Robot-assisted versus laparoscopic radical nephrectomy

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Association of robotic-assisted vs laparoscopic radical nephrectomy with perioperative outcomes and health care costs, 2003 to 2015. *JAMA* 2017;**318:**1561–8.

SUMMARY

This study analysed the Premier Healthcare database for the use of robot-assisted and laparoscopic surgery for radical nephrectomy (RN) in the USA from January 2003 to September 2015, which included a total of 23 753 patients from 416 hospitals. In this retrospective cohort, the primary objective was to evaluate trends in the surgical approach, and secondary objectives were to compare complications (Clavien–Dindo grade), resource use (blood transfusion rates, operative duration and length of stay) and direct hospital costs (procedural cost and estimated cost). The authors used International Classification of Disease (ICD) coding system for identification of patients from the database, which considered ICD-9 code 55.51 (renal mass) for evaluation, excluding upper tract urothelial carcinoma cases. Logistic regression model with inverse probability of treatment weighting (IPTW) was used for statistical evaluation.

The data included a total of 18 573 cases of laparoscopic RN (LRN) and 5180 cases of robot-assisted RN (RRN). Use of the robot for the entire RN cohort increased from 1.5% to 27% till 2015 ($p < 0.001$). There was a parallel decrease in the laparoscopic approach for RN. IPTW-adjusted rates for complications (overall and major), blood transfusion and length of hospital stay were comparable in both groups. However, the operative time was prolonged for the RRN group. In procedural cost comparison, RRN had higher 90-day direct hospital costs, and higher operative room and supply costs. The authors proposed that a non-proportionate increase in robotic approach could have been due to an attempt to sustain the financial viability of the robotic system, especially in small hospitals. Another explanation was the association of increase in robot-assisted partial nephrectomies leading to increase in the rates of conversion to RNs in patients with difficult tumours. The limitations of this study were misclassification bias because of the ICD-9 system for including patients and an inability to differentiate results based on tumour characteristics and as per risk stratification. Also, conversion rates to open RN were difficult to estimate for this database. The authors concluded that the use of robot-assisted surgery for RN has increased from 2003 to 2015 in spite of higher hospital costs and prolonged surgical duration as compared to the laparoscopic approach.

COMMENT

Since the use of a surgical robot was first published in 2000 for RN by Klingler *et al.*,[1] the use of this technology has increased gradually. However, for comparison between RRN and LRN, the level of evidence is limited by few published series. Asimakopoulos *et al.*[2] did a systematic review to address the same issue and included a total of 10 manuscripts that analysed the results for RRN versus LRN. They did not find a significant difference between blood loss and length of stay for both groups. However, the operative time was higher for RRN in two of the studies in this review. They concluded that there was no distinct advantage of RRN over LRN in localized renal cell carcinoma. A prospective comparison[3] of 15 RRN versus 15 LRN for T1-T2N0M0 renal cell carcinoma showed comparable mean estimated blood loss, intraoperative and postoperative complications, blood transfusion rates, analgesic requirement, hospital stay and convalescence. However, RRN required a significantly higher operative time compared to LRN. There were no local, port site or distant recurrences in any group. The authors opined that there was no obvious benefit of RRN over LRN for localized renal cell carcinoma.

Another retrospective evaluation[4] of a large series of 24 312 minimally invasive RNs (32% RRN) for primary renal malignancy from 2009 to 2011 showed that a robotic approach was associated with significantly higher total hospital costs and total charges when both groups were adjusted for Charlson comorbidity index. They also reported that perioperative complication rates and length of stay were comparable in both groups. Similarly, another study[2] found that pure laparoscopy saves around US$ 1300 compared to RRN. Golombos *et al.*[5] analysed the data of 241 RRN and 574 LRN from the Surveillance, Epidemiology, and End Results (SEER) database for 2008 to 2012. They concluded that length of stay and adverse event rates were comparable, whereas, inpatient charges were significantly higher in RRN. This study also found similar overall and cancer-specific survival in the two matched cohorts at 3 years.

While the current study adds to the body of literature opposing the incorporation of a robotic approach for RN, there is another side to the argument as well. Proponents of robotic surgery refer to the several technical advantages provided by this platform—both in terms of vision and dexterity. There is little doubt that a surgical robot offers a precision that is unmatched by laparoscopy.[6] Perhaps the most important advantage is that due to its short

learning curve, it enables the 'average surgeon' to operate with the same expertise as an experienced laparoscopic surgeon. In other words, it levels the playing field among surgeons thereby making minimally invasive surgery much more accessible to a larger number of patients and surgeons alike. Some of these advantages may not be quantifiable in terms of numbers in a database. Using the robot for RN may also serve as an excellent platform to train novice surgeons for more complex cases such as robot-assisted partial nephrectomy or robot-assisted radical prostatectomy—procedures where many studies have shown a clear advantage in favour of robotic surgery. Two more distinct areas where the robot may have an edge over conventional laparoscopy are robot-assisted inferior vena cava (IVC) tumour thrombectomy and R-LESS (robot-assisted laparoendoscopic single site surgery). Abaza[7] described an early experience of 5 successful cases of robot-assisted IVC tumour thrombectomy in terms of safety and efficacy. The initial results were promising. Early results of 10 cases of R-LESS versus 10 conventional LRN showed that R-LESS group had lesser narcotic requirement and lesser hospital stay.[8] This area should be explored further in view of significant technical difficulty in the form of instrument clashing and loss of triangulation with conventional LESS.

In conclusion, while this study may have failed to show the benefits of a robotic platform for RN, it is likely that the final word on this subject is yet to be said. The future may bring forth the unexpected!

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