We acknowledged that the retrospective nature of this study is a limitation, however, what other “significant limitations” do the commenters feel nullify our findings? They stress avoidance of inflexibility and a disregard of pragmatism, however, that is precisely the theme of our findings. We ask surgeons to not be “inflexible” and not to “disregard pragmatism” in their consideration that the 3-arm technique is safe, effective, cost conscious, and perfectly feasible.

**Brett Johnson, M.D., Jeffrey Cadeddu, M.D.**, Department of Urology, University of Texas Southwestern, Dallas, TX

<https://doi.org/10.1016/j.urology.2018.06.070>  
UROLOGY 123: 145, 2019. © 2018 Elsevier Inc.