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Hot Topic

Systematic review and meta-analysis of comparative studies reporting early outcomes after robot-assisted radical cystectomy versus open radical cystectomy

Kaiwen Li [a,b,1], Tianxin Lin [a,b,1], Xinxiang Fan [a,b,1], Kewei Xu [a,b], Liangkuan Bi [a,b], Yu Duan [c], Yu Zhou [d], Min Yu [d], Jielin Li [e], Jian Huang [a,b,*]

[a] Department of Urology, Sun Yat-sen Memorial Hospital, Sun Yat-sen University, 107 W Yanjiang Road, Guangzhou 510020, China
[b] Key Laboratory of Malignant Tumor Gene Regulation and Target Therapy of Guangdong Higher Education Institutes, Sun Yat-sen University, 107 W Yanjiang Road, Guangzhou 510020, China
[c] Clinical Medicine of Eight-year Program, Zhongshan Medical School, Sun Yat-sen University, 74 Zhongshan Second Road, Guangzhou 510000, China
[d] Department of Hepatobilliary Surgery, Sun Yat-sen Memorial Hospital, Sun Yat-sen University, 107 W Yanjiang Road, Guangzhou 510020, China
[e] Department of Urology, The Third Affiliated Hospital of Sun Yat-sen University, Shipai Gangding Road, Guangzhou 510000, China

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ABSTRACT

Background: Robot-assisted radical cystectomy (RARC) is increasingly being used in the management of bladder cancer. Studies comparing RARC and open radical cystectomy (ORC) have reported conflicting results. We conducted a systematic review and meta-analysis of the literature on the efficacy and advantages of RARC compared with ORC.

Methods: An electronic database search of PubMed, Scopus, and the Cochrane Library was performed up to July 8, 2012. This systematic review and meta-analysis was performed based on all randomized controlled trials (RCTs) and observational comparative studies assessing the two techniques.

Results: One RCT, eight studies with prospectively collected data, and four retrospective studies were identified, including 962 cases. Although RARC was associated with longer operative time ($p < 0.001$), patients in this group might benefit from less overall perioperative complications ($p = 0.04$), more lymph node yield ($p = 0.009$), less estimated blood loss ($p < 0.001$), a lower need for perioperative transfusion ($p < 0.001$), and shorter length of hospital stay ($p < 0.001$). Positive surgical margins did not differ significantly between techniques. Sensitivity analysis with prospective studies showed similar results to the original analysis, but no significant difference of lymph node yield and length of stay between two techniques.

Conclusions: RARC is a mini-invasive alternative to ORC with less overall perioperative complications, more lymph node yields, less estimated blood loss, less need for a perioperative transfusion, and shorter length of stay.

Introduction

The gold standard treatment for non-metastatic muscle-invasive and uncontrolled or high-risk superficial bladder cancer is open radical cystectomy (ORC) with pelvic lymph node dissection (PLND).[1] Despite advances in oncologic efficacy, ORC still has a perioperative mortality ranging from 0% to 8% and a morbidity ranging from 30% to 65%.[2–6]

Since the first report of robot-assisted radical cystectomy (RARC) by Menon et al. in 2003,[7] RARC has been adopted in many large medical centers, demonstrating its feasibility.[3,8–10] However, most studies focus on longitudinal experience with RARC alone without comparison with the standard ORC.[11–13] Recently, several high-quality studies comparing RARC with ORC were reported but with conflicting results.[14–16]

We performed a systematic review and meta-analysis of the available literature comparing RARC with ORC for bladder cancer, and we evaluated the effectiveness of a robot using perioperative and early oncologic outcomes.

Methods

A prospective protocol of objectives, literature search strategies, inclusion and exclusion criteria, outcome measurements, and methods of statistical analysis was prepared a priori according

* Corresponding author at: Department of Urology, Sun Yat-sen Memorial Hospital, Sun Yat-sen University, 107 W Yanjiang Road, Guangzhou 510020, China. Tel.: +86 20 81332336; fax: +86 20 81332853.
E-mail address: yehjn@yahoo.cn (J. Huang).
[1] These authors contributed equally to this work.

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to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis and Meta-Analysis of Observational Studies in Epidemiology recommendations for study reporting.[17,18]

Literature search strategy

A literature search was performed in the electronic databases of PubMed, Scopus, and the Cochrane Library on July 8, 2012, restricted to the English language. The following terms and their combinations were searched in [Title/Abstract]: *cystectomy, bladder resection, cystoprostatectomy, robotic,* and *da Vinci*. The Related Articles function was also used to broaden the search. Additional studies were manually searched in the reference lists of all retrieved articles. When multiple reports describing the same population were published, the most recent or complete report was used. However, it was not applicable if the outcome measures were mutually exclusive or measured at different time periods.

Inclusion and exclusion criteria, data extraction and outcomes of interest

All available randomized controlled trials (RCTs) and observational comparative studies that compared RARC with ORC and had at least one of the quantitative outcomes were included. Comparative studies that selected patients with different clinical stages in two groups, as well as editorials, comments, letters to the editor, review articles, case reports, conference abstracts, and experimental animal studies were excluded.

Two authors (Li k and Fan) independently extracted and summarized the data for the following parameters: authors, publication year, country, study design, matching criteria: age, gender, body mass index, American Society of Anesthesiologists (score), diversion type, clinical stage, Charlson index, neoadjuvant chemotherapy, previous abdominal/pelvic radiotherapy, previous pelvic/abdominal surgery, and numbers of surgeon, and the outcomes of interest. Any disagreement was resolved by the adjudicating senior authors (Huang and Lin).

The primary outcomes were overall perioperative (or early: within 30 d of the date of surgery)[19] complication rates, positive surgical margins (PSMs; including urethral/ureteric and soft tissue PSMs) rates, and lymph node yield (LNY). If sufficient data were available, perioperative complications were subdivided into intraoperative complications and postoperative complications within 30 d of the date of surgery. Overall perioperative complications were classified according to the Clavien-Dindo grading system[20] into major (grades 3–5) and minor (grades 1 and 2). Single types of early complications were also evaluated according to the classification by Ng et al.[16] with some modification. PSM rates were subdivided into urethral/ureteric PSM rates and soft tissue PSM rates.

The secondary outcomes were operative time, estimated blood loss (EBL), perioperative transfusion rates, and length of stay (LOS). If sufficient data were available, (1) operative time was a subgroup with three urinary diversion types: ileal conduit, orthotopic neobladder, and Indiana pouch; and (2) the units of red blood cells (RBCs) used for perioperative transfusion and intraoperative transfusion rates were studied.

Quality assessment

Studies were rated for the level of evidence provided according to criteria by the Centre for Evidence-Based Medicine in Oxford, UK.[21] The methodological quality of RCTs was assessed by the Cochrane risk of bias tool.[22] The methodological quality of observational comparative studies was assessed by the modified Newcastle-Ottawa scale.[23] A score of 0–9 was assigned to each study.

Statistical analysis

The meta-analyses were performed using Review Manager V.5.1.[24] The weighted mean difference (WMD) and odds ratio (OR) were used to compare continuous and dichotomous variables, respectively. For studies that presented continuous data as median and range values, the means and standard deviations were calculated using statistical algorithms described by Hozo et al.[25] A $p < 0.05$ was considered significant.

Statistical heterogeneity between studies was assessed using the chi-square test with significance set at $p < 0.10$, and heterogeneity was quantified using the I^2 statistic. A random-effect model was used for outcomes that displayed significant heterogeneity with I^2 values >50%; otherwise, the fixed-effect model was used.[22]

Subgroup analyses were performed. Studies reporting LNY were grouped into subgroups according to the level (I, II, or III) of PLND described by Dorin et al.[26]

Sensitivity analyses were performed in RCTs and studies with prospectively collected data. Publication bias was assessed using the Egger tests[27] and visual inspection of funnel plot.

Results

Thirteen studies[6,14–16,28–36] including 962 cases (364 cases for RARC and 598 cases for ORC) fulfilled the predefined inclusion criteria and were included in the final analysis (Fig. 1). Two[28,30] and another two[16,31] publications had overlapping populations but with some different outcomes. The data of overlapping outcomes reported by Galich et al.[28] or Wang et al.[31] were excluded from meta-analysis because they reported lower number of cases compared with Sterrett et al.[30] or Ng et al.,[16] respectively.

Characteristics of eligible studies and methodological quality

Table 1 shows the characteristics of the included studies. There was only one RCT[14] (evidence level: 2b). Eight studies declared prospective data collection[15,16,28,30–34]; four were retrospective studies.[6,29,35,36] All of them had evidence level 3. All observational

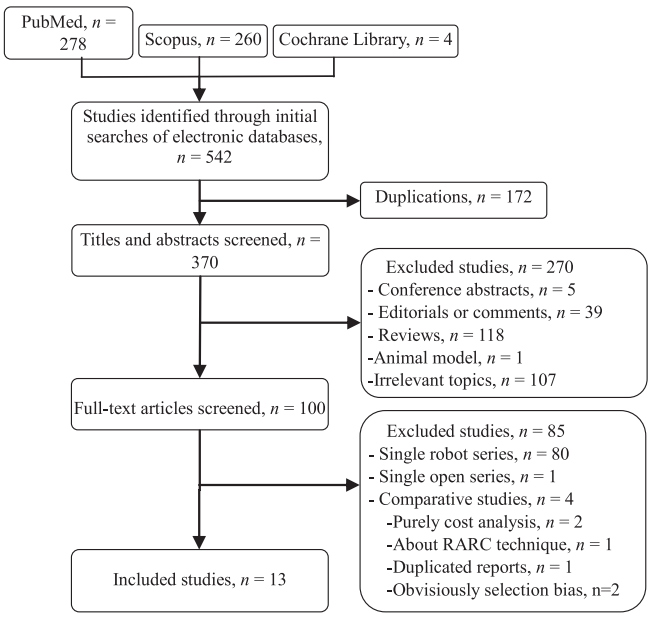

Fig. 1. Flow diagram of studies identified, included, and excluded. RARC = robot-assisted radical cystectomy.