



(REVIEW ARTICLE)



Robotic partial nephrectomy for renal cancer

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Abstract

Introduction: Improved methods are being sought so that the existing low efficiencies can be dealt with for a better solution to the problem of renal cancer. The most promising method is robotic partial nephrectomy which uses a system of automated machines in the treatment of small renal masses as it shows reduced mortality, morbidity, and hospital stay.

Aim: To systematically analyze articles to learn about robotic partial nephrectomy and how it has solved some of the current issues in the treatment of renal cancer.

Materials and methods: The article systematically reviews 20 articles in the development of a literature review on the emerging technology of robotic partial nephrectomy. The articles are recent and have been published in the last five years.

Results and outcome: The studies show the use of robotic partial nephrectomy produces better outcomes in terms of reduced mortality, morbidity, and the number of days a patient stayed in hospital after an operation.

Conclusion: The use of robotic partial nephrectomy is the ideal treatment for patients that have renal cancer as it has better outcomes in almost all the researched areas.

Keywords: Robotic Partial Nephrectomy; Open Partial Nephrectomy; Laparoscopic Partial Nephrectomy; Mortality; Conversion Rate; Morbidity; Oncological Results; Hospital Stay

1. Introduction

Over the past three decades the incidences of renal cell carcinoma have increased rapidly over the world and this translates to having more detection rates of small renal masses (1). The incidences mean that the world of science has to work round the clock to find the best technique to deal with this health problem. As a result, the commonly used procedure on patients that have been diagnosed with renal cell carcinoma has been open partial nephrectomy (4-7). However, due to the shortcomings of the procedure, laparoscopic partial nephrectomy was developed and it offered the benefits of being less invasive with the oncological outcomes being superior to the ones that were observed from the open partial nephrectomy (4, 9, 16, 20). The use of laparoscopic partial nephrectomy ensured that the patients recovered faster after the operation and this was a big achievement in the search for lasting solutions to the problem.

Recently, technology has enabled increased research and another partial nephrectomy that uses machines to aid in the operation has been developed; it is known as robotic partial nephrectomy. The technology means that it utilizes the engineering of robotic platforms in guiding the treatment of cancerous cells developing in the kidney (5-6). The technology offers even greater benefits to the laparoscopic partial nephrectomy and it is gaining greater support in the treatment of renal cell carcinoma. Among the key improvements that this system offers is a robust three-dimensional

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view of the area that is supposed to be operated and even during operation (2). The learning curve in the robotic partial nephrectomy is also shorter when compared to the laparoscopic partial nephrectomy which explains the reason why the demand for the use of robotic partial nephrectomy has increased.

This article uses data that has been researched by various authors in the past five years in developing the understanding of robotic partial nephrectomy compares to the treatment of renal cancer. The literature review will involve the analysis in the areas of morbidity, conversion rate, mortality, hospital stay, and the oncological results so that the robotic partial nephrectomy can be compared with the existing partial nephrectomy procedures for a comprehensive conclusion.

2. Morbidity

In a systematic review by Xia the past data show the superiority of robotic partial nephrectomy in lower comorbidity and improved renal function; however, they find data on mortality rates not sufficient (2). Moreover, the survival rates among the patients that have been diagnosed with renal cancer are also higher when they have undergone treatment through the use of robotic partial nephrectomy (3-5).

3. Mortality

The complications that arise as a result of partial nephrectomy can cause death and the higher the better the method the lower the chances of mortality. In a study by Cacciamani et al. the use of robotic partial nephrectomy causes lesser blood loss with a probability of $p < 0.00001$ this is with a weighted mean difference of 85.01; this meant that the probability for the need for transfusions was also fewer at 0.000001 (1). The data concurred with the research carried out by Xia which showed that the robotic partial nephrectomy was superior to the other partial nephrectomy procedures after doing a meta-analysis. For instance, the expected blood loss was lesser with a probability of $p < 0.00001$ (2). However, in observing the perioperative transfusion between the use of robotic partial nephrectomy and open partial nephrectomy, there were no significant differences (11).

The prevalence of complications was also lower in robotic partial nephrectomy compared with that in other procedures; this was with a 1.87 odds ratio or a probability of 0.00001 while the postoperative complications were at 1.27 odds ratio (6-8). Although other studies showed slightly different findings, the conclusion when comparing them to open partial nephrectomy and laparoscopic partial nephrectomy was superior. An analysis of the studies showed that the intraoperative (9-12).

4. Hospital stay

In the systematic analysis by Cacciamani et al. there was a high probability for a patient to stay at a hospital a shorter time at $p < 0.001$ (1). In the research by Xia the findings show a probability of $p < 0.00001$ which was shorter than the other procedures (2). Khalil presents that on average, with a standard deviation of 3.5 days, a patient who has undergone open partial nephrectomy will stay for 5.8 days (3).

5. Conversion ratio

A systematic review comparing the conversion rate of robotic partial nephrectomy and open partial nephrectomy, the former had a better outcome with an odds ratio of 2.61 (19-20).

Webb et al. in an analysis of the intraoperative rate found that there was no difference in the use of robotic partial nephrectomy and open partial nephrectomy with an odds ratio of 0.91 and a probability of 0.83. Another study by Shen et al. shows that the surgical conversion rates that were analyzed between robotic partial nephrectomy and open partial nephrectomy had no significant differences (4). These studies show that the use of open partial nephrectomy cannot be overlooked in the treatment of renal cancer despite the use of an improved method of using robotic partial nephrectomy.

6. Oncological results

The oncological results that were systematically reviewed showed that there are no differences in the treatment of localized renal tumors using robotic partial nephrectomy and laparoscopic partial nephrectomy (13-14). In 10 years, the use of open partial nephrectomy, since it is the one that has been extensively studied, showed a lower prevalence of

a patient getting a chronic kidney disease as well as lesser cardiovascular morbidity as a result of the operation (17-18).

7. Conclusion

Robotic partial nephrectomy shows promising results for the treatment of renal cancer. The procedure shows lower mortality rates and morbidity rates and also lowers the number of days that a patient stays in hospital post-operation. Moreover, this method shows greater accuracy and precision hence high efficiency in the operation as it leads to lower blood loss leading to reduced demand for a blood transfusion as compared to the other methods especially open partial nephrectomy (15). Since it has a shorter learning curve, it is more preferred to laparoscopic partial nephrectomy and if done by a qualified professional the risk of complications is minimal. However, the greatest challenge to the adoption of the robotic partial nephrectomy is the cost of getting and installation of the system; this may translate to charging high prices for the renal cancer patients that want to use the most efficient partial nephrectomy procedure (8, 10, 13).

Compliance with ethical standards

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Disclosure of conflict of interest

None

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