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Review

Transperitoneal versus retroperitoneal robot-assisted partial nephrectomy: A systematic review and meta-analysis

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HIGHLIGHTS

- Robotic partial nephrectomy can be performed through transperitoneal and retroperitoneal approach.
- Transperitoneal approach has similar complications, conversions, warm ischemia time, blood loss, and surgical margins compared with retroperitoneal approach.
- Retroperitoneal approach has marginally shorter operative time compared with transperitoneal approach.

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ABSTRACT

Purpose: To compare the perioperative outcomes of the transperitoneal (TP) and retroperitoneal (RP) approaches in robot-assisted partial nephrectomy (RAPN).

Methods: A literature search of MEDLINE, EMBASE, SCOPUS and the Cochrane Library was performed to identify relevant studies up to March 2016. All studies with enough data comparing TP-RAPN with RP-RAPN were included. Outcomes of interest were complication, conversion, operative time (OT), warm ischemia time (WIT), estimated blood loss (EBL), and positive surgical margin (PSM). Pooled odds ratios (ORs) and weighted mean differences (WMDs) with 95% confidence intervals (CIs) were calculated using fixed-effect or random-effect model. Publication bias was assessed by funnel plots.

Results: Four studies with the total number of 449 patients assessing TP-RAPN ($n = 229$) versus RP-RAPN ($n = 220$) were included. There was no significant difference between the two groups in any of demographic variables. There were also no significant differences between TP-RAPN and RP-RAPN groups regarding tumor size, tumor laterality, R.E.N.A.L. nephrometry score, and tumor pathology. There was marginally significant difference between the two groups regarding OT ($p = 0.05$, WMD: 28.03; 95% CI, 0.41–55.65). No significant differences were found regarding complication, conversion, WIT, EBL, and PSM. No obvious publication bias was observed.

Conclusions: The present meta-analysis suggests that RP-RAPN appears to be equally safe and efficacious in terms of complication, conversion, WIT, EBL and PSM compared with TP-RAPN. In addition, RP-RAPN has marginally significant advantage of shorter OT. Randomized controlled trials and high-quality observational cohort studies with large sample size and long-term follow-up are needed to update our findings.

1. Introduction

Partial nephrectomy (PN) is now considered the preferred surgical management or “gold standard” for small renal masses [1,2]. With the development of new technology and increased experience in this field, laparoscopic partial nephrectomy (LPN) has become increasingly popular and achieved oncological outcomes comparable to open partial nephrectomy (OPN) [3,4]. Compared with

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OPN, LPN appears to have the advantages of less operative time (OT), decreased estimated blood loss (EBL) and a shorter length of hospital stay (LOS) [5]. Da Vinci robotic platform can be considered as the advanced laparoscopy, which has three-dimensional (3D) view, wristed instruments, and stable camera. Robotic platform undoubtedly makes the challenging LPN relatively easier and safer. It seems that robot-assisted partial nephrectomy (RAPN) has exceeded LPN as the predominant minimally invasive surgical management for renal masses [6,7]. Compared with LPN, RAPN has the lower conversion rate to radical nephrectomy (RN), more favorable renal functional outcome, shorter LOS and warm ischemia time (WIT) [8].

Both LPN and RAPN can be performed through transperitoneal (TP) or retroperitoneal (RP) approach. RP-LPN is less utilized than TP-LPN because of technical difficulties when using rigid laparoscopic instruments in the small space of retroperitoneum cavity [9]. However, with advanced surgical skills and thoughtful patient selection, RP-LPN may be associated with shorter OT, less EBL, shorter LOS compared with TP-LPN [9–11]. One meta-analysis showed that RP-LPN had a shorter OT and a shorter LOS, which led to the conclusion that RP approach might be faster and equally safe compared with the TP approach [12]. As for RAPN, several comparative studies of TP and RP approaches have been reported and no definite conclusions have been reached to date regarding perioperative outcomes [13–16]. Considering that RAPN may have the advantages over LPN, it is possible that the conclusion from a pooled analysis could be different. Therefore, we performed the meta-analysis of available published literature to compare the outcomes of the two approaches (TP-RAPN vs RP-RAPN).

2. Methods

The present meta-analysis was performed adhering to the PRISMA (preferred reporting items for systematic reviews and meta-analyses) statement, including search strategy, selection criteria, data extraction, and data analysis [17].

2.1. Search strategy

A literature search of MEDLINE, EMBASE, SCOPUS and the Cochrane Library was performed to identify relevant studies. No time restriction was applied. We used the search terms combination [*"robot" OR "robotic" OR "robot-assisted" OR "robotic-assisted" OR "da Vinci" AND "partial nephrectomy"*] and restricted language to English for MEDLINE, EMBASE, and SCOPUS. For EMBASE and SCOPUS, we excluded publication types of conference abstract, conference paper, and conference review. The last search was run on March 17, 2016. The Related Articles function was also used to broaden the search. The reference lists of retrieved articles were manually searched to identify related articles.

2.2. Study selection

The following inclusion criteria were used: (a) the literature compared TP-RAPN with RP-RAPN; (b) clear documentation of the surgical technique as TP and/or RP RAPN; and (c) a randomized controlled trial (RCT) or retrospective comparative study design. When two or more studies were reported by the same institution and/or authors, the most recent report and/or the report with the largest cohort and/or the report with the highest quality was included.

The following exclusion criteria were used: (a) the inclusion criteria were not met; (b) pediatric patient population; (c) RAPN/LPN only for benign lesions; (d) articles without full text (i.e., conference abstracts).

Three reviewers (X.Z., X.W., and T.X.) identified all studies that appeared to fit the inclusion criteria for full review. Each reviewer independently selected studies for inclusion in the review. Disagreement between the extracting authors was resolved by consensus or referred to a fourth author (S.Z.).

The methodological quality of observational studies was assessed using the Newcastle–Ottawa Scale (NOS) [18]. The quality of studies was evaluated by examining three aspects of the study design: patient selection, comparability of the study groups, and assessment of outcomes. A score of 0–9 was allocated to each study. Studies achieving a score of 7 or more were considered to be of high quality.

2.3. Data extraction

Two reviewers (X.Z. and X.W.) independently extracted data from the included studies, and disagreements were resolved by discussion until consensuses were reached. The outcomes of interest were perioperative outcomes of the two approaches (TP-RAPN vs RP-RAPN). The primary outcomes of interest were: (a) perioperative complication; (b) conversion. The secondary outcomes of interest were: (a) OT; (b) WIT; (c) EBL; (d) PSM. The following variables were extracted from each study: author, year of publication, patient age, patient gender (No. of female patient), patient body mass index (BMI), tumor size, tumor laterality (No. of right side tumor), R.E.N.A.L. nephrometry score, tumor pathology (No. of malignant tumor), primary outcomes of interest, and secondary outcomes of interest.

2.4. Statistical analysis

The meta-analyses were performed using Review Manager Version 5.3 (The Cochrane Collaboration, Oxford, London, UK). The weighted mean differences (WMDs) and odds ratios (ORs) were used to compare continuous and dichotomous variables, respectively. All results were reported with 95% confidence intervals (CIs). For studies presenting continuous data as median and range or interquartile range, the means and standard deviations (SDs) were calculated using the methodology described by Hozo et al. [19]. as well as Cochrane Handbook [20]. Statistical heterogeneity was assessed using the chi-squared (χ^2) test with a p-value of <0.05 considered to indicate statistical significance, and heterogeneity was also quantified using the I^2 value. A random-effect model was used for outcomes that displayed significant heterogeneity with I^2 values $>50\%$; otherwise, the fixed-effect model was used. Sensitivity analysis was not performed because of the limited number of studies. Publication bias was assessed by funnel plot.

3. Results

3.1. Literature search

The process of study selection was depicted in Fig. 1. We identified 967 studies, of which 793 were excluded because of irrelevance based on the titles and 147 were excluded because of irrelevance based on the abstracts. The full manuscripts of 27 studies were evaluated. After reading the full manuscripts, we excluded 22 studies for reasons relating to our exclusion criteria. Of the remaining 5 studies, one was not included in our meta-analysis because of lacking data. A final number of 4 studies were included in the meta-analysis.

3.2. Characteristics of the included studies

Although the literature search was conducted with no time