International Journal of Research in Medical Sciences
*Neupane B et al. Int J Res Med Sci. 2026 Oct;14(10):4746-4751*
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/ 10.18203/2320-6012.ijrms20263548

**Systematic Review**

# Comparative efficacy of robotic assisted versus laparoscopic gynecologic surgery in Southeast Asia: a systematic review

**Binita Neupane*, Ashish Singh, Heera P., Sonia Naik**

Department of Obstetrics and Gynecology, Max Smart Super Specialty Hospital, Saket, New Delhi, India

**Received:** 10 September 2026
**Revised:** 14 September 2026
**Accepted:** 25 September 2026

***Correspondence:**
Dr. Binita Neupane,
E-mail: binita.neupane@hotmail.com



## ABSTRACT

With scientific evolution, the minimally invasive surgical techniques such as laparoscopic surgery (LS) and robotic-assisted surgery (RAS), have completely transformed gynecologic procedures by reducing patient morbidity, hospital stay and post procedure recovery. While there are several global literatures to validate these modalities, a focused analysis in Southeast Asia countries remains limited. To systematically compare published medical literatures on perioperative outcomes of RAS and LS in gynecologic surgeries across Southeast Asian countries. Adhering to PRISMA guidelines, we conducted a comprehensive search across PubMed, Embase, Cochrane Library and regional databases up to May 2025. Inclusion criteria encompassed studies from Southeast Asia comparing RAS and LS in gynecologic procedures, reporting on operative time, blood loss, complication rates, conversion rates and hospital stay. During the review, we identified 1,200 articles, 15 met inclusion criteria, encompassing 4,500 patients (RAS: 2,100; LS: 2,400). It was observed that RAS demonstrated reduced blood loss (mean difference: -50 mL; 95% CI: -70 to -30 mL) and shorter hospital stay (mean difference: -1.2 days; 95% CI: -1.5 to -0.9 days). However, operative times were observed to be longer in RAS (mean difference: +30 minutes; 95% CI: +20 to +40 minutes). However, no significant differences were observed in overall complication or conversion rates. In Southeast Asia, RAS offers advantages in blood loss and hospitalization duration over LS in gynecologic surgeries, albeit with increased operative times. These findings can facilitate surgical decision-making process, balancing benefits against resource availability.

**Keywords:** Gynecology, Laparoscopic surgery, Minimally invasive surgery, Robotic-assisted surgery, Systematic review, Southeast Asia

## INTRODUCTION

Gynecological conditions contribute significantly to the burden of disease amongst women in Southeast Asia leading to impaired quality of life and increased financial strain on both individual and health systems. Minimally invasive surgery (MIS), over past few decades, have transformed the approach to gynecologic practice, particularly in the management of conditions such as fibroids, endometriosis and gynecologic malignancies, offering reduced postoperative pain, quicker recovery and shorter hospital stay when compared to conventional open procedures. Within MIS, LS has long been tried and tested as the gold standard intervention for various benign and malignant gynecologic conditions. More recently, RAS has emerged as a technologically advanced alternative, providing enhanced dexterity, three-dimensional visualization and improved ergonomics for the surgeon.[1] However, this is not in routine use in many countries in Southeast Asia.[2] These advantages are particularly appealing in complex pelvic procedures where precision and visualization are paramount. Globally, several studies have been undertaken to review the effectiveness of RAS versus LS including systematic reviews.[3-9] Findings have generally indicated that while RAS may result in lower intraoperative blood loss and slightly shorter hospital stays, it is often associated with increased operative times and higher operative costs.[3,5,10,11] However, these comparisons have largely been documented and published in developed countries with well-established robotic programmes and advanced surgical training infrastructures for medical workforce. In contrast, the applicability and effectiveness of RAS is less studied in developing and underdeveloped countries that have diverse healthcare systems with mostly out of pocket expenditures in Southeast Asia region.

Southeast Asia Region has diverse countries with varying levels of economic capacity, healthcare infrastructure and access to advanced technologies including trained workforce. While countries such as Singapore, Malaysia and Thailand have incorporated robotic systems into select tertiary hospitals others across the region are still building foundational laparoscopic capacity at the national and sub-national levels a transition that, even within advanced programmes, has often been recent: laparoscopic radical hysterectomy, for instance, only replaced the open approach at one high-volume Singaporean centre in 2009.[12-14] Despite the growing interest in acquiring robotic technology in select centers across Southeast Asia, there is a notable paucity of region focused evidence that compares RAS and LS within these healthcare systems in the Region. This gap in consolidated evidence in the Region specifically comparing RAS and LS limits the informed decision-making for those who must weigh the potential benefits of robotic systems against their substantial financial and logistical demands.

In this context, there is a need for a systematic and region-specific synthesis of evidence to understand the comparative perioperative outcomes of RAS and LS in gynecologic surgery within Southeast Asia. This study aims to provide systematic review of the scientific publications and literature available from Southeast Asian countries on perioperative outcomes such as operative time, intraoperative blood loss, complication rates, conversion to open surgery and hospital length of stay in gynecologic conditions in clinical practice with focus on minimally invasive gynecologic surgery in the region.

## METHODS

### *Search strategy*

A systematic literature search was conducted in May 2025 following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines.[17] Electronic databases searched included PubMed/MEDLINE, Embase, Cochrane Library and regional databases such as ThaiJO, MyMedR and Indonesia OneSearch.

The search strategy utilized a combination of medical subject headings (MeSH) and free-text terms, including: robotic-assisted surgery or robotic surgery. Laparoscopic surgery or minimally invasive surgery. Gynecology or gynecologic surgery and the names of individual Southeast Asian countries. Manual searches of reference lists and grey literature sources were also undertaken to identify additional relevant studies.

### *Inclusion criteria*

Studies were considered eligible for inclusion if they directly compared RAS and LS for gynecologic procedures, were conducted in or reported data from Southeast Asian countries and reported on at least one perioperative outcome of interest, namely operative time, intraoperative blood loss, postoperative complication rates, conversion to open surgery or length of hospital stay. Only studies published in English up to May 2025 were included.

### *Exclusion criteria*

Studies were excluded from the analysis if they lacked direct comparative data between RAS and LS, focused on non-gynecologic procedures or comprised case reports, case series with fewer than 10 patients, narrative reviews, editorials or commentaries.

### *Data extraction*

Two reviewers independently screened titles and abstracts, followed by full-text assessments of potentially eligible studies. Discrepancies were resolved by consensus or consultation with a third reviewer, while drafting the manuscript.

A standardized data extraction form was used to collect the following information.

Study design and setting. Year and country of publication. Surgical modality (RAS vs. LS). Perioperative outcomes: operative time, estimated blood loss, complication rates, conversion rates and hospital stay. Patient demographics and clinical indications.

### *Quality assessment*

The Newcastle-Ottawa Scale (NOS) was used to assess the methodological quality of observational studies.[18] Each study was evaluated on selection, comparability and outcome domains. Studies were classified as low, moderate or high quality based on their total NOS scores. For randomized controlled trials, the Cochrane Risk of Bias (RoB 2) tool was employed.[19] Inter-reviewer agreement was calculated using Cohen's kappa (κ), with κ>0.80 indicating strong agreement.

## RESULTS

### *T study selection*

The initial database search yielded a total of 1,200 articles. Post removal of duplicates (n=315), 885 articles were screened based on titles and abstracts. Among them, 72 articles were selected for full-text review. Adhering to the inclusion and exclusion criteria, 15 studies were deemed eligible for inclusion in this review. These studies collectively encompassed 4,500 patients; among them 2,100 had undergone RAS whereas 2,400 had undergone LS.

### Study characteristics

The articles considered for this study were conducted in seven Southeast Asian countries: Singapore (n=4), Thailand (n=3), Malaysia (n=2), Indonesia (n=2), Vietnam (n=1), Philippines (n=2) and Myanmar (n=1). The majority were retrospective cohort studies (n=10), with the remaining being prospective observational studies (n=4) and one randomized controlled trial. Surgical procedures included cases related to total hysterectomy, myomectomy, endometriosis excision and early-stage oncologic resections.

### Operative time

A consistent finding across 13 of the 15 studies was that RAS was associated with longer operative times compared to LS. The mean difference in operative time was +30.4 minutes (95% confidence interval (CI): +20.2 to +40.6 minutes; $p<0.001$).

### Intraoperative blood loss

Fourteen of the studies reported intraoperative blood loss. RAS demonstrated a statistically significant reduction in mean estimated blood loss, with a pooled mean difference of -53.7 ml (95% CI: -74.1 to -33.3 ml, $p<0.001$). This reduction was consistent across various surgical indications and more observed in myomectomy and complex endometriosis resections.

### Hospital stay

All articles considered for this study focused the postoperative hospital stay. Patients who underwent RAS had a significantly shorter length of stay, with a pooled mean difference of -1.26 days (95% CI: -1.57 to -0.95 days; $p<0.001$). The difference was most notable in countries with enhanced recovery after surgery (ERAS) protocols integrated into robotic surgery pathways.

### Complication rates

Complication rates were reported in 13 studies with no statistically significant difference between the two groups in terms of overall perioperative complications (Risk Ratio (RR): 0.94; 95% CI: 0.78–1.13; $p=0.51$). Common complications that were reported are fever, urinary tract injuries and port-site hematomas. Subgroup analyses did not reveal procedure-specific differences.

### Conversion to open surgery

Ten studies reported conversion rates to open surgery. The analysis revealed no significant difference between RAS and LS (RR: 1.03; 95% CI: 0.65–1.63; $p=0.88$). Conversion was uncommon in both groups (<2%) and primarily observed in cases of dense pelvic adhesions or uncontrolled hemorrhage.

**Table 1: PRISMA study selection flow.**

| Stage | N (Number) |
|---|---|
| **Records identified through database searching** | 1,200 |
| **Duplicates removed** | 315 |
| **Records screened (title/abstract)** | 885 |
| **Records excluded at title/abstract screening** | 813* |
| **Full-text articles assessed for eligibility** | 72 |
| **Full-text articles excluded** | 57* |
| **Studies included in qualitative synthesis** | **15** |

*Derived by subtraction from the totals reported in the Results text (885 − 72=813; 72 − 15=57); reasons for exclusion at each stage were not itemized in the source data. Note: Study identification and selection followed the PRISMA 2020 guidelines.[17] Data in this table reflect the authors' own database search and screening process conducted for this review (author-generated).

**Table 2: Characteristics of included studies (n=15).**

| Characteristics | Category | N (Number) |
|---|---|---|
| **Country** | Singapore | 4 |
| | Thailand | 3 |
| | Malaysia | 2 |
| | Indonesia | 2 |
| | Philippines | 2 |
| | Vietnam | 1 |
| | Myanmar | 1 |

Continued.

| Characteristics | Category | N (Number) |
|---|---|---|
| **Study design** | Retrospective cohort | 10 |
| | Prospective observational | 4 |
| | Randomized controlled trial | 1 |
| **Patients, total (RAS / LS)** | — | 4,500 (2,100 / 2,400) |
| **Surgical procedures represented** | Total hysterectomy, myomectomy, endometriosis excision, early-stage oncologic resections | — |

**Table 3: Summary of perioperative outcomes.**

| Outcomes | Studies reporting (N/15) | Effect estimate (RAS vs. LS) | 95% CI | P value |
|---|---|---|---|---|
| **Operative time** | 13 | MD +30.4 min | +20.2 to +40.6 | <0.001 |
| **Intraoperative blood loss** | 14 | MD −53.7 ml | −74.1 to −33.3 | <0.001 |
| **Length of hospital stay** | 15 | MD −1.26 days | −1.57 to −0.95 | <0.001 |
| **Postoperative complication rate** | 13 | RR 0.94 | 0.78–1.13 | 0.51 |
| **Conversion to open surgery** | 10 | RR 1.03 | 0.65–1.63 | 0.88 |

## DISCUSSION

This systematic review synthesizes data from 15 comparative studies conducted across seven Southeast Asian countries to evaluate the perioperative efficacy of RAS versus LS in gynecologic procedures. Taken together, the findings suggest that RAS offers measurable perioperative advantages principally reduced intraoperative blood loss and shorter hospital stays but these benefits come at the cost of significantly longer operative times. This pattern is broadly consistent with global evidence, while also offering region-specific insight into how these trade-offs manifest under the practice patterns and resource constraints characteristic of Southeast Asian health systems.[3-9]

The observed reduction in intraoperative blood loss during RAS, with a pooled mean difference of approximately 53.7 mL, mirrors findings from large-scale meta-analyses outside the region. Lim et al reported a comparable trend in a multicenter study of benign gynecologic hysterectomies performed in high-volume centers, where robotic procedures consistently demonstrated lower estimated blood loss than laparoscopic ones.[15] Clinically, a reduction of this magnitude is unlikely, on its own, to change transfusion practice or recovery trajectories, but it is directionally consistent with the improved hemostatic control repeatedly attributed to robotic platforms in procedure-specific reviews of myomectomy, where meticulous, low-blood-loss dissection is particularly valued.[8] The enhanced precision, tremor filtration and articulation offered by robotic instruments may have contributed to this advantage, especially in the complex dissections such as myomectomy and deep endometriosis excision that were frequently performed in the studies considered for this review.

counterparts.[1] Spital stay observed among RAS patients a pooled reduction of 1.26 days is directionally consistent with the earlier findings of Boggess et al who reported that patients undergoing robotic hysterectomy for endometrial cancer were more likely to be discharged within 24 hours than their laparoscopic counterparts.[16] The consistency of this finding across roughly fifteen years and across markedly different health systems suggests that faster recovery after RAS is a relatively robust effect rather than an artefact of any single setting. In the Southeast Asian context, earlier discharge not only improves patient satisfaction but also offers a potential strategy to alleviate hospital bed shortages in high-volume public facilities. Notably, this trend was most prominent in Singapore and Thailand, where Enhanced Recovery After Surgery (ERAS) protocols are routinely integrated into robotic pathways underscoring that the benefit may be as much a function of perioperative pathway design as of the robotic platform itself.

Despite these merits, the longer operative time associated with RAS approximately 30 minutes on average remained the most consistent limitation observed across the included studies. This finding agrees with Lawrie et al whose Cochrane review attributed longer robotic operative times to docking, system calibration and the initial console learning curve.[4] Notably, evidence from randomized controlled trials is less uniform on this point: Kawka et al synthesizing 45 trials across thirteen procedure types, found that robotic and laparoscopic approaches did not differ consistently across outcomes once the comparison was restricted to randomized designs.[5]

This divergence suggests that the operative-time penalty observed in our review drawn predominantly from retrospective cohort studies may partly reflect residual confounding or the learning-curve effects inherent to newer robotic programmes in the region, rather than an inherent limitation of the technology itself. In support of this interpretation, several studies included in this review reported a downward trend in operative times with increasing institutional experience, consistent with the hypothesis that operative inefficiencies diminish as surgical teams gain familiarity with robotic platforms. One such analysis, reportedly from Malaysia, described a 15% reduction in docking time after the first 30 robotic cases, underscoring the importance of case-volume thresholds in realizing the full efficiency potential of robotic platforms

Importantly, complication rates and conversion to laparotomy did not differ significantly between RAS and LS groups in this review a safety-equivalence finding that supports offering either approach where both are locally available. This is consistent with the multicentre analysis by Wright et al which found no significant difference in perioperative complication rates between the two modalities across more than 260,000 cases.[11] However, the comparably low complication rates observed in both arms of our review should be interpreted cautiously: robotic procedures in Southeast Asia are, at present, concentrated among high-volume surgeons operating in well-resourced tertiary centers with strong multidisciplinary support and this pattern of selective adoption may understate the complication risk that would be observed if RAS were extended to lower-volume or less-resourced settings.

From a health systems perspective, the economic implications of adopting robotic surgery are of particular concern in resource-limited settings. Robotic systems such as the da Vinci platform involve substantial capital investment, ongoing maintenance and training requirements. The reviewed studies did not consistently report cost-effectiveness data. One Singapore-based study indicated that lower postoperative complications and reduced readmissions could partially offset the high upfront costs.[13] This is broadly consistent with a recent narrative review of robotic surgery in low- and middle-income countries, which similarly concluded that its value is highly dependent on case volume, training infrastructure and the availability of financial or public-private support, rather than on the technology alone.[20] A recent gynecology-specific review reached a comparable conclusion, noting that the economic case for RAS is context-sensitive and closely tied to institutional case volume, learning-curve effects and the presence (or absence) of standardized reimbursement mechanisms all factors that vary considerably across and even within, Southeast Asian health systems.[21] Taken together, this literature reinforces that widespread implementation of RAS in lower-income countries within the region is unlikely to be feasible without targeted investment, structured training pathways or public-private partnerships to offset acquisition and maintenance costs.

This review must also be interpreted considering several limitations. First, there was considerable variability in surgical competency, case selection and hospital infrastructure across the included studies, which may introduce heterogeneity in outcomes. Second, the predominance of retrospective cohort designs (10 of 15 studies) means that the operative-time and blood-loss findings are more susceptible to selection and confounding bias than would be the case in a review restricted to randomized evidence, this should temper the strength of causal claims drawn from our pooled estimates.[5] Third, publication bias cannot be ruled out, as negative or neutral studies could be underreported. Fourth, the absence of long-term outcomes such as quality of life, recurrence rates for malignancies and fertility preservation limits a more comprehensive comparison of surgical efficacy. Finally, only a subset of studies conducted formal cost analyses, an important consideration in a region with diverse economic profiles.

## CONCLUSION

To our knowledge, this systematic review is among the first to specifically synthesize perioperative outcomes of RAS versus LS in gynecologic procedures across multiple Southeast Asian countries, addressing a gap in the literature where comparative evidence had previously been drawn largely from non-regional, higher-resource settings. Despite these limitations, this systematic review was attempted to specifically evaluate perioperative outcomes of RAS versus LS in gynecologic surgery across Southeast Asia, providing valuable region-specific insights and highlighting the need for context-sensitive adoption of robotic technologies.

The findings underscore that RAS offers key perioperative benefits, particularly reduced intraoperative blood loss and shorter hospital stays, which may contribute to enhanced recovery and improved patient satisfaction in select clinical contexts. However, these advantages are consistently offset by longer operative times associated with RAS and the substantial financial investment required for robotic infrastructure and surgical team training. While complication and conversion rates were comparable between RAS and LS, suggesting both techniques are safe and viable, the limited availability of long-term outcome data especially on cost-effectiveness and recurrence calls for more robust research. In the Southeast Asian context, with its wide variation in healthcare landscape, these findings highlight the need for context-sensitive adoption of RAS: selective and strategic introduction in high-volume centers and for technically complex gynecologic cases may be justified, but broad implementation is unlikely to be sustainable without targeted workforce development and consideration of accessibility and equity.

Critically, the current evidence remains limited; future research must focus on multi-country, region-specific studies with long-term data on clinical outcomes, quality of life and economic evaluations to facilitate informed surgical decision-making that balances benefits against resource availability and by consolidating the available region-specific evidence, this review advances the field by providing a foundation for such context-sensitive, resource-conscious adoption of robotic gynecologic surgery in Southeast Asia.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: Not required*

## REFERENCES

1. American College of Obstetricians and Gynecologists. Robot-assisted surgery for noncancerous gynecologic conditions. ACOG Committee Opinion No. 810. Obstet Gynecol 2020;136:22-30.
2. Ng JS, Leitao MM, Lim PC, Kim TJ, Kim SW. Asian Society for Gynecologic Robotic Surgery consensus guidelines on robotic surgery in gynecological cancer. Gynecologic Robotic Surg. 2024;5(1):8–19.
3. Roh HF, Nam SH, Kim JM. Robot-assisted laparoscopic surgery versus conventional laparoscopic surgery in randomized controlled trials: A systematic review and meta-analysis. PLOS ONE. 2018;13(1):191628.
4. Lawrie TA, Liu H, Lu D, Dowswell T, Song H, Wang L, et al. Robot-assisted surgery in gynaecology. Cochrane Datab Systematic Rev. 2019;4(4):11422.
5. Kawka M, Fong Y, Gall TMH. (2023). Laparoscopic versus robotic abdominal and pelvic surgery: a systematic review of randomised controlled trials. Surgical Endosc. 2023;37(9):6672–81.
6. Zhou Z, Ge J, Ye K, Zhang Y, Hu Q, Wang L. Comparison of robotic-assisted vs. conventional laparoscopy for para-aortic lymphadenectomy in gynecological malignancies: a systematic review and meta-analysis. Frontiers in Surg. 2023;9:843517.
7. Lu Y, Chen J, Wei R, Lin W, Chen Y, Su Y, et al. Application of robotic surgery and traditional laparoscopic surgery in lymph node dissection for gynecological cancer: a meta-analysis. Oncology Letters. 2023;25(5):175.
8. Tsakos E, Xydias EM, Ziogas AC, Sorrentino F, Nappi L, Vlachos N, et al. Multi-port robotic-assisted laparoscopic myomectomy: a systematic review and meta-analysis of comparative clinical and fertility outcomes. J Clin Med. 2023;12(12):4134.
9. Gala RB, Margulies R, Steinberg A, Murphy M, Lukban J, Jeppson P, et al. Systematic review of robotic surgery in gynecology: robotic techniques compared with laparoscopy and laparotomy. J Minimally Invasive Gynecol. 2014;21(3):353-61.
10. Wright JD, Burke WM, Wilde ET, Lewin SN, Charles AS, Kim JH, et al. Comparative effectiveness of robotic versus laparoscopic hysterectomy for endometrial cancer. J Clin Oncol. 2012;30(8):783–91.
11. Wright JD, Ananth CV, Lewin SN, Burke WM, Lu YS, Neugut AI, et al. Robotically assisted vs laparoscopic hysterectomy among women with benign gynecologic disease. JAMA. 2013;309(7):689–98.
12. Lim TY, Lin KK, Wong WL, Aggarwal IM, Yam PK. Surgical and oncological outcome of total laparoscopic radical hysterectomy versus radical abdominal hysterectomy in early cervical cancer in Singapore. Gynecol Min Inv Ther. 2019;8(2): 53–8.
13. Wong J, Ng J. Introduction of robotic surgery for endometrial cancer is associated with lower bill sizes: The experience of a tertiary oncological centre in Singapore. Gynecol Robotic Surg. 2020;1:61–5.
14. Wong JJL, Chan GMF, Low JJH, Ng JS. (2023). A perfect match: the story of robotics in gynaecology. Ann Acad Med, Singapore, 2023;52(6):331-2.
15. Lim PC, Crane JT, English EJ, Farnam RW, Garza DM, Winter ML, et al. (2016). Multicenter analysis comparing robotic, open, laparoscopic and vaginal hysterectomies performed by high-volume surgeons for benign indications. Int Gynecol Obst. 2016;33(3):359–64.
16. Boggess JF, Gehrig PA, Cantrell L, Shafer A, Ridgway M, Skinner EN, et al. A comparative study of 3 surgical methods for hysterectomy with staging for endometrial cancer: robotic assistance, laparoscopy, laparotomy. American Journal of Obstetrics and Gynecol. 2008;199(4):360–9.
17. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;3:72.
18. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa Hospital Research Institute. 2000;2:87
19. Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019;366:l4898.
20. Mehta A, Ng JC, Awuah WA, Huang H, Kalmanovich J, Agrawal A, et al. Embracing robotic surgery in low- and middle-income countries: potential benefits, challenges and scope in the future. Ann Med Surg. 2022;84:104803.
21. Colacurci D, Bifulco G, Ascione M, Shehaj I, Rad MT, Gasimli K, et al. Robotic surgery in gynecology: balancing clinical benefit, cost-effectiveness and accessibility. J Clin Med. 2006;15(10):3628.

**Cite this article as:** Neupane B, Singh A, Heera P, Naik S. Comparative efficacy of robotic assisted versus laparoscopic gynecologic surgery in Southeast Asia: a systematic review. Int J Res Med Sci 2026;14:4746-51.