



A Systematic Review of New Techniques and Advancements in Gynecological Procedures

Authors

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Abstract

Introduction: Minimally invasive surgery (MIS) has gained global acceptance due to benefits like reduced pain, shorter hospital stays, and quicker recovery. Techniques like single-incision laparoscopic surgery (SILS), also known as laparo-endoscopic single-site surgery (LESS), and natural orifice transluminal endoscopic surgery (NOTES) are advancing, aided by robotic systems.

Material and Methods: This systematic review followed PRISMA guidelines 2020, searching various databases for recent articles. Exclusions encompassed pediatric age groups and non-English publications.

Results: Following a comprehensive search across PubMed, Medline, and Google Scholar using terms such as minimal invasive surgeries, robotics in gynecology, LESS, and NOTES, 52,857 articles were initially identified. After rigorous screening and applying specific criteria, 8 articles were selected for a systematic review based on their alignment with inclusion criteria and quality assessment.

Conclusion: Minimally invasive surgeries in gynecology benefit patients and healthcare systems by reducing postoperative complications and hospital stays. Advanced training enables their use in treating gynecological malignancies.

Keywords- MIS, NOTES, LESS, Gynecology, Invasive

Introduction

There have been wide adoption and acceptance for minimal invasive surgeries (MIS) globally. It is due to advantages over traditional laparotomy as there is less postoperative pain, shorter hospital stays, faster postoperative recovery, improved cosmetic outcomes, fewer wound-related complications^[1,2]. Further the evolution from laparotomy to laparoscopy has broadened to include even less invasive techniques, such as single-incision

laparoscopic surgery (SILS), also known as laparo-endoscopic single-site surgery (LESS), and natural orifice transluminal endoscopic surgery (NOTES). SILS achieves access through an abdominal approach using a trans-umbilical single incision. By contrast, NOTES uses the natural orifices of the body surface, such as the mouth and the vagina, as surgical channels of endoscopy to avoid incision scars on the abdominal wall^[3].

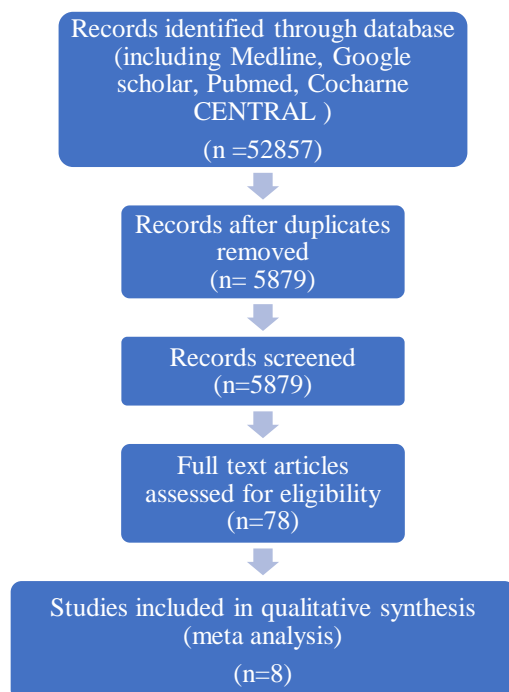
During the past decade, minimal invasive surgeries, including NOTES, have become popular, and most surgeons have begun using these procedures [4].

In two decades, adoption of minimally invasive surgery has greatly increased with implementation of the robotic platform since its 2005 FDA approval in gynecologic surgery.

Methods

This review focuses on the recent advances in minimal invasive surgeries in gynecology. We excluded the pediatrics age group and the publications that were in language other than English. The review follows the guidelines for Preferred items for Systematic reviews and Meta analysis (PRISMA) for 2020 and only uses the data collected from published papers, eliminating the need for ethical approval. (Figure 1)

Figure 1 : Identification of records



Systematic Literature Search and Study Selection

We conducted a thorough search for relevant publications by using Pubmed, including Medline and Google Scholar. We searched for studies mentioned in review papers, editorials, and commentaries on Pubmed. We continued searching

for additional studies that satisfied our inclusion criteria.

We had a list of abstracts that we independently reviewed for inclusion using specific criteria. The criteria included human studies, in age group > 18 years, published in English language and within last 10 years.

Results

After searching through three selected databases, Pubmed, Medline, Google Scholar we extracted 52857 articles. ‘The search terms included minimal invasive surgeries in gynecology’, ‘robotics in gynecology’ acronyms like ‘LESS’, ‘NOTES’. We further applied specific criterias, which led to excluding 46,978 articles. From the remaining 5879 papers, we chose not to utilize 5871 of them due to unsatisfactory titles or abstracts. We examined the remaining 78 papers and excluded 69 more as they did not meet our inclusion criteria. Finally, we conducted thorough quality check on remaining 8 articles which met are criteria. The eight articles were included in our final systematic review.[Table number 1]

Table number 1: Overview of Selected Research Studies

Author/Year	Country	Study Design	Data base used	Conclusion
Jiang D et al ⁵ / 2021	China	Retrospective study	Pubmed	They aim to estimate the safety and feasibility of laparo-endoscopic single-site surgery (LESS) in pregnant patients with acute abdomen. They concluded that the feasibility and efficacy of laparoscopic surgery during pregnancy is similar between single- or multiport routes, however, the single-port route may be associated with less postoperative pain, shorter hospital stay, and lower anxiety.
Sandburg EM et al ⁶ / 2017	Netherland	Systematic review and Metanalysis	Google Scholar	They aim to assess the safety and effectiveness of LESS compared to conventional hysterectomy to assess the safety and effectiveness of LESS compared to conventional hysterectomy. They concluded that the single-port technique for benign hysterectomy is feasible, safe, and equally effective compared to the conventional technique.
Koo YJ ⁴ / 2018	Korea	Systematic review	Pubmed	This study aims to provide a recent-updates on the clinical outcomes of minimally invasive procedures in gynecologic diseases. It concluded that majority of surgical outcomes were equivalent between LESS and MLS, except for the longer operative time required for LESS than for MLS for both adnexal surgery and hysterectomy.
Terzi H. et al ⁷ /2018	Turkey	Case Report	Google Scholar	The aim of this study was to demonstrate a new hybrid NOTES technique in gynecology which can be used for hysterectomy and salpingo-oophorectomy in patients with adnexal pathology and multiple operation histories. It was concluded that Hybrid V-NOTES is superior to laparoscopy assisted vaginal hysterectomy (LAVH) as it uses only natural orifices, safer to perform for patients who have had previous surgeries and adnexal masses, because it provides direct visualization of the abdominal cavity.

Yoshiki N. ³ /2017	Japan	Systematic review	Pubmed	The aim of this article was to review the published literature on transvaginal NOTES in gynecology. It concluded that using transvaginal NOTES by applying the method of SILS via the vaginal route, not only adnexal surgery and hysterectomy, but also myomectomy and oncologic surgery could be performed safely and effectively
Ertan AK et al ⁸ / 2011	Germany	Retrospective Study	Pubmed	It concluded that the robotic assisted minimal invasive surgery has the potential to revolutionize the existing standards of the gynecological surgical procedures, especially the oncological interventions, both by a largely elimination of postoperative morbidity and by preservation of the radicality and principles of oncological surgery.
Alkatout I et al ⁹ / 2023	Switzerland	Meta analysis	Pubmed	It aim to summarize the advantages and main limitations to a broader adoption of robotic-assisted surgery compared to laparoscopic surgeries in gynecology. It concluded that there is going to be continued exponential growth in the use of RAS for gynecological procedures in the coming years, along with the implementation of cutting-edge technological advances driven by accelerated research in artificial intelligence.
Moore MS et al ¹⁰ /2023	USA	Retrospective Review	Google scholar	Its objective was to evaluate the peri- and postoperative complication rates in patients age 65 years or above in minimally-invasive robotic gynecologic surgery. It was concluded that older patients who are candidates for robotic assisted minimally invasive surgery should be given special consideration as robotic assisted surgery becomes more integrated into patient care algorithms.

Discussion

NOTES surgery is a minimally invasive technique which improves cosmetic outcomes and reduces surgical injury. Also, it shortens the recovery time and reduces postoperative pain. In fact, because hybrid V-NOTES is performed through natural orifices, it decreases the inflammatory and neuroendocrine responses

The clinically relevant benefits and risks of LESS could vary according to the individual institution or surgeon. Although an indication of LESS is very uncertain and is largely dependent on the skill and preference of the operating surgeon, it is suggested that LESS should be avoided as an initial experience of surgeons for more complex surgeries, such as large ovarian cystectomy,

surgery for severe endometriosis. After the adoption of the da Vinci Surgery robotic platform in gynecology, there has been an increase in hysterectomy performed by robotic assisted hysterectomy. A large number of women have benefitted from minimally invasive hysterectomy by robotics because the robot is an easy to learn, rapidly adopted, minimally invasive tool. Moreover, the available literature highlights the statistical limitation of the analysis as well as the major differences in the surgical techniques and the equipment used among the various Minimal invasive surgeries.

Although extensive experience with minimally invasive surgery for benign conditions has already been accumulated. However, future well-designed large-scale research is necessary to determine the effectiveness of LESS as well as R-LESS and NOTES for gynecologic malignancies. An indication and absolute contraindication should also be ascertained before the widespread use of these procedures.

New technologies are even often adopted in surgical oncology subspecialties before randomized trials are conducted to confirm their safety and efficacy. There is widespread adoption of minimally invasive radical hysterectomy for early-stage cervical cancer, which was largely based on individual clinical experiences, expert opinion, and retrospective institutional studies. [11-13]

LESS and NOTES represent pivotal advancements in minimally invasive surgery. Overcoming initial technical challenges, these techniques benefit from recent technological innovations such as robotic surgical systems, versatile multi-channel ports, and advanced articulating instruments, which have significantly enhanced their feasibility and applicability. [4]

Conclusions

Minimal invasive surgeries are boon in gynecology. It benefits both the patient and health care system at large. MIS has been shown to reduce blood loss, minimize postoperative complications

and pain, shorten hospital stays, and promote faster recovery. [14,15] Although more training and expertise are required to perform these surgeries. With the advancement in training to surgeons, these surgeries can be taken up for treating gynecological malignancy too.

Acknowledgement

I extend my gratitude to Dr. Aagman Dhadwal for his significant contribution in designing this paper. He has helped me in coming up with a relevant topic for systematic review. I acknowledge his efforts for drafting this article. He has helped me in coming up with different search strategies and databases to be used in this article. He has helped me in providing relevant ways to conduct the methods used in this article. Furthermore, joint efforts of us both were used in writing manuscript of this article. He diligently reviewed the entire article, ensuring the identification and rectification of any writing or grammatical errors and it was the combined efforts of us both that helped in development of this article. Furthermore, it is essential that we both has provided our final approval for manuscript publication and also have voluntarily accepted accuracy and authenticity of the work demonstrating our commitment to being accountable for its scholarly content.

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