

Comparative analysis of perioperative outcomes in radical prostatectomy: laparoscopic versus robot-assisted techniques

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Abstract

Introduction: Robot-assisted radical prostatectomy (RARP) is a technological evolution of laparoscopic radical prostatectomy (LRP) and have been compared using different levels of evidence. However, most studies were based on retrospective analyses and debatable levels of evidence. This review aimed to apply a new methodology called Reverse Systematic Review to compare perioperative outcomes between LRP and RARP by critical subgroup analysis.

Methods: A systematic search for Systematic Review (SR) from 01/01/2000 to 05/12/2020 on radical prostatectomy was performed. From 80 eligible SR's, all 910 studies included in these reviews were cataloged in a database called EVIDENCE. For this study, a subgroup analysis of 34 studies that compared perioperative outcomes between LRP and RARP was performed.

Results: Thirty-four studies were included for analysis regarding 6,450 patients undergoing LRP and 6,280 patients undergoing RARP. The preoperative clinical characteristics were similar. RARP was, on average, 30 minutes shorter than LRP. Estimated blood loss of LRP is, on average, 180 mL higher than RARP, resulting in a transfusion rate more than twice as high in LRP, without impacting conversion rates, length of stay and catheter time. Regarding complication rates, there is a higher overall rate in LRP, at the expense of minor complications, specifically Clavien 1, but without repercussions on major ones.

Conclusion: RARP presented a shorter operative time, bleeding rate, transfusion and minor complication rates than LRP, but without a clinically significant impact on major complication rates. The heterogeneity generated by the EVIDENCE database and the population-based nature increase the representativeness of the results in different clinical scenarios, but caution should be taken when comparing with more specific conditions.

Keywords: Prostate cancer, radical prostatectomy, robotic, laparoscopic, perioperative outcomes, systematic review

Introduction

At the beginning of the 21st century, the standardization of minimally invasive surgery represented a major paradigm

shift for the treatment of prostate carcinoma, represented by laparoscopic radical prostatectomy (LRP) and, sequentially, by the robot assisted radical prostatectomy technique (RARP) [1, 2].

The classic laparoscopic approach spread rapidly worldwide, mainly in the USA-Europe axis, and several centers began to improve it in order to reduce the difficulties inherent to the learning curve [3-5]. However, with the emergence of RARP, the laparoscopic technique was quickly replaced, mainly in North American centers, since the technical difficulties of LRP were overcome by the technology incorporated into the surgical robot [6, 7].

Despite the facilitation of movements provided by the

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robot, the global urological community needed to compare such techniques through scientific evidence in order to justify the high financial investment associated with robotic technology. Thus, many studies were generated with different levels of evidence, whether the lowest, such as an expert's opinion, or the highest, represented by Systematic Reviews (SR) [8].

This discussion made more sense in a period of commercial exclusivity of the main robotic platform (Da Vinci™, Intuitive Inc.), where the costs of implementing robotic surgery could be questioned in the face of cheaper LRP consumables. With the emergence of new robotic platforms and greater accessibility, even in developing countries [9, 10], the comparison with the laparoscopic technique has become less evidence-based in the scientific scenario. In view of this new era of robotic surgery, it is of great importance to retrospectively evaluate the importance of this scientific dispute in the development of surgical treatment of prostate cancer.

Therefore, in order to assess how the best evidence based on RS compared LRP and RARP in just over two decades, a reverse systematic review was carried out which brought together all the comparative studies used in the RS on the subject, with a critical analysis of the results [11].

Methods

This study is a critical review of comparative studies (randomized or not) between LRP and RARP, from a database called EVIDENCE, generated by a new methodology called Reverse Systematic Review, and previously described by the authors (Moretti, TBC e Reis, LO) [12-18].

Figure 1 represents the path of evidence in the classic SR and RSR. Colored circles represent the primary studies available (T1, T2..., T8) and blue circles represent SR available in the literature (R1, R2..., R6).

In classic SR, the search starts at the center, through the selection of studies that answer specific questions (PICO),

generating a corresponding systematic review, with the centrifugal direction, that is, from the center to the periphery.

In the RSR, the evidence is captured in a centripetal way. It starts with a search for all systematic reviews on different subjects and returns to the primary studies that were chosen by these reviews, composing a heterogeneous and population-based database (P).

Thus, to create the EVIDENCE database, a systematic search was carried out for SRs published between 01/01/2000 and 05/12/2020 related to radical prostatectomy in 8 databases (*PubMed, Cochrane, Web of Science, Embase, Scopus, ProQuest, CINAHL, BVS/Bireme*), resulting in 634 SR's (Supplementary 1). Sequentially, off-topic and duplicate studies were excluded, electing 80 SRs for analysis (Supplementary 2). After reading all these reviews, 2,356 baseline studies were found and, again, after excluding duplicates or off-topic studies, 910 studies were selected to compose the final database (Supplementary 3). All studies were read and outcomes were catalogued in a general database called EVIDENCE, which encompasses open, laparoscopic and robotic techniques.

For this specific study, an analysis of perioperative outcomes was performed in a subset of EVIDENCE, specifically only studies that directly compared LRP and RARP techniques, resulting in 34 studies (Figure 2).

As it is a critical review based on an unconventional search methodology, without the criteria of a classic systematic review, it became incompatible with registration in PROSPERO and PRISMA checklist.

The results were presented using the weighted mean and standard error of the mean of the central tendency values (mean or median) of the outcomes in order to establish the accuracy of the population mean. A statistical comparison test was not performed given the great heterogeneity of the studies, making its applicability unfeasible.

Results

Thirty-four studies were included for analysis with two cohorts each, resulting in 68 cohorts representing 6,450 patients undergoing LRP and 6,280 patients undergoing RARP [7, 19-51].

Among the preoperative variables, the volume of operated cases from both a global and annual perspective were similar between the two techniques, with RARP presenting an average of 10 more surgeries per year compared to LRP. Among the clinical aspects, there is equivalence among other variables described in Table 1, demonstrating that the comparative studies included in the review are balanced in the selection of patients, allowing future comparisons.

Regarding perioperative variables, robotic surgery was, on average, 30 minutes shorter than LARP. Regarding the levels of preservation and lymphadenectomies performed, there is a similarity in the profile of the techniques. Even so, estimated blood loss (EBL) of LRP is, on average, 180 mL higher than robotic surgery, resulting in a transfusion

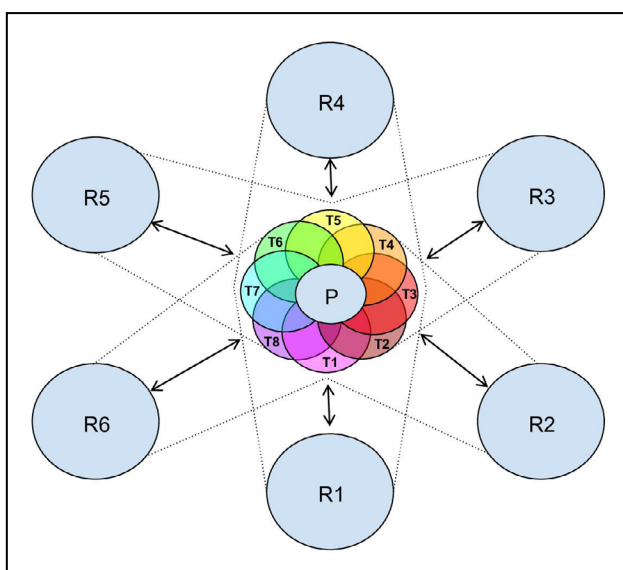


Figure 1. Search strategy.

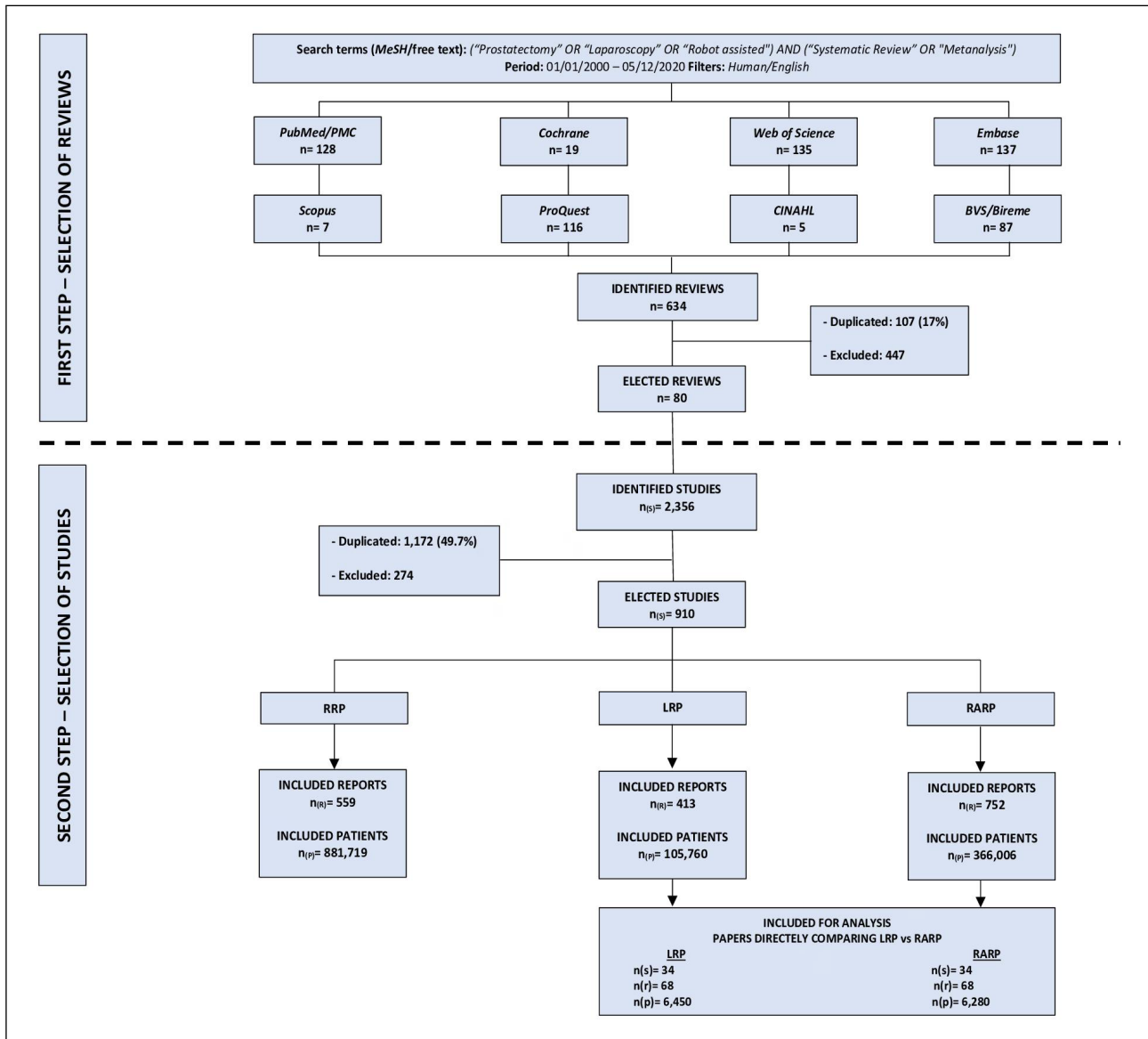


Figure 2. Study design

rate more than twice as high in laparoscopic surgery, without impacting conversion rates, length of stay and catheter time (Table 2).

Regarding complication rates, there is a higher overall rate in LRP, at the expense of minor complications, specifically Clavien 1, but without repercussions on major ones (Table 3).

Discussion

The natural history of radical prostatectomy has been one of the main topics of scientific discussion over the last 20 years, since the three main techniques (open, laparoscopic and robotic) began to coexist. Technological development has accelerated and driven scientists to generate substrates for scientific discussions through evidence. Among the secondary studies, 14 types of review studies were described, with SRs with meta-analysis providing the greatest evidence, especially if come from RCT's [8].

This study is the first to apply a new review methodology, called Reverse Systematic Review, in order to compare comparative studies between LRP and RARP from the largest evidence in the literature.

Our study demonstrated that LRP presented a longer mean operative time, with a higher rate of bleeding and transfusion than RARP, but without clinically significant repercussions on perioperative major complication rates.

Considering the highest level of evidence, we do not have systematic reviews of RTCs (Level of Evidence: 1a) comparing LRP and RARP. At the level below, only two studies were randomized (Level of evidence: 1b) by Porpiglia *et al.* which demonstrated no difference among perioperative outcomes evaluated comparing 60 patients in each arm [41, 48].

In 2009, Ficarra *et al.* produced the most robust systematic review of homogeneous studies (level of evidence: 3a) comparing LRP vs. RARP [52]. There was no difference in operative time after overcoming the learning curve, especially in a center with experience in LRP [19,

Table 1. Descriptive statistics of preoperative variables from included studies comparing laparoscopic and robotic radical prostatectomy.

Preoperative variables	LRP			RARP		
	n _p	Mean	SE	n _p	Mean	SE
n of patients	6,450	522	6.0	6,280	488	5.0
Study duration (months)	6,325	6.4	0.1	6,155	5.1	0.0
n of surgery/year	6,325	87.2	0.7	6,155	97.8	0.7
Age (years)	6,450	63.4	0.0	6,280	63.0	0.0
BMI (kg/m ²)	5,177	26.0	0.0	4,732	26.2	0.0
iPSA—Mean	5,995	9.1	0.0	5,832	8.8	0.0
< 4 ng/mL (%)	358	15.4	0.0	322	20.6	0.0
4–10 ng/mL (%)	358	69.0	0.0	322	66.4	0.0
4–20 ng/mL (%)	358	15.6	0.0	322	13.1	0.0
> 20 ng/mL (%)	0	NA	NA	0	NA	NA
cGS—Median	832	6.1	0.0	786	6.1	0.0
cGS < 7	5,095	59.0	0.2	4,992	53.0	0.2
cGS = 7	4,919	32.1	0.1	4,758	37.2	0.2
cGS > 7	5,186	8.3	0.1	4,892	10.0	0.1
cT1 (%)	2,601	56.8	0.4	2,295	54.2	0.4
cT1a (%)	358	1.7	0.0	322	0.3	0.0
cT1b (%)	491	0.7	0.0	455	0.0	0.0
cT1c (%)	3,662	66.3	0.3	2,832	64.4	0.4
cT2 (%)	2,701	39.2	0.3	2,395	42.1	0.3
cT2a (%)	1,667	25.6	0.2	1,258	24.3	0.2
cT2b (%)	1,477	7.0	0.2	1,208	8.0	0.2
cT2c (%)	1,339	9.3	0.2	1,131	12.4	0.3
cT3 (%)	1,723	6.0	0.2	1,505	5.7	0.2
cT3a (%)	1,339	5.5	0.2	920	7.1	0.3
cT3b (%)	1,206	2.2	0.1	787	2.2	0.1
cT4 (%)	144	0.0	0.0	183	0.0	0.0

Note: LRP: laparoscopic radical prostatectomy; RARP: robot-assisted radical prostatectomy; n_p: number of patients; SE: Standard error of the mean; BMI: Body Mass Index; iPSA: initial Prostate Specific Antigen; cGS: clinical Gleason Score; cT1–cT4: TNM stage Classification.

22]. Among the studies that provided data for analysis, there was no difference in operative time (WMD: -19.39 min; 95% CI of WMD: -49.34–88.13; $P = 0.58$) and blood loss (WMD: 19.45; 95% CI of WMD: -112.53–106.73; $P = 0.96$) respectively for LRP and RALP. The same overlapping results were found for the rates of bleeding, blood transfusion and perioperative complications (RR: 1.83; 95% CI of RR: 0.78–4.31; $P = 0.16$). However, only 4 studies were included for the analysis described above, compared with the 34 in our study, which demonstrated a higher EBL rate and transfusion in LRP.

In 2020, a critical review of the literature carried out by Coelho *et al.* gathered studies that considered high-volume centers (studies with more than 250 patients) did not perform statistical tests like our study and, through the weighted average, only showed a longer hospital stay with LRP (mean: 4.87 days) in relation to RARP (mean: 1.43 days) with a similar finding of longer operative time for LRP compared to RARP (205 min vs. 162.6 min) [53].

Considering different phases of the surgeon, a study by Rassweiler *et al.* in 2003, evaluated the impact of experience through the learning curve on perioperative outcomes in the evolution of the Heilbronn LRP technique [54]. The

first group, relating to the first 150 patients, was compared with the last 150 ones. Operative time was shorter in the more experienced group (mean OR time: 211.4 versus 304.6 min), as well as the transfusion rate (11.3% versus 38.6%), conversion to open (0.7% versus 3.3%) and complications (8 % versus 19.3%).

On the other hand, a similar study proposed by Zorn *et al.* in 2007 compared the learning curve in RARP between the first group of patients 0-50 and the last group of patients 101-150 [55]. The last group had shorter operative time (247 min versus 343 min), lower EBL (197 mL versus 312 mL), lower transfusion rate (0% versus 2.2%), lower conversion to open (0% versus 8%) and fewer complications (12 % versus 19.6%) compared to the first one. These two studies described above demonstrate how LRP results are quickly achieved by RARP with a smaller number of patients (about 50), with better results over a learning curve of 150 patients. Obviously, the studies cited included surgeons who were part of a context of migration from the LRP to RARP technique, which was very common between the years 2000 and 2010, mainly in a European context.

The Reverse Systematic Review provided a new perspec-

Table 2. Descriptive statistics of perioperative variables from included studies comparing laparoscopic and robotic radical prostatectomy.

Preoperative Variables	LRP			RARP		
	n _p	Mean	SE	n _p	Mean	SE
Operative time (min)	5,322	211.8	0.6	5,591	178.0	0.7
PLND (%)	3,692	43.2	0.5	3,749	39.1	0.5
Bilateral NVB preservation (%)	4,032	59.6	0.2	3,379	63.9	0.3
Unilateral NVB preservation (%)	4,032	16.8	0.1	3,379	17.1	0.2
Non NVB preservation (%)	4,069	23.4	0.1	3,691	17.5	0.2
EBL (mL)	4,771	538.0	3.8	4,198	361.7	2.5
Transfusion rate (%)	4,036	7.7	0.1	3,755	3.1	0.1
Conversion rate (%)	2,280	0.5	0.0	2,797	0.3	0.0
LOS (days)	4,676	5.7	0.0	4,578	5.6	0.0
Catheter time (days)	3,102	8.1	0.0	3,364	8.1	0.1

Note: LRP: laparoscopic radical prostatectomy; RARP: robot-assisted radical prostatectomy; n_p: number of patients; SE: Standard error of the mean; PLND: pelvic lymph node dissection; NVB: neurovascular bundle; EBL: estimated blood loss; LOS: length of stay.

Table 3. Descriptive statistics of surgical complication variables from included studies comparing laparoscopic and robotic radical prostatectomy.

Surgical complications	LRP			RARP		
	n _p	Mean	SE	n _p	Mean	SE
Global rate (%)	4,424	18.3	0.2	4,586	14.5	0.1
Minor (%)	3,250	9.2	0.2	3,501	7.2	0.1
Major (%)	3,250	4.5	0.1	3,501	4.7	0.1
Clavien 1 (%)	2,885	4.8	0.1	3,258	2.4	0.1
Clavien 2 (%)	2,885	4.6	0.1	3,258	4.8	0.0
Clavien 3a (%)	1,163	5.2	0.1	2,349	4.9	0.1
Clavien 3b (%)	1,521	4.0	0.1	2,349	1.5	0.0
Clavien 4a (%)	922	1.3	0.0	1,532	1.0	0.0
Clavien 4b (%)	714	0.0	0.0	1,324	0.0	0.0
Clavien 5 (%)	2,178	0.0	0.0	2,333	0.1	0.0

Note: LRP: laparoscopic radical prostatectomy; RARP: robot-assisted radical prostatectomy; n_p: number of patients; SE Standard error of the mean.

tive on the evidence, allowing the heterogeneity of scenarios between different studies to increase the representativeness and external validation of the results. In addition, the weighting by the large number of patients allowed a greater dilution of the results and approximation to the population mean. The results presented in the tables can serve as reference values for individual comparisons by the reader and for future studies, since the narrow standard error of the mean increases precision with the population mean.

The limitations of the study are inherent to the methodology itself, since there is no control over heterogeneity. However, we know that greater heterogeneity can increase the representativeness of different clinical scenarios and proximity to the real world. Furthermore, the data are a global summary of the best that the urological community has produced over 20 years and probably come from centers with recognized scientific production and extensive experience, which limits extrapolations to less favored scenarios. This argument may be more valid for studies comparing open radical prostatectomy, but between LRP and RARP, most of the studies came from the same centers, but at different stages of technological and scientific

development, as part of a natural history of radical prostatectomy [56].

These results, inserted in the current context of the robotic surgery era, where current knowledge is created from patients undergoing RARP, as well as the exclusive interest of major scientific journals and opinion makers in the robotic technique, means that LRP is limited to a transitional technique from open to robotic. However, in a heterogeneous global scenario with many countries still performing open surgery, LRP is certainly a less costly alternative and a well-established, mature and effective minimally invasive technique option, which was once considered the new gold standard [57], this time led by RARP [58].

It is worth mentioning that the discussion regarding functional and oncological outcomes were not considered in this study and, especially the latter, long-term outcomes must be analyzed with caution and have space for discussion.

Conclusions

The Reverse Systematic Review of comparative studies

between LRP and RARP demonstrated a small clinical and practical difference in perioperative outcomes, mainly in relation to operative time, EBL and blood transfusion, favoring RARP. Although it is a small difference, within an evolutionary context of minimally invasive surgery, it demonstrates the improvement of techniques and the search for better scientifically proven results.

The laparoscopic technique has reached maturity and is an equivalently safe treatment option compared to RARP. It is important to emphasize that the robotic technique has become the most widely accepted LRP modality in the world and drives science and new technologies. New studies regarding long-term oncological safety are still needed within this comparison.

Declarations

Author contributions: Moretti, TBC: development of methodology, reading of studies and composition of the database, statistical analysis and presentation of results, writing and discussion. Reis, LO: development of methodology, supervision. Maes, KU: paper design, supervision, writing, discussion

Availability of data and materials: Not applicable.

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Conflicts of interest: All authors declare that they have no competing interests.

Ethical approval and informed consent: Not applicable.

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Supplementary 1—SEARCH STRATEGY

Search strategy was systematized in 8 databases described below and were done using health descriptors specific to each base. It was complemented with use of synonyms in open search in title, abstract and subject through Boolean indicators.

Health Science Descriptors

Search Base	Vocabulary of subjects	Health Science Descriptors		
		1	2	3
PUBMED	MeSh	<i>Prostatectomy</i>	<i>Laparoscopy</i>	<i>Robotic Surgical Procedures</i>
BVS/BIREME	DeCS	<i>Prostatectomy</i>	<i>Laparoscopy</i>	<i>Robotic Surgical Procedures</i>
SCOPUS	--	<i>Prostatectomy</i>	<i>Laparoscopy</i>	<i>Robotic Surgical Procedures</i>
WEB OF SCIENCE	--	<i>Prostatectomy</i>	<i>Laparoscopic</i>	<i>Robotic Surgical Procedures</i>
EMBASE	Emtree	<i>Prostatectomy</i>	<i>Laparoscopy</i>	<i>Robotic Surgical Procedures</i> <i>Use preferred term: Robotic Surgical Procedure</i>
COCHRANE LIBRARY	MeSh	<i>Prostatectomy</i>	<i>Laparoscopy</i>	<i>Robotic Surgical Procedures</i>
PROQUEST	MeSh	<i>Prostatectomy</i>	<i>Laparoscopy</i>	<i>Robotic Surgical Procedures</i>
CINAHL	MH	<i>Prostatectomy</i>	<i>Laparoscopy</i>	<i>Robotic Surgical Procedures</i>

Key-words (synonymous):

- **Prostatectomy:** Prostatectomy OR Prostatectomies OR “Prostatectomy, Suprapubic” OR “Prostatectomies, Suprapubic” OR “Suprapubic Prostatectomies” OR “Suprapubic Prostatectomy” OR “Prostatectomy, Retropubic” OR “Prostatectomies, Retropubic” OR “Retropubic Prostatectomies” OR “Retropubic Prostatectomy”.

- **Laparoscopy:** Laparoscopy OR Laparoscopies OR Celioscopy OR Celioscopies OR Peritoneoscopy OR Peritoneoscopies OR “Surgical Procedures, Laparoscopic” OR “Laparoscopic Surgical Procedure” OR “Procedure, Laparoscopic Surgical” OR “Procedures, Laparoscopic Surgical” OR “Surgery, Laparoscopic” OR “Laparoscopic Surgical Procedures” OR “Laparoscopic Surgery” OR “Laparoscopic Surgeries” OR “Surgeries, Laparoscopic” OR “Laparoscopic Assisted Surgery” OR “Laparoscopic Assisted Surgeries” OR “Surgeries, Laparoscopic Assisted” OR “Surgery, Laparoscopic Assisted” OR “Surgical Procedure, Laparoscopic”.

- **Robotic Surgical Procedures:** “Robotic Surgical Procedures” OR “Procedure, Robotic Surgical” OR “Procedures, Robotic Surgical” OR “Robotic Surgical Procedure” OR “Surgical Procedure, Robotic” OR “Surgical Procedures, Robotic”.

- **Cystectomy:** Cystectomy OR Cystectomies.

Free Terms (not descriptors)

- **All the search bases:** “laparoscopic radical prostatectomy (LRP)” OR LRP OR “laparoscopic assisted radical prostatectomy” OR “Robot-assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy (RALRP)” OR RALRP OR “Robotic assisted laparoscopic prostatectomy (RALP)” OR “robot-assisted radical prostatectomy (RARP)” OR “robot assisted radical prostatectomy (RARP)” OR RARP OR “Endoscopic extraperitoneal radical prostatectomy (EERP)” OR EERP OR “Endoscopic extraperitoneal radical prostatectomy (EERPE)” OR EERPE OR “Robot-assisted” OR “Robot assisted” OR “robotic prostatectomy” OR “radical prostatectomy (RP)”

OR “radical prostatectomy” OR RP OR RRP OR “retropubic radical prostatectomy” OR “open prostatectomy” OR “laparoscopic radical prostatectomy” OR “robot-assisted prostatectomy” OR “Robot-assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy” OR “Robot-assisted laparoscopic radical prostatectomy” OR RALRP OR “Robotic assisted laparoscopic prostatectomy (RALP)” OR “Robot-assisted laparoscopic prostatectomy (RALP)” OR “Robot assisted laparoscopic prostatectomy” OR “Robot-assisted laparoscopic prostatectomy” OR RALP OR “Robot-assisted radical prostatectomy (RARP)” OR “Robot assisted radical prostatectomy (RARP)” OR “Robot-assisted radical prostatectomy” OR “Robot assisted radical prostatectomy” OR RARP OR “Robotic prostatectomy”.

- Embase: “robot-assisted prostatectomy” OR “robot-assisted prostatectomy” OR “laparoscopic radical prostatectomy” OR “Robotic radical prostatectomy” OR “Robotic-assisted radical prostatectomy” OR “Robotic assisted radical prostatectomy”.

Systematic Review Filter

- **PubMed:** (systematic review [ti] OR meta-analysis [pt] OR meta-analysis [ti] OR systematic literature review [ti] OR this systematic review [tw] OR pooling project [tw] OR (systematic review [tiab] AND review [pt]) OR meta synthesis [ti] OR meta-analy*[ti] OR integrative review [tw] OR integrative research review [tw] OR rapid review [tw] OR umbrella review [tw] OR consensus development conference [pt] OR practice guideline [pt] OR drug class reviews [ti] OR cochrane database syst rev [ta] OR acp journal club [ta] OR health technol assess [ta] OR evid rep technol assess summ [ta] OR jbi database system rev implement rep [ta] OR (clinical guideline [tw] AND management [tw]) OR ((evidence based[ti] OR evidence-based medicine [mh] OR best practice* [ti] OR evidence synthesis [tiab]) AND (review [pt] OR diseases category[mh] OR behavior and behavior mechanisms [mh] OR therapeutics [mh] OR evaluation studies[pt] OR validation studies[pt] OR guideline [pt] OR pmcbook)) OR ((systematic [tw] OR systematically [tw] OR critical [tiab] OR (study selection [tw]) OR (predetermined [tw] OR inclusion [tw] AND criteri* [tw]) OR exclusion criteri* [tw] OR main outcome measures [tw] OR standard of care [tw] OR standards of care [tw]) AND (survey [tiab] OR surveys [tiab] OR overview* [tw] OR review [tiab] OR reviews [tiab] OR search* [tw] OR handsearch [tw] OR analysis [ti] OR critique [tiab] OR appraisal [tw] OR (reduction [tw]AND (risk [mh] OR risk [tw]) AND (death OR recurrence))) AND (literature [tiab] OR articles [tiab] OR publications [tiab] OR publication [tiab] OR bibliography [tiab] OR bibliographies [tiab] OR published [tiab] OR pooled data [tw] OR unpublished [tw] OR citation [tw] OR citations [tw] OR database [tiab] OR internet [tiab] OR textbooks [tiab] OR references [tw] OR scales [tw] OR papers [tw] OR datasets [tw] OR trials [tiab] OR meta-analy* [tw] OR (clinical [tiab] AND studies [tiab]) OR treatment outcome [mh] OR treatment outcome [tw] OR pmcbook)) NOT (letter [pt] OR newspaper article [pt]) .

Available in: (https://www.nlm.nih.gov/bsd/pubmed_subsets/sysreviews_strategy.html)

Filters

- **Search period:** from January 1, 2000 to December 5, 2020.
- **Language:** English
- **Type of study:** Systematic Review and Meta-analysis
- **Species:** Human

Search Strategy

Each specific search strategy for each database is described below, with the date of the search and the number of articles found:

1 – PUBMED/PMC (MEDLINE)

• **Search Date:** December 5, 2020.

• **Number of articles found:** 128

• **Search Strategy:** (((((((((Robotics[MeSH Terms]) OR Robotics[Title/Abstract])) OR (((((((((Robotic Surgical Procedures[MeSH Terms]) OR “Robotic Surgical Procedures “[Title/Abstract]) OR “Procedure, Robotic Surgical”[Title/Abstract]) OR “Procedures, Robotic Surgical”[Title/Abstract]) OR “Robotic Surgical Procedure”[Title/Abstract]) OR “Surgical Procedure, Robotic”[Title/Abstract]) OR “Surgical Procedures, Robotic”[Title/Abstract])) OR (((((((((((“Robot-assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy” OR “Robot-assisted laparoscopic radical prostatectomy” OR RALRP)) OR (((((((“Robot-assisted radical prostatectomy (RARP)” OR “Robot assisted radical prostatectomy (RARP)” OR “Robot-assisted radical prostatectomy” OR “Robot assisted radical prostatectomy” OR RARP)) OR “Robotic prostatectomy” OR (“Robot-assisted prostatectomy” OR “Robot assisted prostatectomy”)) OR “Robotic radical prostatectomy” OR (“Robotic-assisted radical prostatectomy” OR “Robotic assisted radical prostatectomy”)) OR (((((((“Robotic assisted laparoscopic prostatectomy (RALP)” OR “Robot-assisted laparoscopic prostatectomy (RALP)” OR “Robot assisted laparoscopic prostatectomy” OR “Robot-assisted laparoscopic prostatectomy” OR RALP)))))) AND (((((((((((Prostatectomy[MeSH Terms]) OR Prostatectomy[Title/Abstract]) OR Prostatectomies[Title/Abstract]) OR “Prostatectomy, Suprapubic”[Title/Abstract]) OR “Prostatectomies, Suprapubic”[Title/Abstract]) OR

“Suprapubic Prostatectomies”[Title/Abstract]) OR “Suprapubic Prostatectomy”[Title/Abstract]) OR “Prostatectomy, Retropubic”[Title/Abstract]) OR “Prostatectomies, Retropubic”[Title/Abstract]) OR “Retropubic Prostatectomies”[Title/Abstract]) OR “Retropubic Prostatectomy”[Title/Abstract])) AND systematic [sb] Filters: Publication date from 2000/01/01 to 2020/12/05; Humans; English.

2 - BVS / BIREME

• **Search Date:** December, 2020

• **Number of articles found:** 87 (MEDLINE, LILACS, IBECs)

• **Search Strategy:** (tw:(prostatectomy OR prostatectomies OR “Prostatectomy, Suprapubic” OR “Prostatectomies, Suprapubic” OR “Suprapubic Prostatectomies” OR “Suprapubic Prostatectomy” OR “Prostatectomy, Retropubic” OR “Prostatectomies, Retropubic” OR “Retropubic Prostatectomies” OR “Retropubic Prostatectomy”)) AND (tw:(robotics)) OR (tw:(“Robot-assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy” OR “Robot-assisted laparoscopic radical prostatectomy” OR ralrp)) OR (tw:(“Robotic assisted laparoscopic prostatectomy (RALP)” OR “Robot-assisted laparoscopic prostatectomy (RALP)” OR “Robot assisted laparoscopic prostatectomy” OR “Robot-assisted laparoscopic prostatectomy” OR ralp)) OR (tw:(“Robot-assisted radical prostatectomy (RARP)” OR “Robot assisted radical prostatectomy (RARP)” OR “Robot-assisted radical prostatectomy” OR “Robot assisted radical prostatectomy” OR rarp)) OR (tw:(“Robotic prostatectomy”)) OR (tw:(“Robot-assisted prostatectomy” or “Robot assisted prostatectomy”)) OR (tw:(“Robotic radical prostatectomy”)) OR (tw:(“Robotic-assisted radical prostatectomy” OR “Robotic assisted radical prostatectomy”)) OR (tw:(“Robotic Surgical Procedures” OR “Procedure, Robotic Surgical” OR “Procedures, Robotic Surgical” OR “Robotic Surgical Procedure” OR “Surgical Procedure, Robotic” OR “Surgical Procedures, Robotic”)) AND (tw:(“SYSTEMATIC REVIEWS” OR “SYSTEMATIC REVIEW”)) AND (instance:“regional”) AND (la:“en”).

3 - CINAHL (The Cumulative Index to Nursing and Allied Health Literature)

• **Search Date:** December 5, 2020

• **Number of articles found:** 05

• **Search Strategy:** (MH “Prostatectomy”) OR “Prostatectomy” OR Prostatectomy OR Prostatectomies OR “Prostatectomy, Suprapubic” OR “Prostatectomies, Suprapubic” OR “Suprapubic Prostatectomies” OR “Suprapubic Prostatectomy” OR “Prostatectomy, Retropubic” OR “Prostatectomies, Retropubic” OR “Retropubic Prostatectomies” OR “Retropubic Prostatectomy” AND (MH “Robotics”) OR “Robotics” OR (“Robot-assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy” OR “Robot-assisted laparoscopic radical prostatectomy” OR RALRP) OR (“Robotic assisted laparoscopic prostatectomy (RALP)” OR “Robot-assisted laparoscopic prostatectomy (RALP)” OR “Robot assisted laparoscopic prostatectomy” OR “Robot-assisted laparoscopic prostatectomy” OR RALP) OR (“Robot-assisted radical prostatectomy (RARP)” OR “Robot assisted radical prostatectomy (RARP)” OR “Robot-assisted radical prostatectomy” OR “Robot assisted radical prostatectomy” OR RARP) OR “Robotic prostatectomy” OR “Robot-assisted prostatectomy” OR “Robot assisted prostatectomy” OR “Robotic radical prostatectomy” OR (“Robotic-assisted radical prostatectomy” OR “Robotic assisted radical prostatectomy”) OR (MH “Robotic Surgical Procedures”) OR “Robotic Surgical Procedures” OR “Robotic Surgical Procedures” OR “Procedure, Robotic Surgical” OR “Procedures, Robotic Surgical” OR “Robotic Surgical Procedure” OR “Surgical Procedure, Robotic” OR “Surgical Procedures, Robotic” AND TI “SYSTEMATIC REVIEWS” OR TI “SYSTEMATIC REVIEW”.

4 - WEB OF SCIENCE

• **Search Date:** December 5, 2020

• **Number of articles found:** 135

• **Search Strategy:** ((“Robot-assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy” OR “Robot-assisted laparoscopic radical prostatectomy” OR RALRP) OR (“Robotic assisted laparoscopic prostatectomy (RALP)” OR “Robot-assisted laparoscopic prostatectomy (RALP)” OR “Robot assisted laparoscopic prostatectomy” OR “Robot-assisted laparoscopic prostatectomy” OR RALP) OR (“Robot-assisted radical prostatectomy (RARP)” OR “Robot assisted radical prostatectomy (RARP)” OR “Robot-assisted radical prostatectomy” OR RARP) OR (“Robotic prostatectomy”) OR (“Robot-assisted prostatectomy” OR “Robot assisted prostatectomy”) OR (“Robotic radical prostatectomy”) OR (“Robotic-assisted radical prostatectomy” OR “Robotic assisted radical prostatectomy”)) OR ((“Robotic Surgical Procedures” OR “Procedure, Robotic Surgical” OR “Procedures, Robotic Surgical” OR “Robotic Surgical Procedure” OR “Surgical Procedure, Robotic” OR “Surgical Procedures, Robotic”)) OR (Robotics)) AND (Prostatectomy OR Prostatectomies OR “Prostatectomy, Suprapubic” OR “Prostatectomies, Suprapubic” OR “Suprapubic Prostatectomies” OR “Suprapubic Prostatectomy” OR “Prostatectomy, Retropubic” OR “Prostatectomies, Retropubic” OR “Retropubic Prostatectomies” OR “Retropubic Prostatectomy”) AND (2020 OR 2019 OR 2012 OR 2005 OR 2018 OR 2011 OR 2004 OR 2017 OR 2010 OR 2003 OR 2016 OR 2009 OR 2002 OR 2015 OR 2008 OR 2001 OR 2014 OR 2007 OR 2000 OR 2013 OR 2006) AND (“SYSTEMATIC REVIEWS” OR “SYSTEMATIC REVIEW”).

5 – EMBASE

• **Search Date:** December 5, 2020

• **Number of articles found:** 137

• **Search Strategy:** ('prostatectomy'/exp OR 'prostatectomy'/syn) AND ('systematic reviews':ab,ti OR 'systematic review':ab,ti) AND ('robotics'/exp OR 'robotic assisted laparoscopic prostatectomy'/exp OR 'robotic assisted laparoscopic prostatectomy (ralp)' OR 'robot-assisted laparoscopic prostatectomy (ralp)' OR 'robot assisted laparoscopic prostatectomy'/exp OR 'robot assisted laparoscopic prostatectomy' OR 'robot-assisted laparoscopic prostatectomy'/exp OR 'robot-assisted laparoscopic prostatectomy' OR ralp OR 'robot-assisted prostatectomy'/exp OR 'robot-assisted prostatectomy'/syn OR 'robot-assisted laparoscopic radical prostatectomy (ralrp)' OR 'robot assisted laparoscopic radical prostatectomy (ralrp)' OR 'robot assisted laparoscopic radical prostatectomy'/exp OR 'robot assisted laparoscopic radical prostatectomy' OR 'robot-assisted laparoscopic radical prostatectomy'/exp OR 'robot-assisted laparoscopic radical prostatectomy' OR ralrp OR 'robot-assisted radical prostatectomy (rarp)' OR 'robot assisted radical prostatectomy (rarp)' OR 'robot-assisted radical prostatectomy'/exp OR 'robot-assisted radical prostatectomy' OR 'robot assisted radical prostatectomy'/exp OR 'robot assisted radical prostatectomy' OR rarp OR 'robotic prostatectomy'/exp OR 'robotic prostatectomy' OR 'robotic radical prostatectomy'/exp OR 'robotic radical prostatectomy' OR 'robotic-assisted radical prostatectomy'/exp OR 'robotic-assisted radical prostatectomy' OR 'robotic assisted radical prostatectomy'/exp OR 'robotic assisted radical prostatectomy' OR 'robotic surgical procedure'/exp OR 'robotic surgical procedure'/syn) AND [english]/lim AND (2000:py OR 2001:py OR 2002:py OR 2003:py OR 2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py OR 2018:py OR 2019:py OR 2020:py).

6 - COCHRANE LIBRARY

• **Search date:** December 5, 2020

• **Number of articles found:** 19

• **Search Strategy:**

MeSH descriptor: [Prostatectomy] explode all trees OR (Prostatectomy OR Prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies, Retropubic" OR "Retropubic Prostatectomies" OR "Retropubic Prostatectomy"):ti,ab,kw AND MeSH descriptor: [Robotics] explode all trees OR (Robotics):ti,ab,kw OR ("Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR RALRP) OR ("Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR RALP) OR ("Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR RARP) OR ("Robotic prostatectomy") OR ("Robot-assisted prostatectomy" OR "Robot assisted prostatectomy") OR ("Robotic radical prostatectomy") OR ("Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy") OR MeSH descriptor: [Robotic Surgical Procedures] explode all trees OR ("Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic" OR "Surgical Procedures, Robotic"):ti,ab,kw AND ("SYSTEMATIC REVIEWS"):ti,ab,kw OR ("SYSTEMATIC REVIEW"):ti,ab,kw.

7 - PROQUEST CENTRAL

• **Search Date:** December 5, 2020

• **Number of articles found:** 116

• **Search Strategy:** ((MJMESH.EXACT.EXPLODE("Prostatectomy") OR (Prostatectomy OR Prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies, Retropubic" OR "Retropubic Prostatectomies" OR "Retropubic Prostatectomy")) AND ((MESH.EXACT("Robotics") OR Robotics) OR ("Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR RALRP) OR ("Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR RALP) OR ("Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR RARP) OR ("Robotic prostatectomy" OR ("Robot-assisted prostatectomy" OR "Robot assisted prostatectomy") OR "Robotic radical prostatectomy" OR ("Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy")) OR ((MJMESH.EXACT.EXPLODE("Robotic Surgical Procedures:E.04.749.500") OR MJMESH.EXACT.EXPLODE("Robotic Surgical Procedures:L.01.313.500.750.100.710.800.500") OR MJMESH.EXACT.EXPLODE("Robotic Surgical Procedures:E.02.950.875.500")) OR ("Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic" OR "Surgical Procedures, Robotic")))) AND (ti("SYSTEMATIC REVIEWS") OR ti("SYSTEMATIC REVIEW")) AND (la.exact("ENG") AND pd(20000101-20201205)).

8 – SCOPUS

• **Search date:** December 5, 2020

• **Number of articles found:** 7

• **Search Strategy:** (TITLE-ABS-KEY(Prostatectomy OR Prostatectomies OR “Prostatectomy, Suprapubic” OR “Prostatectomies, Suprapubic” OR “Suprapubic Prostatectomies” OR “Suprapubic Prostatectomy” OR “Prostatectomy, Retropubic” OR “Prostatectomies, Retropubic” OR “Retropubic Prostatectomies” O)) and ((TITLE-ABS-KEY(Robotics)) or ((ALL(“Robot-assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy (RALRP)” OR “Robot assisted laparoscopic radical prostatectomy” OR “Robot-assisted laparoscopic radical prostatectomy” OR RALRP) OR ALL(“Robotic assisted laparoscopic prostatectomy (RALP)” OR “Robot-assisted laparoscopic prostatectomy (RALP)” OR “Robot assisted laparoscopic prostatectomy” OR “Robot-assisted laparoscopic prostatectomy” OR RALP) OR ALL(“Robot-assisted radical prostatectomy (RARP)” OR “Robot assisted radical prostatectomy (RARP)” OR “Robot-assisted radical prostatectomy” OR “Robot assisted radical prostatectomy” OR RARP) OR ALL(“Robotic prostatectomy”) OR ALL(“Robot-assisted prostatectomy” OR “Robot assisted prostatectomy”) OR ALL(“Robotic radical prostatectomy”) OR ALL(“Robotic-assisted radical prostatectomy” OR “Robotic assisted radical prostatectomy”)))) or (TITLE-ABS-KEY(“Robotic Surgical Procedures” OR “Procedure, Robotic Surgical” OR “Procedures, Robotic Surgical” OR “Robotic Surgical Procedure” OR “Surgical Procedure, Robotic” OR “Surgical Procedures, Robotic”))) and ((TITLE-ABS-KEY(“SYSTEMATIC REVIEWS”) OR TITLE-ABS-KEY(“SYSTEMATIC REVIEW”))).

Supplementary 2—INCLUDED SYSTEMATIC REVIEWS

Selected systematic review studies for analysis are listed below (A¹⁻⁸⁰):

1. Abboudi H, Khan MS, Guru KA, et al. Learning curves for urological procedures: A systematic review. *Review. BJU International*. 2014;114(4):617-629. doi:10.1111/bju.12315
2. Allan C, Ilic D. Laparoscopic versus Robotic-Assisted Radical Prostatectomy for the Treatment of Localised Prostate Cancer: A Systematic Review. *Review. Urologia Internationalis*. 2016;96(4):373-378. doi:10.1159/000435861
3. Autorino R, Zargar H, White WM, et al. Current applications of near-infrared fluorescence imaging in robotic urologic surgery: A systematic review and critical analysis of the literature. *Review. Urology*. 2014;84(4):751-759. doi:10.1016/j.urology.2014.05.059
4. Bai Y, Pu C, Yuan H, et al. Assessing the Impact of Barbed Suture on Vesicourethral Anastomosis During Minimally Invasive Radical Prostatectomy: A Systematic Review and Meta-analysis. *Urology*. Jun 2015;85(6):1368-75. doi:10.1016/j.urology.2015.02.033
5. Baladakis J, Perera M, Bolton D, Lawrentschuk N, Adam A. Is There an Optimal Curative Option in HIV-Positive Men with Localized Prostate Cancer? A Systematic Review. *Curr Urol*. Jul 2019;12(4):169-176. doi:10.1159/000499309
6. Bellangino M, Verrill C, Leslie T, Bell RW, Hamdy FC, Lamb AD. Systematic Review of Studies Reporting Positive Surgical Margins After Bladder Neck Sparing Radical Prostatectomy. *Review. Current Urology Reports*. 2017;18(12) doi:10.1007/s11934-017-0745-0
7. Berryhill R, Jhaveri J, Yadav R, et al. Robotic prostatectomy: a review of outcomes compared with laparoscopic and open approaches. *Urology*. Jul 2008;72(1):15-23. doi:10.1016/j.urology.2007.12.038
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Supplementary 3—INCLUDED STUDIES

Selected studies for analysis are listed below (C¹⁻⁹¹⁰):

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