

Robotic assistance helps low-volume surgeons deliver better outcomes to their patients

Urology has been one of the leaders in adapting new technologies in medicine. The driver for all such innovations is the patient; improving outcomes and decreasing morbidity, including that associated with the surgery. Additional considerations are ergonomics for the surgeon and economy for the health-care systems. Therefore, innovations become controversial when they actually lead to an increase in the cost of healthcare. Discussions about costs typically occur in the first few years after the introduction of new technology. Once it proves its value to the specialty, such discussions subside. However, with robotic technology, these discussions remain germane even 20 years after its introduction, primarily because the costs remain high.

While it is widely accepted that laparoscopy provides benefits over open surgery in terms of hospital stay, pain, and cosmesis, robotics is unlikely to score over laparoscopy in these outcomes. Further, cost comparisons between robotics and laparoscopy will always favor laparoscopy. It is thus natural to repeatedly question the need for robotic surgery when laparoscopy can do the job just as well.

Most outcome comparisons are based on surgeries performed by experts in their chosen technique; sample size determinations mandate large cohorts. Such comparisons miss an important reality. How many surgeons actually reach such a level of expertise and what fraction of the population can benefit from them? It is not surprising that outcomes in the hands of experts are equivalent irrespective of the modality. It is well known that outcomes improve with case volume and would tend to reach a similar level irrespective of the technique. The issue that needs to be addressed is whether the outcomes are comparable even in the hands of low-volume surgeons?

This issue is particularly relevant in countries such as India, where subspecialty practice is almost nonexistent. Considering the number of robotic prostatectomies being performed in the country and the number of surgeons performing them, it is likely that the average caseload per surgeon is <20 per year. If we accept that laparoscopy is better for the patient, we must try and provide its benefits to most of our patients. However, laparoscopy is not easy, particularly for reconstructive procedures.

This brings us to the “need” for a robot. It is well documented that the learning curve (LC) of robotics is less than conventional laparoscopy in maiden users.^[1] In one of the first reports on robot-assisted radical prostatectomy (RARP), laparoscopy-naïve surgeons demonstrated rapid acquisition of competence with robot assistance.^[2] Therefore, does the robot help the low-volume surgeon provide minimally invasive surgery to his patients with better results than he would have done laparoscopically? While our individual anecdotal experience would certainly suggest so, a scientific evaluation can be performed by looking at the numbers required to meet the expected competency level.

The common reconstructive urological procedures performed with robotic assistance are RARP, partial nephrectomy (RAPN), radical cystectomy (RARC), and pyeloplasty (RALP). Between 33% and 70% of RARP in the United States are performed by low-volume surgeons.^[3] While the estimated LC for pure laparoscopy is 750 cases to reach a 90% recurrence-free probability,^[4] the LC of RARP is 80–120 cases in reaching a comparable surgical, oncological, and functional results of the high-volume centers.^[5] While the number needed for expert open surgeons to reach the same comfort and confidence is higher, it is still lower than for laparoscopy.^[6] Further, perioperative complications continue to decline with increasing experience from 9.8% in low-volume surgeons (<25 cases/year) to 6.7% with mid-volume surgeons (50–74 cases/year) and 2.2% with surgeons performing >100 cases/year.^[7]

Similarly, learning RAPN seems easier than learning laparoscopic partial nephrectomy (LPN). While it takes 565 cases to master LPN within the target warm ischemia time (WIT),^[8] the estimated LC of RAPN in terms of WIT and operative time (OT) are 20 and 50 cases, respectively.^[9] For expert renal surgeons, the LC of RAPN appears to be <30 cases to attain similar proficiency.^[10] Low-volume surgeon (<7 cases/year) had a comparable complication rate (18.1% vs. 15.9% vs. 16.1%, $P = 0.81$) as high-volume (15–30 cases/year) and very high-volume (>30 cases/year) surgeons.^[11] Even for a complex procedure such as RARC, an acceptable level of proficiency is reached after 21–30 cases (benchmark OT of <6.5 h; lymph node yield of 20 and <5% positive surgical margin).^[12] Complications rate for RARC was similar in the first quartile as with the last quartile of 100 consecutive RARC.^[13]

Much of the LC data for RALP come from the pediatric population and its applicability to adult pyeloplasty is not

known. Considered as a gateway to advanced reconstruction, RALP is far simpler than the above procedures.^[14] As compared to the estimated LC of 50 cases for laparoscopic pyeloplasty^[15] the LC of RALP in novice surgeons is about 15–20 cases for achieving an OT within one standard deviation of the open pyeloplasty^[16] and is only five cases for expert open surgeons.^[17] The complication rate of RALP is about 0%–2%.^[18]

The US-FDA approved the *da Vinci* Surgical System in 2000 for urological surgeries. In the last two decades, there has been remarkable uptake of RARP. RARP adoption in the USA has increased from 0.7% to 42% between 2003 and 2010^[19] and currently, up to 80% of radical prostatectomy is performed robotically.^[20] In the case of RAPN, the uptake occurred at a moderate rate reaching 64.1% by 2013.^[21] RARC adoption has increased from 0.6% in 2004 to 12.8% in 2010.^[22] While some of this could be attributed to “hype,” surely some of it is also due to the ability of a greater number of surgeons to offer minimally invasive surgery to their patients.

Despite the short LC associated with robotic urological procedures, structured training programs are required for the smooth transition to robotic surgery. Unlike the established curricula like ‘Fundamentals of robotic surgery’ and ‘Fundamental skills of robotic surgery’ in the United States and the European association of urology robotic section, structured robotic training programs are lacking in India.^[23] The Urological Society of India has planned to start short-term observership, short- and long-term fellowship programs for young urologists from the country, including the subspecialty covering robotic surgery.

The robotic platform, thus, has the potential to help low-volume surgeons deliver good, minimally invasive surgical outcomes to their patients. However, the robot is still a slave to the “master” behind the console. It is easier to master the robot than it is to master reconstructive laparoscopy, but it still needs training and patience.

Sridhar Panaiyadiyan, Rajeev Kumar*

Department of Urology, All India Institute of Medical Sciences,
New Delhi, India

*E-mail: editor@indianjurol.com

REFERENCES

1. Anderberg M, Larsson J, Kockum CC, Arnbjörnsson E. Robotics versus laparoscopy – An experimental study of the transfer effect in maiden users. *Ann Surg Innov Res* 2010;4:3.
2. Ahlering TE, Skarecky D, Lee D, Clayman RV. Successful transfer of


- open surgical skills to a laparoscopic environment using a robotic interface: Initial experience with laparoscopic radical prostatectomy. *J Urol* 2003;170:1738-41.
3. Wilt TJ, Shamlivan TA, Taylor BC, MacDonald R, Kane RL. Association between hospital and surgeon radical prostatectomy volume and patient outcomes: A systematic review. *J Urol* 2008;180:820-8.
4. Vickers AJ, Savage CJ, Hruza M, Tuerk I, Koenig P, Martínez-Piñero L, *et al*. The surgical learning curve for laparoscopic radical prostatectomy: A retrospective cohort study. *Lancet Oncol* 2009;10:475-80.
5. Gumus E, Boylu U, Turan T, Onol FF. The learning curve of robot-assisted radical prostatectomy. *J Endourol* 2011;25:1633-7.
6. Herrell SD, Smith JA Jr. Robotic-assisted laparoscopic prostatectomy: What is the learning curve? *Urology* 2005;66:105-7.
7. Hirasawa Y, Yoshioka K, Nasu Y, Yamamoto M, Hinotsu S, Takenaka A, *et al*. Impact of surgeon and hospital volume on the safety of robot-assisted radical prostatectomy: A multi-institutional study based on a national database. *Urol Int* 2017;98:334-42.
8. Gill IS, Kamoi K, Aron M, Desai MM. 800 laparoscopic partial nephrectomies: A single surgeon series. *J Urol* 2010;183:34-41.
9. Abboudi H, Khan MS, Guru KA, Froghi S, de Win G, Van Poppel H, *et al*. Learning curves for urological procedures: A systematic review. *BJU Int* 2014;114:617-29.
10. Uvin P, Leys C, Gandaglia G, Fossati N, De Groote R, Mottrie A. Robotic or laparoscopic renal surgery: Pros and cons. In: Hemal AK, Menon M, editors. *Robotics in Genitourinary Surgery* [Internet]. Cham: Springer International Publishing; 2018. p. 515-47. Available from: https://doi.org/10.1007/978-3-319-20645-5_38.
11. Peyronnet B, Tondut L, Bernhard JC, Vaessen C, Doumerc N, Sebe P, *et al*. Impact of hospital volume and surgeon volume on robot-assisted partial nephrectomy outcomes: A multicentre study. *BJU Int* 2018;121:916-22.
12. Hayn MH, Hussain A, Mansour AM, Andrews PE, Carpentier P, Castle E, *et al*. The learning curve of robot-assisted radical cystectomy: Results from the International Robotic Cystectomy Consortium. *Eur Urol* 2010;58:197-202.
13. Guru KA, Perlmutter AE, Butt ZM, Piacente P, Wilding GE, Tan W, *et al*. The learning curve for robot-assisted radical cystectomy. *JSL* 2009;13:509-14.
14. Tasian GE, Casale P. The robotic-assisted laparoscopic pyeloplasty: Gateway to advanced reconstruction. *Urol Clin North Am* 2015;42:89-97.
15. Singh O, Gupta SS, Arvind NK. Laparoscopic pyeloplasty: An analysis of first 100 cases and important lessons learned. *Int Urol Nephrol* 2011;43:85-90.
16. Sorensen MD, Delostrinos C, Johnson MH, Grady RW, Lendvay TS. Comparison of the learning curve and outcomes of robotic assisted pediatric pyeloplasty. *J Urol* 2011;185:2517-22.
17. Bowen DK, Lindgren BW, Cheng EY, Gong EM. Can proctoring affect the learning curve of robotic-assisted laparoscopic pyeloplasty? Experience at a high-volume pediatric robotic surgery center. *J Robot Surg* 2017;11:63-7.
18. Chammas MF Jr, Mitre AI, Arap MA, Hubert N, Hubert J. Learning robotic pyeloplasty without simulators: An assessment of the learning curve in the early robotic era. *Clinics (Sao Paulo)* 2019;74:e777.
19. Chang SL, Kibel AS, Brooks JD, Chung BI. The impact of robotic surgery on the surgical management of prostate cancer in the USA. *BJU Int* 2015;115:929-36.
20. Ploussard G. Robotic surgery in urology: Facts and reality. What are the real advantages of robotic approaches for prostate cancer patients? *Curr Opin Urol* 2018;28:153-8.
21. Cheung H, Wang Y, Chang SL, Khandwala Y, Del Giudice F, Chung BI. Adoption of robot-assisted partial nephrectomies: A population-based analysis of U.S. surgeons from 2004 to 2013. *J Endourol* 2017;31:886-92.

22. Satkunasivam R, Wallis CJ, Nam RK, Desai M, Gill IS. Contemporary evidence for robot-assisted radical cystectomy for treating bladder cancer. *Nat Rev Urol* 2016;13:533-9.
23. Santok GD, Raheem AA, Kim LH, Chang K, Chung BH, Choi YD, *et al.* Proctorship and mentoring: Its backbone and application in robotic surgery. *Investig Clin Urol* 2016;57:S114-S120.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

Access this article online	
Quick Response Code:	Website:
	www.indianjurol.com
	DOI:
	10.4103/iju.IJU_216_20

How to cite this article: Panaiyadiyan S, Kumar R. Robotic assistance helps low-volume surgeons deliver better outcomes to their patients. *Indian J Urol* 2021;35:1-3.
 © 2021 Indian Journal of Urology | Published by Wolters Kluwer -.Medknow