

INTRODUCTION

Robot-assisted surgery using da Vinci surgical system (dV-RAS) is seeing an increase in use for benign gynecologic conditions such as uterine fibroids, ovarian cysts, endometriosis, pelvic organ prolapse, and uterine bleeding. There is a need for a comprehensive summary of current publications to assess the value dV-RAS compared to laparoscopic (Lap) or traditional open approaches.

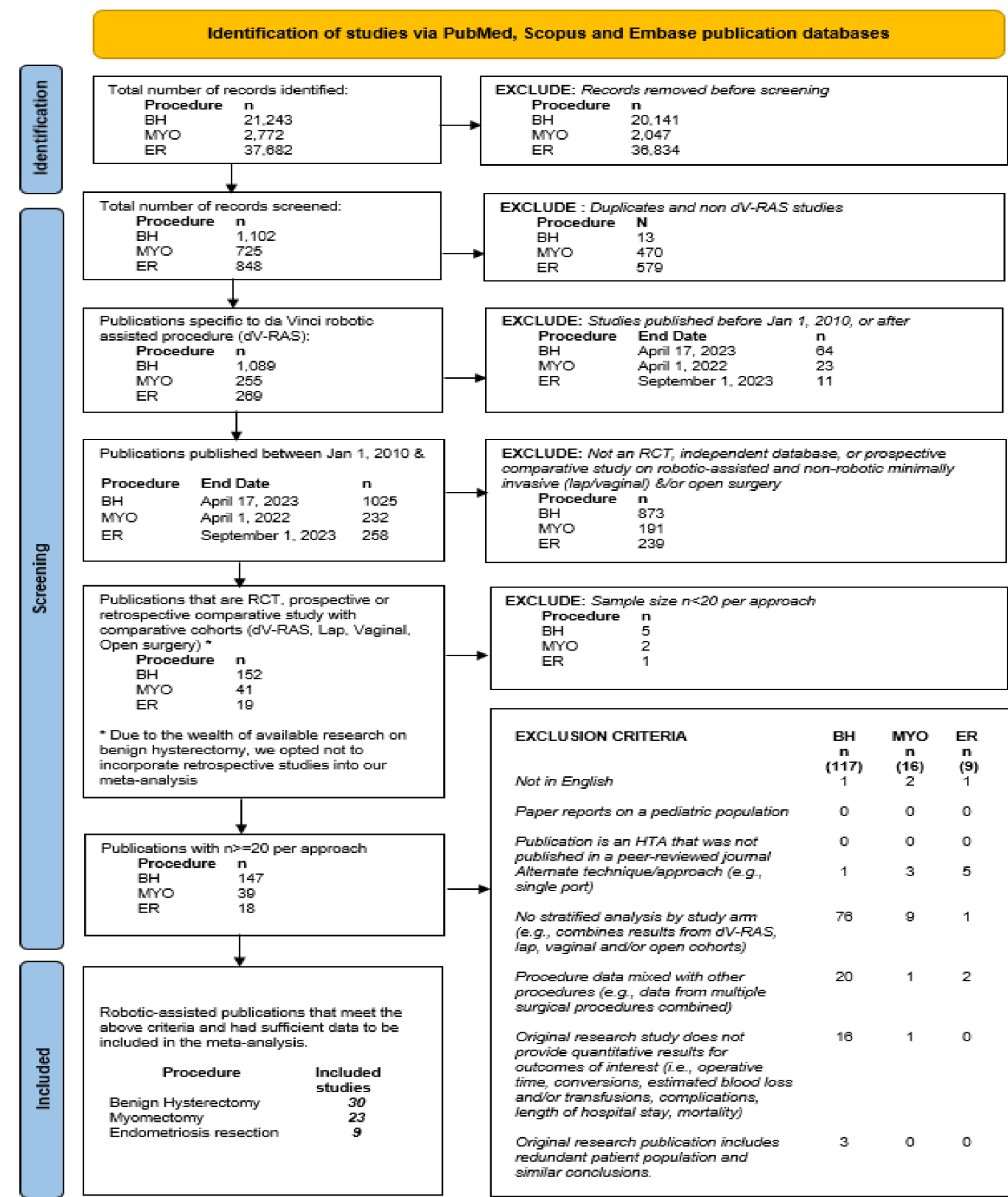
AIM

To review and synthesize the evidence across three benign gynecologic procedures to understand the results of common perioperative clinical outcomes and value of dV-RAS, presented as a meta-analysis.

METHODS

- A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guided literature review and R software based meta-analysis assessed studies where dV-RAS was compared to Lap or open approach in benign hysterectomy (BH),myomectomy (MYO), and endometriosis resection (ER).
- A PubMed, Embase, and Scopus search spanning a 12-year period was performed for each procedure and screened for eligibility based on title, keywords and abstracts.

Figure 1. Study flow



Publications specific to da Vinci robotic assisted procedure (dV-RAS):

Procedure n

BH 1,089

MYO 255

ER 299

EXCLUDE: Studies published before Jan 1, 2010, or after

Procedure End Date n

BH April 17, 2023 64

MYO April 1, 2023 23

ER September 1, 2023 11

Publications published between Jan 1, 2010 &

Procedure End Date n

BH April 17, 2023 1025

MYO April 1, 2023 232

ER September 1, 2023 258

EXCLUDE: Not an RCT, independent database, or prospective comparative study on robotic-assisted and non-robotic minimally invasive (lap/vaginal) &/or open surgery

Procedure n

BH 873

MYO 191

ER 239

Publications that are RCT, prospective or retrospective comparative study with comparative cohorts (dV-RAS, Lap, Vaginal, Open surgery) *

Procedure n

BH 152

MYO 41

ER 19

EXCLUDE: Sample size n<20 per approach

Procedure n

BH 5

MYO 2

ER 1

* Due to the wealth of available research on benign hysterectomy, we opted not to incorporate retrospective studies into our meta-analysis

Publications with n>=20 per approach

Procedure n

BH 147

MYO 39

ER 18

EXCLUSION CRITERIA

BH n (117)

MYO n (16)

ER n (9)

Not in English 1 2 1

Paper reports on a pediatric population 0 0 0

Publication is an HTA that was not published in a peer-reviewed journal 0 0 0

Alternate technique/approach (e.g., single port) 1 3 5

No stratified analysis by study arm (e.g., combines results from dV-RAS, lap, vaginal and/or open cohorts) 76 9 1

Procedure data mixed with other procedures (e.g., data from multiple surgical procedures combined) 20 1 2

Original research study does not provide quantitative results for outcomes of interest (i.e., operative time, conversions, estimated blood loss and/or transfusions, complications, length of hospital stay, mortality) 16 1 0

Original research publication includes redundant patient population and similar conclusions. 3 0 0

Robotic-assisted publications that meet the above criteria and had sufficient data to be included in the meta-analysis.

Procedure Included studies

Benign Hysterectomy 30

Myomectomy 23

Endometriosis resection 9

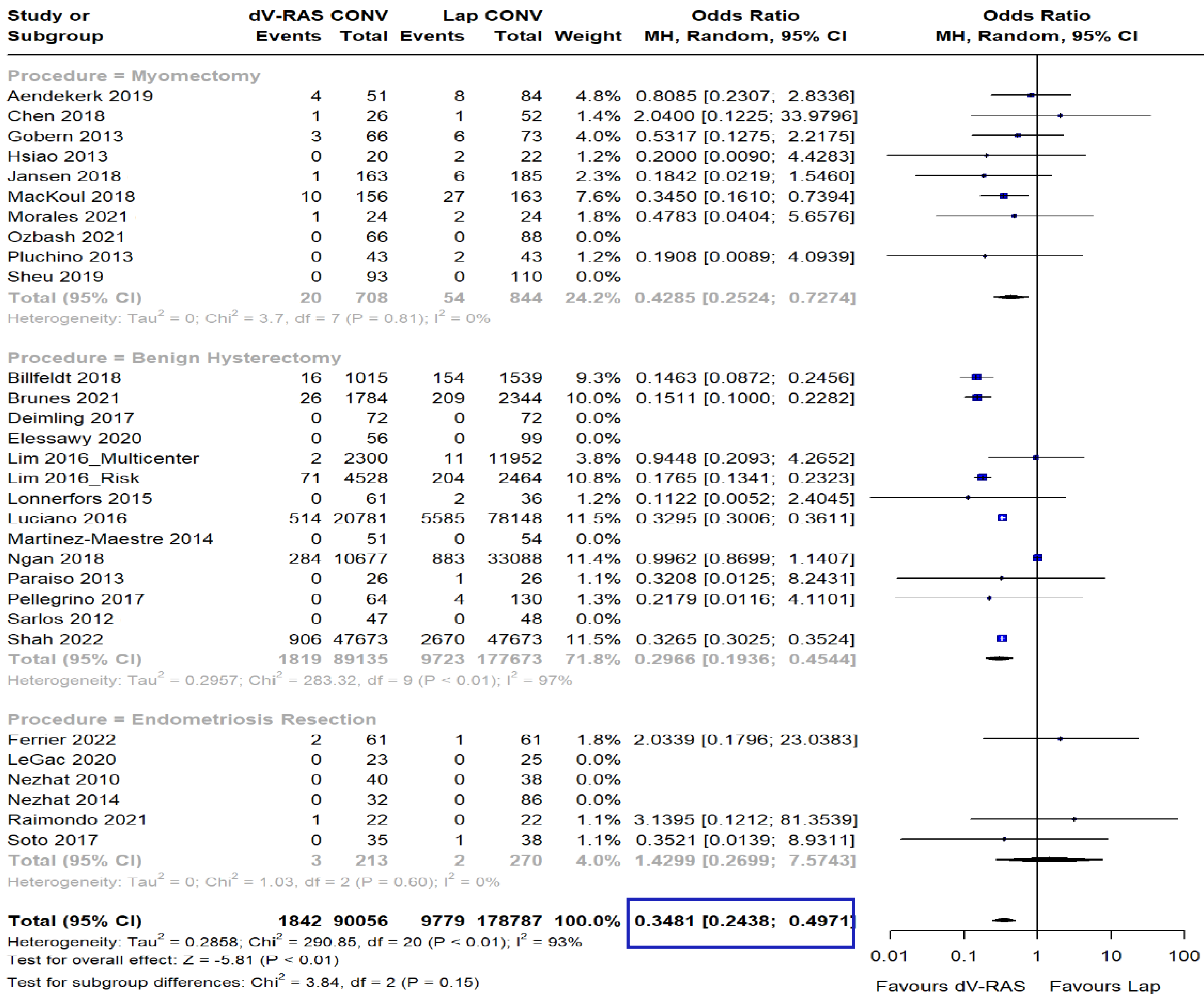
RESULTS

- The search identified 30 publications on BH, 22 on MYO, and 9 on ER.

Table 1. Comparative analysis by surgical modality for benign gynecological procedures

Outcome	Comparison	Studies	dV-RAS N	Lap/Open N	Effect size	p-value of Effect size	Heterogeneity	Model	Conclusion
Operative time (min)	dV-RAS vs LAP	BH(12), MYO(14), ER(8)	29534	93321	MD: 34.10 [21.72; 46.49]	p<0.01	p=0; I ² =99%	Random	Favors LAP
	dV-RAS vs Open	BH(4), MYO(13)	22959	148115	MD: 62.56 [42.93, 82.19]	p<0.01	p<0.01; I ² =99%	Random	Favors Open
Conversion to open (%)	dV-RAS vs LAP	BH(14), MYO(10), ER(6)	90056	178787	OR: 0.35 [0.24, 0.50]	p<0.01	p<0.01; I ² =93%	Random	Favors RAS
	dV-RAS vs Open	Not applicable							
Estimated blood loss (ml)	dV-RAS vs LAP	BH(6), MYO(13), ER(6)	3776	3667	MD: -11.63 [-33.64; 10.38]	p=0.30	p<0.01; I ² =94%	Random	No difference
	dV-RAS vs Open	BH(4), MYO(13)	2236	9268	MD: -102.90 [-163.62, -42.18]	p<0.01	p<0.01; I ² =97%	Random	Favors RAS
Blood transfusions (%)	dV-RAS vs LAP	BH(11), MYO(12), ER(2)	49207	138099	OR: 0.79 [0.69, 0.91]	p<0.01	p=0.09; I ² =31%	Fixed	Favors RAS
	dV-RAS vs Open	BH(5), MYO(10)	29468	155600	OR: 0.28 [0.20, 0.38]	p<0.01	p<0.01; I ² =68%	Random	Favors RAS
Post-op complications 30-day (%)	dV-RAS vs LAP	BH(13), MYO(11), ER(5)	126225	196507	OR: 0.87 [0.76, 0.99]	p=0.04	p<0.01; I ² =88%	Random	Favors RAS
	dV-RAS vs Open	BH(7), MYO(9)	106198	834039	OR: 0.47 [0.38, 0.59]	p<0.01	p<0.01; I ² =97%	Random	Favors RAS
Length of hospital stay (days)	dV-RAS vs LAP	BH(13), MYO(11), ER(5)	44510	112699	MD: -0.08 [-0.23; 0.07]	p=0.29	p<0.01; I ² =93%	Random	No difference
	dV-RAS vs Open	BH(6), MYO(13)	32392	164884	MD: -1.48 [-1.77; -1.19]	p<0.01	p=0; I ² =99%	Random	Favors RAS
Readmissions 30-day (%)	dV-RAS vs LAP	BH(6), MYO(0), ER(2)	22555	36855	OR: 0.90 [0.82; 0.99]	p=0.03	p=0.07; I ² =48%	Fixed	Favors RAS
	dV-RAS vs Open	BH(4), MYO(2)	22516	170233	OR: 0.94 [0.65; 1.34]	p=0.73	p<0.01; I ² =89%	Random	No difference
Reoperations 30-day (%)	dV-RAS vs LAP	BH(5), MYO(3), ER(3)	14804	24635	OR: 0.92 [0.66; 1.28]	p=0.63	p=0.86; I ² =0%	Fixed	No difference
	dV-RAS vs Open	BH(3), MYO(1)	14561	22212	OR: 0.45 [0.18; 1.14]	p=0.09	p<0.01; I ² =85%	Random	No difference

Figure 2. Detailed Forest-plot for Conversion to open surgery



RESULTS

Compared to Lap surgery the evidence for dV-RAS benign gynecologic procedures demonstrates:

- **65%** lower likelihood of a conversion to open surgery with dV-RAS
- **21%** lower likelihood of receiving a blood transfusion with dV-RAS
- **13%** lower likelihood of experiencing a complication with dV-RAS
- Significantly longer operative time with dV-RAS by an average of **34 minutes**
- Comparable length of hospital stay, estimated blood loss, postoperative readmission and reoperation within 30-days of surgery

Compared to Open surgery the evidence for dV-RAS benign gynecologic procedures demonstrates:

- **72%** lower likelihood of receiving a blood transfusion with dV-RAS
- **53%** lower likelihood of experiencing a complication with dV-RAS
- **10%** lower likelihood of a 30-day readmission with dV-RAS
- Significantly shorter hospital length of stay by an average of **1.5 days** with dV-RAS
- Significantly less estimated blood loss with dV-RAS by an average of **103 ml**
- Significantly longer operative time with dV-RAS by an average of **62 minutes**
- Comparable rate of reoperations within 30-days of surgery

CONCLUSIONS

- dV-RAS for benign gynecologic surgery results in lower conversion rates, fewer blood transfusions and fewer postoperative complications when compared to Lap.
- dv-RAS for benign gynecologic surgery results in fewer blood transfusions, less blood loss, shorter hospital stay, fewer postoperative complications and a reduction in readmissions compared to Open surgery.
- The increase in minimally invasive surgery (MIS) is supported by the results of this meta-analysis.
- This holistic approach to summarizing the evidence can help regulators and decision makers in evaluating dv-RAS for benign gynecologic procedures.

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