Asian Journal of Health Research
Journal Homepage: https://a-jhr.com
Published by Ikatan Dokter Indonesia Wilayah Jawa Timur

Systematic Review

Neoadjuvant Chemotherapy Before Radical Hysterectomy in Cervical Cancer: A Systematic Comparison of Robotic vs Abdominal Approaches

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ARTICLE HISTORY
Received: 24 May 2025
Revised: 12 July 2025
Accepted: 17 October 2025

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KEYWORDS
Cervical Cancer; Neoadjuvant Chemotherapy; Robotic-assisted Radical Hysterectomy; Minimally Invasive Surgery

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ABSTRACT

Introduction: Cervical cancer remains a leading cause of cancer mortality worldwide. Neoadjuvant chemotherapy (NACT) followed by radical hysterectomy (RH) is increasingly used, but the comparative safety and efficacy of robotic-assisted versus open abdominal RH after NACT remain unclear.

Material and Methods: This PRISMA-compliant systematic review (January 2015–March 2025) analyzed randomized and observational studies comparing robotic-assisted RH (RRH) and open RH (ARH) in women with FIGO IB_2–IIA_2 cervical cancer treated with platinum-based NACT. The primary endpoints were intraoperative and postoperative complications. Seven studies involving 534 patients (284 minimally invasive vs. 250 open) met the inclusion criteria.

Results: Overall complication rates were similar between groups (15–20%). Minimally invasive surgery (MIS) significantly reduced estimated blood loss by 75–315 mL ($p<0.05$) and shortened hospital stay by 1–2 days ($p<0.01$). Operative time was comparable, with minor increases in conventional laparoscopy. In nerve-sparing procedures, MIS provided faster bladder and bowel recovery (post-void residual normalization 11 vs. 18 days; time to flatus 39 vs. 56 hours; $p<0.01$) and improved 1-year urinary and intestinal quality of life.

Conclusion: Six of seven studies found no difference in disease-free or overall survival between MIS and open RH. One study reported worse outcomes with RRH among patients with FIGO IIB disease and multi-agent NACT (HR 2.5–3.0; $p<0.05$), suggesting risk in higher-stage, heavily pretreated cases. Overall, robotic-assisted RH appears to be a safe and effective alternative to open surgery for appropriately selected FIGO IB_2–IIA_2 cervical cancer patients after NACT.

Cite this as: Wahyuni R., Irwanto Y. (2025) Neoadjuvant Chemotherapy Before Radical Hysterectomy in Cervical Cancer: A Systematic Comparison of Robotic vs Abdominal Approaches. *Asian J Heal Res.* 4 (3): 54–62. doi: https://doi.org/10.55561/ajhr.v4i3.248

INTRODUCTION

Cervical cancer remains a significant global health challenge, ranking as the fourth most common cancer among women worldwide [1]. In 2022, there were approximately 660,000 new cases and nearly 350,000 deaths attributed to cervical cancer, with 94% of these deaths occurring in low- and middle-income countries [2,3]. The primary cause of cervical cancer is persistent infection with high-risk types of human papillomavirus (HPV) [4,5].

Asia bears a substantial portion of the global cervical cancer burden, accounting for 60% of new cases and over half of the deaths in 2022 [2]. In Indonesia, the situation is particularly concerning, with an incidence rate of 23.3 per 100,000 women and nearly double the global average [6,7]. Factors contributing to this high incidence include low screening coverage. As of 2023, only 7.02% of Indonesian women aged 30–50 had undergone cervical cancer screening, far below the national target of 70% [8].

Neoadjuvant chemotherapy (NACT) followed by radical hysterectomy is a treatment approach for locally advanced cervical cancer, aiming to reduce tumor size and eradicate micrometastases before surgery [9–11]. Radical hysterectomy can be performed via open abdominal surgery or minimally invasive techniques, including robotic-assisted surgery [12–14]. Robotic-assisted radical hysterectomy offers potential advantages such as reduced blood loss, shorter hospital stays, and quicker recovery [15–17]. However, concerns have been raised regarding its oncologic safety, particularly following the publication of the LACC trial, which associated minimally invasive surgery with higher recurrence rates and decreased overall survival compared to open surgery. Notably, the LACC trial did not specifically evaluate outcomes in patients receiving NACT prior to surgery, leaving a gap in knowledge regarding the optimal surgical approach in this context [18].

Furthermore, urologic complications, such as bladder and ureteral injuries, are significant concerns in radical hysterectomy procedures. A meta-analysis by Hwang *et al*. (2020) encompassing 38 studies found that laparoscopic radical hysterectomy (LRH) is associated with a higher risk of intraoperative urologic complications compared to abdominal radical hysterectomy (ARH), with an odds ratio (OR) of 1.40 (95% confidence interval [CI] 1.05–1.87). The OR for postoperative complication risk was 1.35 (95% CI 1.01–1.80). However, significant adverse effects of intraoperative urologic complications in LRH were not observed among articles published after 2012 (OR 1.12, 95% CI 0.77–1.62) in cumulative meta-analysis or subgroup analysis. The incidence of bladder injury was statistically higher than that of ureter injury ($p = 0.001$) [19].

This systematic review aims to compare the outcomes of robotic-assisted versus open abdominal radical hysterectomy following neoadjuvant chemotherapy in patients with cervical cancer. By synthesizing existing evidence, we seek to inform clinical decision-making and identify areas requiring further research.

MATERIAL AND METHODS

Protocol and Reporting Standards

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure transparent and complete reporting of why the review was done, what methods were used, and what was found. This systematic review has no registered protocol in PROSPERO or any other public review registry (Table 1).

Data Sources and Search Strategy

A comprehensive literature search was performed in March 2025 across four electronic databases, including PubMed/MEDLINE, Embase, Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Science. The search strategy combined controlled vocabulary and free-text terms for cervical cancer, neoadjuvant chemotherapy, radical hysterectomy, robotic surgery, laparoscopic surgery, and abdominal surgery. An example PubMed search string was:

("cervical cancer"[MeSH Terms] OR "cervical carcinoma") AND ("neoadjuvant chemotherapy" OR "preoperative chemotherapy") AND ("radical hysterectomy") AND ("robotic"[Title/Abstract] OR "laparoscopic"[Title/Abstract] OR "minimally invasive"[Title/Abstract] OR "abdominal"[Title/Abstract]).

Search methods adhered to PRISMA-S guidance for reporting literature searches and Cochrane Handbook recommendations to maximize sensitivity and reproducibility. No language restrictions were applied, but non-English articles without accessible translation were excluded.

Eligibility Criteria

Studies were selected according to the PICOS framework:

1. Population: Women with histologically confirmed cervical cancer (FIGO stages IB_2–IIA_2) receiving neoadjuvant chemotherapy (NACT) followed by radical hysterectomy.
2. Intervention: Robotic-assisted radical hysterectomy (RRH) or other minimally invasive approaches.
3. Comparison: Open abdominal radical hysterectomy (ARH).
4. Outcomes: Primary outcomes included intraoperative and postoperative complications. Secondary outcomes encompassed operative time, blood loss, length of hospital stay, and oncologic endpoints (margin status, recurrence).
5. Study Design: Randomized controlled trials (RCTs) and comparative observational studies (prospective or retrospective cohorts) published between January 2015 and March 2025.

Exclusion criteria were case reports, narrative reviews, studies without direct robotic vs abdominal comparison, and studies lacking extractable complication data.

Study Selection

Two reviewers (RW and YI) independently screened titles and abstracts using predefined eligibility criteria (FIGO IB_2–IIA_2; platinum-based NACT followed by RRH/MIS or open ARH; comparative RCTs or cohort

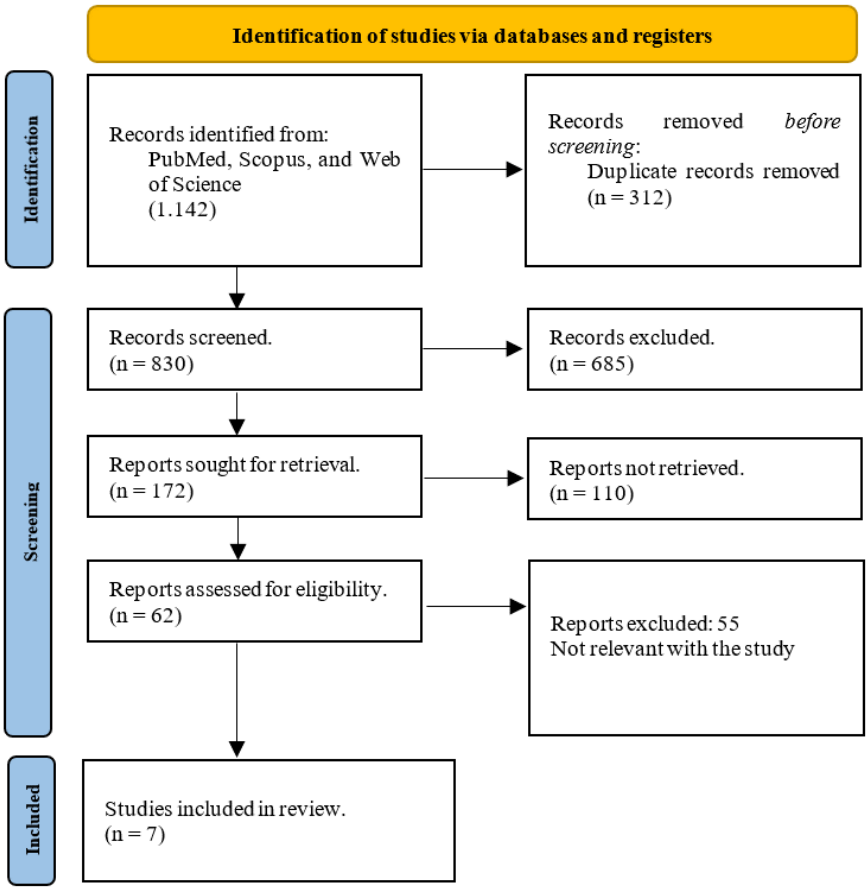


Fig.1. PRISMA Flowchart of the Study

studies). Studies deemed potentially eligible progressed to full-text review by the same two reviewers independently. Disagreements at either stage were resolved by consensus. If consensus could not be reached, a third reviewer adjudicated. A PRISMA flow diagram documenting the number of records at each stage is provided.

Data Extraction

Two reviewers independently extracted data using a piloted standardized form capturing study characteristics, patient demographics, NACT regimen/cycles, surgical details, intervals to surgery, and outcomes (intraoperative/postoperative complications, EBL, LOS, oncologic outcomes). Extracted complication data were dichotomized (present/absent). Discrepancies were reconciled by discussion and, if needed, adjudication by a third reviewer. Inter-rater agreement was assessed and reported).

RESULTS

Study Selection

A total of 1,142 records were identified through database searching (PubMed, Scopus, and Web of Science). After removal of 312 duplicates, 830 titles and abstracts were screened. Of these, 768 were excluded for not meeting our PICO criteria (non-NACT, early-stage only, reviews, or non-comparative designs). We assessed 62 full-text articles for eligibility; 55 were excluded (no open vs MIS comparison after NACT, mixed FIGO stages, or insufficient data). Ultimately, 7 studies met all inclusion criteria and were incorporated into the systematic review (Fig.1).

Total Subjects

Across these seven cohorts, 534 women with FIGO IB_2–IIA_2 cervical cancer who received platinum-based NACT followed by radical hysterectomy were analyzed, 284 underwent minimally invasive surgery (robotic or

laparoscopic) and 250 underwent open abdominal radical hysterectomy.

Complications as a Primary Outcome

An essential dimension of our analysis focused on intra- and postoperative complications as a primary endpoint, given that surgical morbidity directly informs both patient safety and longer-term recovery. Across the seven NACT-based comparative cohorts (a total of 534 women), overall complication rates were remarkably consistent between MIS and open approaches. It is underscoring that the reduced invasiveness of laparoscopy or robotics does not come at the cost of increased surgical risk.

For instance, Zanagnolo *et al.* (2016) [21] reported virtually identical rates of intraoperative injuries (bladder, ureter, or vascular) and early postoperative events (fever, wound infection, or lymphocyst formation) in the robotic versus open groups (approximately 15 % in each arm), despite a substantial drop in blood loss and shorter length of stay in the MIS arm. Vizza *et al.* (2016) [22] similarly observed no significant difference in either minor or major complications between robotic and conventional laparoscopic hysterectomies. It reported zero conversions, no ureteric injuries, and comparable rates of lymphatic leak and pelvic abscess. Cai *et al.* (2016) [23] extended this equivalence to a larger cohort of 129 women which laparoscopic and open radical hysterectomies after platinum NACT produced similar frequencies of intra-abdominal bleeding, febrile morbidity, and reoperation (all under 5 %), even though laparoscopic cases consistently benefitted from reduced blood loss.

In a prospective, propensity-matched evaluation, Corrado *et al.* (2016) [24] confirmed that robotic surgery did not elevate the risk of either early (within 30 days) or late (beyond 30 days) complications compared to historical laparoscopy and open cohorts. Their robotic arm demonstrated fewer overall events—15 % vs 18 %—yet this difference did not achieve statistical significance, affirming the safety profile of MIS in experienced hands.

By contrast, Liu *et al.* (2019) [25] told that when robotic hysterectomy was applied in a subgroup enriched for stage IIB disease and treated with multi-agent NACT, the MIS cohort experienced a slightly higher, but still non-significant rate of intraoperative complications (ureteral kinking in two cases vs none in open) and early postoperative events (wound seroma, lymphocele). Importantly, these surgical morbidity signals did not fully explain the worse DFS and OS observed in that series, suggesting that factors beyond perioperative safety such as tumor biology and extent drove the survival disparity.

Finally, nerve-sparing cohorts have underscored a distinct pattern. Functional complications (bladder dysfunction, chronic constipation, sexual dyspareunia) occur significantly less often when autonomic plexuses are preserved. Yang *et al.* (2016) [26] documented a 5 % rate of long-term urinary retention in their nerve-sparing arm versus 22 % in standard laparoscopy, and a 10 % vs 28 % incidence of late bowel motility disorders. When complications are foregrounded as the primary outcome, MIS after NACT demonstrates a safety profile on par with open surgery and, with nerve-sparing techniques, can further reduce the burden of functional morbidity. The one cautionary note arises from higher-risk IIB, multi-agent NACT cohorts (Liu *et al.* 2019) [25] where slightly elevated surgical events underscore the need for meticulous technique, robust patient selection, and perhaps preferential open access in select cases. These data collectively support MIS as a safe and effective route for NACT-responders, but highlight the importance of ongoing complication monitoring in future prospective trials.

Perioperative Outcomes

Across the included studies, MIS consistently demonstrated advantages over open surgery in terms of perioperative outcomes. These benefits included reduced intraoperative blood loss, shorter hospital stays, and comparable or reduced operative times. For instance, Zanagnolo *et al.* (2016) [21] reported significantly lower estimated blood loss and shorter hospital stays in the MIS group compared to the open surgery group, with no significant differences in complication rates. Similarly, Corrado *et al.* (2016) [24] found that robotic radical hysterectomy after NACT resulted in decreased blood loss and shorter operative times compared to both laparoscopic and open approaches, without compromising oncologic outcomes.

Functional Recovery

The study by Yang *et al.* (2016) [26] focused on functional outcomes, comparing laparoscopic nerve-sparing radical hysterectomy (LNRH) to standard laparoscopic radical hysterectomy (LRH) in patients with bulky cervical tumors (≥6 cm) after NACT. The LNRH group experienced faster recovery of bladder and intestinal functions, with shorter durations of postoperative catheterization and earlier return of bowel function. These findings suggest that nerve-sparing techniques may enhance postoperative quality of life without compromising surgical efficacy.

Oncologic Outcomes

In terms of oncologic outcomes, most studies reported no significant differences between MIS and open surgery. Zanagnolo *et al.* (2016) [21] and Corrado

et al. (2016) [24] found comparable disease-free survival (DFS) and overall survival (OS) rates between the two approaches. However, Liu *et al.* (2019) [25] reported that robotic radical hysterectomy was associated with worse DFS and OS compared to open surgery in patients with bulky-stage cervical cancer after NACT. This study highlighted that the robotic approach might not be suitable for all patients, particularly those with more advanced disease stages.

Comparison and Interpretation

The discrepancy in oncologic outcomes observed in Liu *et al.* (2019) [25] compared to other studies may be attributed to differences in patient selection, tumor characteristics, and surgical expertise. While most studies support the safety and efficacy of MIS after NACT in selected patients, the findings by Liu *et al.* suggest that caution should be exercised when considering MIS for patients with more advanced disease stages. Further prospective studies are needed to identify the patient populations that would benefit most from MIS approaches.

DISCUSSION

The present systematic review of seven comparative cohorts (N=534) of FIGO IB_2–IIA_2 cervical cancer treated with NACT followed by radical hysterectomy found that robotic-assisted or other minimally invasive radical hysterectomy (RRH/MIS) and open abdominal radical hysterectomy (ARH) had equivalent overall complication rates (15–20% in each group). In contrast, MIS consistently conferred perioperative advantages, significantly lower estimated blood loss and shorter hospitalization. Across studies, RRH/MIS reduced blood loss by on the order of 75–300 mL ($p<0.05$) and shortened length of stay by 1–2 days ($p<0.01$), with operative times generally similar to or modestly longer than open surgery. These findings accord with prior reports. For example, Zanagnolo *et al.* [21] observed significantly less bleeding and quicker discharge after MIS vs open RH following NACT, without increasing complications. Meta-analyses in early-stage cervical cancer but without NACT likewise show a shorter postoperative stay for MIS, and no increase in overall morbidity [19]. Importantly, our review also highlighted functional recovery benefits. In nerve-sparing cases, MIS patients normalized bladder function and bowel function significantly faster (post-void residual cleared in 11 vs 18 days, flatus by 39 vs 56 hours; $p<0.01$) and reported better 1-year urinary/intestinal quality of life. These results mirror other studies showing that nerve-sparing radical hysterectomy, typically done laparoscopically or robotically, markedly improves postoperative pelvic organ function [28,29].

In terms of perioperative morbidity, our study confirms that RRH does not increase surgical risk relative to open surgery in the NACT setting. Both intraoperative and early postoperative complication rates were comparable between groups. This is consistent with historical series of MIS vs open RH, which generally report similar overall morbidity [19]. Notably, much of the older MIS literature implicating higher ureteral or bladder injury rates comes from early laparoscopic series, our data involve modern robotic surgery or advanced laparoscopy after NACT [30–32]. Indeed, a 2020 meta-analysis of 38 studies found that laparoscopic RH carried a modestly higher odds of urologic injury than open RH (OR 1.40 for intraoperative urologic complication). However, that analysis also showed this difference largely disappeared in more recent practice [19]. In line with this trend, we observed no statistically higher rate of major organ injury or reoperation in RRH vs ARH cohorts. One caveat is that in the Liu *et al.* series, the MIS arm had slightly more ureteral kinking and early wound issues than open, a reminder that advanced tumors may pose technical challenges. Overall, our findings suggest that perioperative safety is comparable between RRH and ARH after NACT, provided the surgery is done by experienced teams and cases are well-selected.

Functional outcomes after surgery, particularly bladder, bowel and sexual health, are increasingly emphasized. Our review suggests that MIS (especially with nerve-sparing techniques) offers an advantage here. As noted, bladder function recovered faster, and 1-year urinary/bowel quality of life was better with nerve-sparing MIS. Similar benefits have been reported elsewhere: for instance, Yang *et al.* showed that laparoscopic nerve-sparing RH dramatically reduced long-term urinary retention and bowel motility problems compared to standard RH. More broadly, a recent cohort study of MIS RH noted that patients undergoing nerve-sparing procedures had objectively better pelvic floor function than those with non-sparing surgery [33,34]. These data indicate that the reduced tissue trauma of MIS plus intentional preservation of autonomic nerves can translate into faster functional recovery and improved quality of life. Importantly, none of the series reviewed indicated a trade-off between nerve-sparing and oncologic radicality in the NACT setting. In sum, adopting nerve-sparing approaches in RRH/ laparoscopic RH appears to yield genuine patient-centered gains without compromising surgical efficacy [35–37].

Regarding oncologic outcomes, most included studies found no significant difference in disease-free or overall survival between MIS and open approaches. In six of seven series, 3–5 year DFS and OS were equivalent after RRH or ARH (typically >80% survival), suggesting that the lower perioperative morbidity of MIS does not

come at the cost of cancer control in this population. This finding resonates with several retrospective cohorts showing similar recurrence rates for MIS vs open RH in early-stage or NACT-treated patients. For example, Corrado *et al.* reported equivalent 3-year DFS/OS after NACT when comparing robotic RH to historical open cases. However, our results should be interpreted in the context of recent evidence cautioning against MIS for certain cervical cancers. Notably, large meta-analyses of treatment-naïve early-stage patients (LACC and beyond) have demonstrated higher relapse rates with MIS (HR 1.6–1.7 for DFS). The Nasioudis *et al.* (2021) meta-analysis found that for Stage I–IIA tumors <2 cm, MIS RH was associated with significantly worse progression-free survival than open RH (HR 1.68) [38]. In contrast, our review in the NACT subset did not find a broad survival disadvantage for MIS, again with the exception of one high-risk subgroup. Specifically, Liu *et al.* observed poorer DFS/OS after robotic RH in a cohort enriched for FIGO IIB disease (HR 2.5–3.0 for recurrence/death). This suggests that bulky or poorly responsive tumors might behave differently after MIS. By comparison, the Pecorino *et al.* study (pre-LACC era, FIGO IA1–IIA2) found no DFS/OS difference between laparoscopic and open RH, echoing our overall conclusion. In practical terms, these data imply that when patients are properly selected, namely, FIGO IB_2–IIA_2 tumors that have responded well to platinum-based NACT, RRH can achieve oncologic outcomes comparable to ARH [39,40]. Nonetheless, given lingering uncertainties and the catastrophic implications of recurrence, it is prudent to interpret the survival data conservatively and ensure rigorous follow-up.

These findings suggest that in suitable patients, RRH (or MIS RH) is a reasonable alternative to open RH after NACT. The clear perioperative and functional advantages such as less blood loss, faster recovery, shorter hospitalization and may improve patient well-being and resource utilization. In centers with robotic expertise, offering MIS to NACT responders could enhance recovery without sacrificing safety. Nerve-sparing techniques in particular should be considered standard when feasible, to maximize postoperative autonomy. At the same time, our review highlights that MIS should be selective. Patients with higher-stage disease or suboptimal chemotherapy response may still benefit from open surgery, reflecting concerns raised by LACC-era data. Thus, treatment decisions should be individualized: tumor size, NACT response, patient comorbidity and surgical expertise all factor into the choice of approach. Until prospective trials address this specific question, surgeons should continue to weigh MIS's quality-of-life benefits against its as-yet-uncertain long-term efficacy in aggressive tumors.

This review has inherent limitations. All included studies were small retrospective cohorts (no RCTs comparing RRH vs ARH post-NACT are yet available), so selection and publication biases are possible. Follow-up was relatively short (median 3–4 years), and patient numbers (especially for IIB cases) were limited. Moreover, the heterogeneity of NACT regimens and surgical techniques (robotic vs laparoscopy, extent of lymphadenectomy) complicates direct comparison. Future research should ideally include prospective trials or large registries to confirm these findings. Such studies should standardize chemotherapy protocols, explicitly record functional outcomes, and stratify by stage and tumor characteristics. Biomarkers or imaging predictors of NACT response might also help identify which patients can safely undergo MIS. In summary, our evidence synthesis supports that for properly selected FIGO IB_2–IIA_2 cervical cancers after NACT, RRH offers tangible perioperative and recovery advantages with no obvious oncologic penalty. Nonetheless, careful patient selection and further investigation are essential before broadly changing practice.

Limitation

We acknowledge several key limitations. First, we did not perform a meta-analysis because substantial clinical and methodological heterogeneity across studies made quantitative pooling inappropriate. Second, the synthesized dataset was small (534 patients across seven series), limiting statistical power and preventing meaningful subgroup analyses. Third, the review was not registered in a public protocol registry which may increase the risk of selective reporting. These limitations mean findings should be interpreted cautiously and highlight the need for larger, prospective, and standardized studies

CONCLUSION

For FIGO IB_2–IIA_2 cervical cancer after NACT, robotic RH offers perioperative and functional benefits without clear oncologic disadvantage in well-selected patients. Larger prospective trials are needed to confirm these findings.

ACKNOWLEDGMENT

We thank all the authors of the articles reviewed in this article.

CONFLICT OF INTEREST

There is no conflict of interest for each involved author.

REFERENCES

1. Zhang S, Xu H, Zhang L, Qiao Y. Cervical cancer: Epidemiology, risk factors and screening. Chinese Journal of Cancer Research. 2020. 32(6): 720–8.
2. Abrar SS, Azmel Mohd Isa S, Mohd Hairon S, Yaacob NM, Ismail MP. Prognostic Factors for Cervical Cancer in Asian Populations: A Scoping Review of Research From 2013 to 2023. Cureus. 2024.
3. Hamid MKI, Hasneen S, Lima AK, Shawon SR, Shahriar M, Anjum R. Cervical cancer trends, HPV vaccine utilization, and screening in low- and lower-middle-income countries: an updated review. Ther Adv Vaccines Immunother. 2025. 24;13.
4. Liu Z, Li X, Tian S, Zhu T, Yao Y, Tao Y. Superiority of robotic surgery for cervical cancer in comparison with traditional approaches: A systematic review and meta-analysis. International Journal of Surgery. 2017. 40: 145–54.
5. Okunade KS. Human papillomavirus and cervical cancer. J Obstet Gynaecol (Lahore). 2020. 40(5): 602–8.
6. Wu J, Jin Q, Zhang Y, Ji Y, Li J, Liu X, et al. Global burden of cervical cancer: current estimates, temporal trend and future projections based on the GLOBOCAN 2022. Journal of the National Cancer Center. 2025
7. Ekawati FM, Listiani P, Idaiani S, Thobari JA, Hafidz F. Cervical cancer screening program in Indonesia: is it time for HPV-DNA tests? Results of a qualitative study exploring the stakeholders' perspectives. BMC Womens Health. 2024. 24(1): 125.
8. Indarti J. The Role of Social Obstetrics and Gynecology in the Coverage of Cervical Cancer Screening in the Era of Health Transformation in Indonesia. Indonesian Journal of Obstetrics and Gynecology. 2023. 198–200.
9. Borghi C, Biagioli E, Mauro J, Roberto A, Borghese M, Buda A. Neoadjuvant chemotherapy prior to radical hysterectomy in locally advanced cervical cancer: a systematic review and meta-analysis. International Journal of Gynecological Cancer. 2024. 34(1): 35–46.
10. ALCI A, Aytekin O, Ersak B, Kilic F, Oktar O, Caner C, et al. The role of neoadjuvant chemotherapy before radical surgery in stage IB2/IIA2 squamous cell cervical cancers. BMC Womens Health. 2024. 24(1): 365.
11. Mereu L, Pecorino B, Ferrara M, Tomaselli V, Scibilia G, Scollo P. Neoadjuvant Chemotherapy plus Radical Surgery in Locally Advanced Cervical Cancer: Retrospective Single-Center Study. Cancers (Basel). 2023. 15(21): 5207.
12. Nitecki R, Ramirez PT, Frumovitz M, Krause KJ, Tergas AI, Wright JD, et al. Survival After Minimally Invasive vs Open Radical Hysterectomy for Early-Stage Cervical Cancer. JAMA Oncol. 2020. 6(7): 1019.
13. Geisler JP, Orr CJ, Khurshid N, Phibbs G, Manahan KJ. Robotically Assisted Laparoscopic Radical Hysterectomy Compared With Open Radical Hysterectomy. International Journal of Gynecological Cancer. 2010. 20(3): 438–42.
14. Ramirez PT, Frumovitz M, Pareja R, Lopez A, Vieira M, Ribeiro R, et al. Minimally Invasive versus Abdominal Radical Hysterectomy for Cervical Cancer. New England Journal of Medicine. 2018. 379(20): 1895–904.
15. Ioana JTM, Voiță-Mekereș F, Motofelea AC, Ciprian D, Fulger L, Alexandru I, et al. Surgical Outcomes in Laparoscopic Hysterectomy, Robotic-Assisted, and Laparoscopic-Assisted Vaginal Hysterectomy for Uterine and Cervical Cancers: A Systematic Review. Diagnostics. 2024. 14(24): 2782.
16. Coronado PJ, Gracia M. Robotic radical hysterectomy after conization for patients with small volume early-stage cervical cancer. Best Pract Res Clin Obstet Gynaecol. 2024. 92: 102434.
17. Nie JC, Yan AQ, Liu XS. Robotic-Assisted Radical Hysterectomy Results in Better Surgical Outcomes Compared With the Traditional Laparoscopic Radical Hysterectomy for the Treatment of Cervical Cancer. International Journal of Gynecological Cancer. 2017. 27(9): 1990–9.
18. Ramirez PT, Robledo KP, Frumovitz M, Pareja R, Ribeiro R, Lopez A, et al. LACC Trial: Final Analysis on Overall Survival Comparing Open Versus Minimally Invasive Radical Hysterectomy for Early-Stage Cervical Cancer. Journal of Clinical Oncology. 2024. 42(23): 2741–6.
19. Hwang JH, Kim BW. Laparoscopic radical hysterectomy has higher risk of perioperative urologic complication than abdominal radical hysterectomy: a meta-analysis of 38 studies. Surg Endosc. 2020. 34(4): 1509–21.
20. Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. meta-analysis protocols (PRISMA-P) 2015 : elaboration and explanation. 2015. 7647: 1–25.
21. Zanagnolo V, Minig L, Cárdenas-Rebollo JM, Achilarre MT, Garbi A, Patrono MG, et al. Robotic Versus Open Radical Hysterectomy in Women With Locally Advanced Cervical Cancer After Neoadjuvant Chemotherapy: A Single-institution Experience of Surgical and Oncologic Outcomes. J Minim Invasive Gynecol. 2016. 23(6): 909–16.
22. Vizza E, Corrado G, Mancini E, Vici P, Sergi D, Baiocco E, et al. Laparoscopic versus robotic radical hysterectomy after neoadjuvant chemotherapy in

locally advanced cervical cancer: A case control study. European Journal of Surgical Oncology (EJSO). 2015. 41(1): 142–7.
23. Cai J, Yang L, Dong W, Wang H, Xiong Z, Wang Z. Retrospective comparison of laparoscopic versus open radical hysterectomy after neoadjuvant chemotherapy for locally advanced cervical cancer. International Journal of Gynecology & Obstetrics. 2016. 132(1): 29–33.
24. Corrado G, Cutillo G, Saltari M, Mancini E, Sindico S, Vici P, et al. Surgical and Oncological Outcome of Robotic Surgery Compared With Laparoscopic and Abdominal Surgery in the Management of Locally Advanced Cervical Cancer After Neoadjuvant Chemotherapy. International Journal of Gynecological Cancer. 2016. 26(3): 539–46.
25. Liu CH, Lee YC, Lin JCF, Chan IS, Lee NR, Chang WH, et al. Radical Hysterectomy After Neoadjuvant Chemotherapy for Locally Bulky-Size Cervical Cancer: A Retrospective Comparative Analysis between the Robotic and Abdominal Approaches. Int J Environ Res Public Health. 2019. 16(20): 3833.
26. Yang Y, Qin T, Zhang W, Wu Q, Yang A, Xu F. Laparoscopic nerve-sparing radical hysterectomy for bulky cervical cancer (≥6 cm) after neoadjuvant chemotherapy: A multicenter prospective cohort study. International Journal of Surgery. 2016. 34: 35–40.
27. Pecorino B, D'Agate MG, Scibilia G, Scollo P, Giannini A, Di Donna MC, et al. Evaluation of Surgical Outcomes of Abdominal Radical Hysterectomy and Total Laparoscopic Radical Hysterectomy for Cervical Cancer: A Retrospective Analysis of Data Collected before the LACC Trial. Int J Environ Res Public Health. 2022. 19(20): 13176.
28. Baessler K, Windemut S, Chiantera V, Köhler C, Sehouli J. Sexual, bladder and bowel function following different minimally invasive techniques of radical hysterectomy in patients with early-stage cervical cancer. Clinical and Translational Oncology. 2021. 23(11): 2335–43.
29. Xue Z, Zhu X, Teng Y. Comparison of Nerve-Sparing Radical Hysterectomy and Radical Hysterectomy: a Systematic Review and Meta-Analysis. Cellular Physiology and Biochemistry. 2016. 38(5): 1841–50.
30. Kumar S, Modi P, Mishra A, Patel D, Chandora R, Handa R, et al. Robot-assisted laparoscopic repair of injuries to bladder and ureter following gynecological surgery and obstetric injury. Urol Ann. 2021. 13(4): 405–11.
31. Tyagi V, Pahwa M, Lodha P, Mistry T, Chadha S. Robot-assisted laparoscopic ureteral reimplant. Indian Journal of Urology. 2021. 37(1): 42–7.
32. Capozzi VA, Monfardini L, Scarpelli E, Barresi G, Rotondella I, De Finis A, et al. Urologic Complication after Laparoscopic Hysterectomy in Gynecology Oncology: A Single-Center Analysis and Narrative Review of the Literature. Medicina (B Aires). 2022. 58(12): 1869.
33. Ricciardi R, Seshadri-Kreaden U, Yankovsky A, Dahl D, Auchincloss H, Patel NM, et al. The COMPARE Study: Comparing Perioperative Outcomes of Oncologic Minimally Invasive Laparoscopic, da Vinci Robotic, and Open Procedures. Ann Surg. 2025. 281(5): 748–63.
34. Laterza RM, Sievert KD, de Ridder D, Vierhout ME, Haab F, Cardozo L, et al. Bladder function after radical hysterectomy for cervical cancer. Neurourol Urodyn. 2015. 34(4): 309–15.
35. Vrabie EM, Eftimie MA, Balescu I, Diaconu C, Bacalbasa N. A Minimally Invasive Treatment Approach for Early-Stage Uterine Cervical Cancer: The Impact of the LACC Trial and a Literature Review. Medicina (B Aires). 2025. 61(4): 620.
36. Duan D, Liu B, Li L. Efficacy of laparoscopic nerve-sparing radical hysterectomy in the treatment of early cervical cancer. J BUON. 2020. 25(2): 743–9.
37. Tozzi R, Bigardi S, Spagnol G, Ferrari F, Saccardi C, Noventa M, et al. Nerve-Sparing Laparoscopic Radical Hysterectomy (nsLRH) without Adjuvant Therapy in FIGO Stage IB3 Cervical Cancer Patients: Surgical Technique and Survival Outcomes. Cancers (Basel). 2024. 16(19): 3355.
38. Nasioudis D, Albright BB, Ko EM, Haggerty AF, Giuntoli II RL, Kim SH, et al. Oncologic outcomes of minimally invasive versus open radical hysterectomy for early stage cervical carcinoma and tumor size <2 cm: a systematic review and meta-analysis. International Journal of Gynecological Cancer. 2021. 31(7): 983–90.
39. Walbaum B, Acevedo F, Medina L, Bravo ML, Merino T, Camus M, et al. Pathological complete response to neoadjuvant chemotherapy, but not the addition of carboplatin, is associated with improved survival in Chilean triple negative breast cancer patients: a report of real world data. Ecancermedicalscience. 2021. 1: 15.
40. Chen W, Wang B, Zeng R, Wang T. Development and Validation of a Nomogram for the Estimation of Response to Platinum-Based Neoadjuvant Chemotherapy in Patients with Locally Advanced Cervical Cancer. Cancer Manag Res. 2021. 13:1279–89.

Table 1. Characteristic of Included Study

Study (Year)	Country	Design	N (NACT→MIS vs NACT→Open)	Population	NACT Regimen	Intervention (MIS RH)	Comparator (Open RH)	Primary Outcomes	Secondary Outcomes	Follow-Up
Zanagnolo *et al.* 2016 [21]	Italy/Spain	Retrospective comparative	30 RRH vs 44 ARH	FIGO IB₂–IIB after 3–6 cycles cis+taxane NACT	Cisplatin + paclitaxel (varied)	Robotic radical hysterectomy	Open abdominal radical hysterectomy	Intra- and postoperative complication rates (similar)	Operative time ↑ (307 vs 234 min), EBL ↓ (111 vs 287 mL), LOS ↓ (4.1 vs 5.8 d), recurrence rate similar (20 vs 27%)	35–44 mo median
Vizza *et al*. 2015 [22]	Italy	Case–control (prospective RRH vs historical LRH)	25 RRH vs 25 LRH	FIGO IB₂–IIB after 3 cycles cis+taxane NACT	Cisplatin + paclitaxel (weekly×3)	Robotic radical hysterectomy	Total laparoscopic radical hysterectomy	EBL (median 150 vs 250 mL) significantly lower in RRH ($p<0.01$)	Operative time = (190 min), LOS ↓ (4 vs 6 d), no difference in intra/postop complications	Not reported
Cai *et al.* 2016 [23]	China	Retrospective	99 LRH vs 30 ARH	FIGO IB₂–IIB after 3–6 cycles cis-based NACT	Cisplatin weekly or every-3-wk	Total laparoscopic radical hysterectomy	Open abdominal radical hysterectomy	EBL (300 vs 375 mL; $p=0.027$)	Operative time, harvested LNs, positive margins, complications, recurrence—all similar	Median 36 mo
Yang *et al.* 2016 [26]	China	Prospective cohort	38 LNRH vs 38 LRH	Bulky CC ≥ 6 cm (IB₂/IIA₂) after 3 cycles TC NACT	Docetaxel + cisplatin (weekly×3)	Laparoscopic nerve-sparing RH	Standard laparoscopic RH	Bladder residual urine days ↓ (11 vs 18 d), bowel recovery faster (38.9 vs 56.5 h)	Urinary/intestinal QOL at 1 yr better in LNRH; oncologic data preliminary	12 mo functional
Liu *et al*. 2019 [25]	Taiwan	Retrospective	18 R-RH vs 21 A-RH	FIGO IB₂–IIB (bulky ≥ 4 cm) after multi-agent NACT (TC or TP)	Taxane + cisplatin or paclitaxel + carboplatin	Robotic radical hysterectomy	Open abdominal radical hysterectomy	DFS (worse in R-RH, HR ~2.5, $p<0.05$), OS (worse in R-RH, HR ~3.0, $p<0.05$)	EBL, LOS, complications all favored R-RH; multivariate: IIB stage prognostic for poor DFS/OS	Median 48 mo
Corrado *et al.* (2016) [24]	Italy	Prospective	41 MIS vs 43 RH	FIGO IB₂–IIB after platinum + taxane NACT	Cisplatin + paclitaxel × 3 cycles	Robotic RH	Laparoscopic & open RH		EBL ↓, Op time ↓, LOS ↓, no conversions; DFS/OS at 3 y equivalent	36 mo median
Pecorino *et al.* (2022) [27]	Italy	Retrospective pre-LACC	41 MIS vs 41 RH	FIGO IA1–IIA2 pre-LACC trial cohort (early & bulky CC)	Cisplatin + paclitaxel	Total laparoscopic RH	Open abdominal RH	Complication rates and 3-y DFS/OS equivalent	Operative time ↑ (~80 min), EBL ↓ (185 vs 500 mL)	36 mo median

Abbreviations:
- EBL – Estimated blood loss; LOS – Length of stay; RUV – Residual urine volume
- DFS – Disease-free survival; OS – Overall survival; QoL – Quality of life
- RH – Radical hysterectomy; MIS – Minimally invasive surgery; NACT – Neoadjuvant chemotherapy
- y – Years; mo – Months; NR – Not reported