International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Manchanda R et al. Int J Reprod Contracept Obstet Gynecol. 2026 Jan;15(1):395-403
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20254320

Review Article

Complication trends in gynecologic endoscopy: a global registry review

Rahul Manchanda, Ruchika Gupta*, Roshini Arunaa

Department of Gynaecology Endoscopy, PSRI Hospital, New Delhi, India

Received: 19 November 2025
Revised: 11 December 2025
Accepted: 11 December 2025

***Correspondence:**
Dr. Ruchika Gupta,
E-mail: dr.ruchikagupta15@gmail.com

ABSTRACT

Minimally invasive gynecologic surgery (MIGS) has expanded substantially over the past decade, supported by technological advances, structured surgical training, and enhanced perioperative care pathways. Although MIGS offers clear benefits over laparotomy, clinically significant complications—including vascular, bowel, and urinary tract injuries in laparoscopy and uterine perforation, fluid overload, and gas embolism in hysteroscopy—remain important contributors to morbidity. Earlier literature, primarily derived from single-centre retrospective studies, was limited by inconsistent definitions and incomplete reporting, prompting greater reliance on national and multinational registries to capture real-world outcomes. This narrative review synthesises evidence from registry analyses, large administrative databases, and institutional audits published between 2015 and 2025 to evaluate complication patterns, risk factors, and prevention strategies in gynecologic laparoscopy and hysteroscopy. Across datasets, advanced age, elevated BMI, prior abdominal surgery, high ASA class, prolonged operative duration, and increased procedural complexity consistently emerged as risk factors. Preventive measures—including structured skills training, simulation-based crisis preparation, intraoperative monitoring standards, device- and technique-specific safeguards, and ERAS-based perioperative protocols—were associated with improved safety. Despite these gains, substantial heterogeneity persists in complication definitions, follow-up intervals, coding standards, and case-mix adjustment across registries, contributing to under-reporting and limiting meaningful international benchmarking. Harmonised reporting frameworks, unified definitions, minimum dataset requirements, and integrated cross-disciplinary reporting structures are essential to improving surveillance, guiding training and credentialing, and strengthening global quality-improvement efforts in gynecologic endoscopy.

Keywords: Minimally invasive gynecology, Gynecologic laparoscopy, Hysteroscopy, Endoscopic surgery, Registries, Complications, Quality improvement

INTRODUCTION

Minimally invasive gynecologic surgery (MIGS) has transformed operative practice by offering reduced postoperative pain, shorter hospital stay, and faster recovery compared with laparotomy.[1] With advancements in laparoscopic imaging systems, electrosurgical technologies, and hysteroscopic fluid-management platforms, increasingly complex procedures can now be performed safely across benign and oncologic indications.[1,2] Although MIGS demonstrates a favourable safety profile, complications such as vascular, bowel, and urinary tract injuries in laparoscopy and uterine perforation or fluid overload in hysteroscopy continue to pose important clinical challenges.[2] Early institutional audits have further demonstrated variability in reporting and under-recognition of operative injuries due to inconsistent documentation and fragmented coding systems.[3] Mortality analyses highlight that despite the overall safety of minimally invasive techniques, delayed recognition of visceral or vascular trauma can contribute to rare but serious fatal outcomes.[4]

Narrative reviews of life-threatening complications emphasise that events such as major haemorrhage, massive fluid overload, gas embolism, and circulatory collapse, although infrequent require systematic surveillance and consistent reporting across operative settings.[5] Technical reviews similarly underline that variability in entry techniques, energy-modality use, and procedural difficulty contributes to heterogeneity in complication profiles across institutions.[6] Foundational prospective hysteroscopy studies established the importance of structured postoperative follow-up and standardised criteria for capturing perforation, bleeding, and fluid-related complications.[7] These observations informed subsequent European efforts to harmonise definitions across centres, leading to proposed minimum datasets and unified categorisation of intraoperative versus postoperative events.[8] In parallel, the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) introduced a validated 30-day outcome framework that enables risk adjustment and modelling of postoperative morbidity, including complications after laparoscopic hysterectomy.[9]

Given the increasing complexity of MIGS, the variability in institutional practices, and the methodological limitations inherent in earlier single-centre reports, synthesising contemporary registry-based evidence is essential. This review integrates data from 2015–2025 to describe complication patterns, identify modifiable risk factors, evaluate reporting heterogeneity, and outline strategies to strengthen safety and standardisation in gynecologic laparoscopy and hysteroscopy.

METHODS

Design

This narrative review emphasizes data derived from clinical registries and large national or international databases reporting outcomes of gynecologic laparoscopy and hysteroscopy from 1 January 2015 to 31 December 2025. The review follows best practices for evidence synthesis of registry data and adheres, where applicable, to PRISMA principles for structured literature searching and transparent reporting.

Data sources and search strategy

A comprehensive search of PubMed/MEDLINE, Embase, Scopus, and Web of Science was conducted using combinations of the following keywords: “laparoscopy” OR “hysteroscopy” OR “minimally invasive gynecology” AND “complication” OR “adverse event” OR “mortality” OR “conversion” AND “registry” OR “database” OR “national surgical quality” OR “NSQIP” OR “audit” OR “surveillance”. Major surgical and specialty registries, including national quality databases, were queried for publicly available reports or associated publications addressing gynecologic endoscopy outcomes. Grey literature sources included professional society reports, conference abstracts, government hospital episode statistics, and industry technical briefs. Reference lists of included articles were screened for additional eligible studies.

Inclusion and exclusion criteria

Studies were included if they reported registry-based or large-database data on complications related to gynecologic laparoscopy or hysteroscopy and provided numerical estimates of complication rates, risk factors, or temporal trends. Excluded sources comprised case reports, small single-centre case series (<50 patients without registry linkage), and studies that did not present complication outcomes relevant to gynecologic endoscopy.

Data extraction and synthesis

For each eligible publication, data were extracted on registry name, country or region, years covered, procedures included, sample size, definitions of complications, rates of major adverse events (vascular or visceral injury, hemorrhage requiring transfusion or reoperation, thromboembolism, anaesthetic-related events, mortality), conversion rates, and reported risk factors or mitigation strategies. Temporal trends were tabulated when available, and findings were synthesized narratively. Owing to methodological heterogeneity across registries—particularly in complication definitions and data capture—statistical pooling was not undertaken. Instead, the review presents descriptive ranges, trend directions, and contextual interpretation of observed variability.

Quality assessment

The methodological quality of included registry reports was appraised using an adapted Joanna Briggs Institute (JBI) checklist for observational data and registry reliability criteria. Specific domains assessed included clarity of outcome definitions, case ascertainment methods, completeness of follow-up, and transparency of reporting. Limitations inherent to registry data—such as underreporting, coding inconsistencies, and variability in data validation—are acknowledged and discussed.

LANDSCAPE OF REGISTRIES AND DATA SOURCES

The systematic recording and evaluation of complications in gynecologic endoscopy rely heavily on the availability of robust, well-structured databases. Over the last decade, a progressive shift has occurred from anecdotal reporting and single-institution audits toward organized national and multinational registries designed to capture real-world outcomes. These registries form the cornerstone of contemporary surgical quality improvement by enabling longitudinal trend analysis, benchmarking, and the identification of modifiable risk factors.

Among the most comprehensive models is the Norwegian Gynaecological Endoscopic Registry (NGER), one of the earliest structured, web-based national systems for endoscopic data collection. It records demographic characteristics, procedural complexity, intraoperative events, and postoperative outcomes using standardized electronic questionnaires completed approximately four weeks after surgery. Building on this experience, Putz et al. proposed the creation of a broader European Operative Registry to harmonize definitions, facilitate cross-country comparison, and promote uniform documentation of adverse events in operative gynecology.[8] Such multinational registries exemplify the movement toward data-driven transparency and international collaboration in surgical governance.

Complementing these regional efforts, large-scale quality improvement programs such as the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) have demonstrated the power of prospectively collected, risk-adjusted datasets. NSQIP's rigorously validated methodology—based on standardized preoperative variables, intraoperative parameters, and 30-day outcomes—has been instrumental in developing predictive models for laparoscopic hysterectomy. Using this database, Pepin et al. identified significant predictors of complications, including advanced age, elevated body mass index (BMI), prior laparotomy, and prolonged operative time, thereby providing clinicians with quantifiable preoperative risk assessment tools.[9]

At the national and institutional levels, administrative and hospital-based registries continue to contribute essential complementary data. A decade-long audit from a United Kingdom NHS district general hospital integrated multiple data sources, including electronic theatre records, a gynecology complications register, and clinical governance logs, to identify major vascular, bowel, and urinary tract injuries.[3] Similarly, descriptive multicenter or institutional audits remain vital in characterizing the spectrum and mechanisms of complications. Large observational studies—such as the Spanish cohort of 2,888 laparoscopic procedures and the Indian tertiary-centre audit—have documented the incidence of intraoperative and postoperative events, associations with surgical difficulty, and conversion rates to laparotomy.[1,2] Although such datasets are inherently limited in generalizability, they provide valuable procedural granularity often absent from administrative databases.

Beyond morbidity surveillance, registry data contribute significantly to mortality tracking and device-safety evaluation. A systematic review of benign laparoscopic and robotic gynecologic surgeries by Behbehani et al. utilized aggregated registry and manufacturer-linked data to estimate mortality rates and emphasized the importance of early recognition of visceral or vascular injuries.[4] These findings reinforce how registry-based surveillance complements post-marketing vigilance systems to enhance patient safety.

Specialized analyses from perioperative and intraoperative reviews further highlight the cross-disciplinary value of registry data. Hemdan et al. underscored that life-threatening events—such as venous air embolism and fluid overload during hysteroscopy—are consistently captured through structured reporting systems, thereby informing anesthetic precautions and multidisciplinary response strategies.[5] Complementing this, Giorgi et al. demonstrated that standardized reporting frameworks and centralized databases are pivotal to transforming isolated intraoperative experiences into system-level learning to prevent future complications.[6] Narrative syntheses of catastrophic cases similarly illustrate how individual events, when aggregated through registries, contribute to broader system-level safety improvements.[5]

Collectively, these registries and audits illustrate both the progress and limitations inherent in global complication reporting. Large national programs such as NSQIP offer methodological rigor and statistical power but may lack the procedure-specific detail provided by specialty registries. Conversely, single-institution audits provide rich qualitative insights at the expense of external validity. Across these studies, persistent challenges include heterogeneity in complication definitions, inconsistent follow-up intervals, and incomplete case ascertainment.[2-8] Overcoming these barriers requires harmonization of data elements, universal adoption of minimum datasets, and integration of electronic reporting systems within routine surgical pathways.

Ultimately, the consolidation of data from multiple registries—ranging from local hospital audits to multinational databases—forms the foundation for meaningful global benchmarking in gynecologic endoscopy. These collective efforts across Europe, North America, and Asia have established a framework through which future research can refine classification systems, standardize reporting, and strengthen preventive strategies for surgical complications worldwide.

DEFINITIONS AND STANDARDIZATION ISSUES ACROSS REGISTRIES

Accurate comparison of complication rates in gynecologic laparoscopy and hysteroscopy requires robust and standardised definitions across registries. However, the literature demonstrates substantial heterogeneity in how complications are defined, graded, and captured, creating significant barriers to cross-study interpretation and global benchmarking. This inconsistency contributes to wide variation in reported complication rates even when procedures and populations appear comparable.[2,3]

One of the major challenges arises from differences in classification frameworks. Many studies utilise a binary major–minor categorisation, commonly defining major complications as visceral or vascular injuries, severe haemorrhage, or events requiring laparotomy, while minor complications include wound issues or postoperative

infections. This dichotomous system is used in several large retrospective audits, including the Spanish 12-year review of 2,888 laparoscopies, which classifies visceral, urological, and vascular injuries as major events and postoperative wound or bleeding complications as minor ones.1 Similarly, the Pune tertiary-centre audit applies an analogous major/minor framework and highlights how differing interpretations of visceral injury severity may alter classification and reported incidence.[2]

Another important source of variability stems from timing-based definitions. Some authors distinguish immediate intraoperative events from early postoperative complications, whereas others report them as a single composite category. Narrative reviews of hysteroscopic complications describe "immediate" events—such as uterine perforation, haemorrhage, electrolyte disturbances, and venous air embolism—separately from "late" complications including infection, adhesions, or subsequent uterine rupture.[5] Temporal separation, however, is not universally applied across registries, making cross-registry comparison challenging.

Large national or multicentre data systems further illustrate definitional inconsistencies. The Norwegian Gynecological Endoscopic Registry (NGER) defines complications based on intraoperative findings and postoperative questionnaire follow-up, incorporating both technical and patient-related adverse events; importantly, NGER includes socioeconomic modifiers as risk variables, which are absent in many other datasets.[8] In contrast, the American NSQIP program applies a strict 30-day postoperative surveillance window and employs composite outcome measures such as readmission, reoperation, transfusion, or prolonged operative duration.[9] This broader surveillance framework may yield higher complication estimates compared to narrowly injury-based registries.

Differences in coding practices and under-reporting further exacerbate non-standardisation. The UK NHS 10-year review of laparoscopic complications observed that retrospective datasets frequently miss adverse events because of inconsistent hospital coding, clinician under-reporting, and medico-legal concerns, thereby obscuring the "true" incidence of major injuries.[3] Such systemic limitations mean that complications meeting registry criteria may not be captured at all, undermining data fidelity.

A further methodological challenge is the inconsistent application of severity-grading systems such as the Clavien–Dindo classification. Although some European registries incorporate formal severity scales, others rely solely on the presence or absence of a complication. The European operative registry proposal emphasised that without harmonised definitions and uniform grading, regional variation cannot be accurately attributed to patient-, surgeon-, or system-level factors and will instead reflect definitional artefacts.[8]

The cumulative result is a fragmented landscape in which similar injuries may be categorised differently across registries, generating artificial variability in reported complication rates. This lack of standardised terminology limits international benchmarking and hampers efforts to advance global surgical safety. Moving toward universally adopted definitions—encompassing injury type, severity, timing, and management consequences—will be essential for developing interoperable registries and improving the comparability of gynecologic endoscopy outcomes worldwide.

RISK FACTORS IDENTIFIED ACROSS REGISTRIES

Understanding determinants of complications in gynecologic endoscopy requires synthesis of evidence from registry analyses, institutional audits, and narrative reviews. Across datasets, risk factors are consistently grouped into four domains such as patient-related, procedure-related, surgeon and team-related, and system-level, each contributing independently and synergistically to overall complication risk.

Patient-level factors

Registry-based analyses and large national databases consistently identify comorbidity burden and physiologic reserve as major determinants of perioperative risk. The Norwegian registry (NGER) demonstrated that obesity (BMI >35), diabetes mellitus, cardiovascular disease, and hypertension were independent predictors of postoperative complications, and additionally showed that low educational status correlated with higher reoperation rates, suggesting socioeconomic factors influence surgical outcomes.8 NSQIP-derived models likewise identified age, BMI, ASA class, and prior laparotomy as key predictors of composite complications following laparoscopic hysterectomy.[9] Findings from single-centre audits reinforce these trends: both the Spanish cohort and the Pune audit reported higher complication and conversion rates among older patients and those with previous abdominal surgery.[1,2] Narrative reviews further highlight that patients with limited cardiopulmonary reserve or immuno-compromised states may exhibit reduced tolerance to pneumoperitoneum, prolonged Trendelenburg positioning, and anaesthetic stresses, predisposing them to hemodynamic instability and delayed recovery.[5]

Procedure-related factors

Procedure complexity, operative duration, and specific intra-abdominal or intrauterine exposures are consistently associated with higher complication rates. Registries report increased conversions and intraoperative injuries during technically challenging procedures such as myomectomy, advanced endometriosis excision, or oncology operations; NGER specifically lists myomas and cancer procedures among categories with elevated

conversion risk.[8] Institutional series from Spain and Pune similarly identified technical difficulty and prolonged operative time as predictors of both intraoperative and postoperative complications.[1,2] Several narrative and registry-based reviews emphasise the mechanistic contributors to harm such as trocar entry trauma, thermal injury, and distension-media absorption highlight that extended operative duration and elevated distension pressures significantly increase the risk of electrolyte disturbances, fluid overload, and embolic phenomena, particularly during hysteroscopic procedures.[5,6]

Surgeon and team factors

Operator experience, credentialing, and the functionality of the operative team consistently emerge as key determinants of endoscopic safety. Multiple audits and reviews document the learning-curve effect, wherein less experienced surgeons exhibit higher rates of mechanical injury, haemorrhage, and conversion during early phases of training; conversely, high-volume surgeons and centres demonstrate lower complication rates attributable to technical proficiency and standardized workflows.[1,2] NSQIP-based analyses indirectly account for surgeon and team effects by incorporating variables such as prior abdominal surgery and uterine weight into predictive models, reflecting the influence of procedural planning and case selection on outcomes.[9] Narrative syntheses underscore the importance of structured simulation, formal credentialing, and inter-professional team training in reducing adverse events and improving response to intraoperative crises.[5,6]

System-level factors

Systemic and organisational determinants also exert substantial influence on measured complication rates. National registries such as NGER reveal regional variation attributable to differences in hospital size, procedure mix, referral patterns, and resource distribution.[8] The UK NHS 10-year audit highlighted persistent risks of under-reporting arising from inconsistent hospital coding practices and variable local reporting cultures, demonstrating that system-level factors such as governance structures, data capture processes, and medico-legal environments substantially affect documented incidence.[3] Narrative reviews further emphasise the role of infrastructure and perioperative pathways, including equipment availability, standardization of instruments and pressure-regulation systems, perioperative protocols such as fluid management and thromboprophylaxis, and the presence of multidisciplinary escalation frameworks, all of which influence both the likelihood of complications and the timeliness of their recognition and management.[5,6]

Interaction and multilevel effects

The literature highlights that these risk domains rarely act in isolation. For example, an obese patient (patient factor) undergoing a complex myomectomy with prolonged operative duration (procedure factor), performed by a less-experienced surgeon (surgeon factor) in a low-volume institution with limited reporting infrastructure (system factor), faces substantially elevated complication risk. Registries capable of integrating patient comorbidity, procedural detail, and institutional characteristics such as NGER and NSQIP are uniquely positioned to model these interaction effects and generate clinically actionable risk prediction tools.[8,9]

INTERVENTIONS AND PREVENTION STRATEGIES REPORTED ACROSS REGISTRIES AND REVIEWS

Preventive strategies identified across registry analyses, institutional audits, and narrative reviews emphasise structured perioperative optimisation, enhanced intraoperative monitoring, technical safeguards, and systematic team-based responses. These measures align closely with the mechanisms of injury and complication profiles documented in laparoscopic and hysteroscopic practice.[1,5,6]

Preoperative optimisation and physiological preparation

Narrative reviews of life-threatening complications highlight that rigorous preoperative preparation including optimisation of cardiovascular status, correction of anaemia, and stabilisation of comorbidities substantially reduces the risk of intraoperative haemodynamic instability and postoperative ICU admission. Hemdan et al. emphasise the importance of physiological preparation, particularly for high-complexity laparoscopic and hysteroscopic procedures.[5] These recommendations are consistent with registry-based findings demonstrating that patient comorbidity significantly shapes perioperative risk profiles.[8,9]

Continuous intraoperative monitoring

Hemdan et al underscore continuous monitoring of haemodynamics, oxygen saturation, and end-tidal CO_2 as critical tools for the early detection of concealed haemorrhage, venous gas embolism, cardiovascular collapse, and other catastrophic events during endoscopic surgery.[5] Such monitoring is especially important during prolonged procedures and those involving elevated intra-abdominal or intrauterine pressures.

Anaesthesia-specific measures in hysteroscopy

An anaesthetic management plays a key preventive role in operative hysteroscopy. Elahmedawy et al detail essential precautions, including strict fluid-deficit surveillance, careful selection of distension media, adherence to safe intrauterine pressure thresholds, and vigilance for electrolyte disturbances and venous air embolism.[10] These measures are supported by early prospective hysteroscopy data documenting perforation, haemorrhage, and fluid-

related complications as principal causes of morbidity.[7] Simulation-based multidisciplinary training further enhances safety by improving teamwork, situational awareness, and coordinated crisis response.

Hemdan et al note that simulation reduces delays in recognising and managing life-threatening events such as vascular injury, massive haemorrhage, or circulatory collapse during hysteroscopy and laparoscopy.[5]

INSTITUTIONAL SAFETY FRAMEWORKS AND REPORTING SYSTEMS

Technical and device-related safeguards

Technical precision remains central to preventing intraoperative injury. Giorgi et al provide detailed practical safeguards for laparoscopic surgery, including controlled trocar-insertion angles, continuous visualisation during entry, safe pneumoperitoneum-establishment techniques, and energy-modality–specific precautions to reduce thermal injury.[6]

In hysteroscopy, Elahmedawy et al describe essential device- and technique-related safety measures such as pressure-regulated infusion systems, continuous fluid-deficit tracking, and adherence to thermal safety parameters to prevent perforation, embolism, and electrolyte imbalance.[10] The importance of hysteroscopic safety is further reinforced in guidelines from professional societies, which emphasise appropriate distension-media selection, controlled pressure settings, and structured procedural protocols.[12-14]

Capozzi et al further demonstrate that adherence to ERAS-compliant perioperative pathways—including appropriate antibiotic prophylaxis, normothermia maintenance, chlorhexidine skin preparation, and early catheter removal—significantly reduces infectious complications in laparoscopic gynecologic oncology.[15]

ERAS-BASED PERIOPERATIVE PATHWAYS

Registry reporting heterogeneity and data quality issues

Substantial heterogeneity characterises how gynecologic endoscopy registries and institutional audits define, capture, and report complications, resulting in marked variability in published complication rates and limiting meaningful cross-registry comparison. This variation arises from inconsistent case definitions, differing classification frameworks, uneven follow-up durations, variation in coding practices, incomplete datasets, and diverse institutional reporting cultures. Early observational studies demonstrated that complication capture varies widely depending on institutional definitions and follow-up protocols.[2,7] Large institutional audits have further revealed significant under-reporting caused by fragmented coding systems, incomplete electronic records, and inconsistent clinician documentation.[3] Catastrophic complications are particularly vulnerable to misclassification, with mortality analyses showing that deaths from vascular or bowel injury or perioperative collapse may bypass routine surgical registries and instead be recorded in anaesthetic or medico-legal systems.[4-10] Narrative reviews similarly note that events such as major haemorrhage, fluid overload, and gas or air embolism are often captured outside standard surgical datasets, leading to underestimation of their true incidence.[5] Technical reviews further highlight that non-standardised terminology for entry injuries, thermal complications, and procedural difficulty complicates inter-study comparisons.[6]

The lack of harmonised definitions and reporting frameworks is reinforced by international registry initiatives and professional guidelines. The European operative registry proposal identified substantial variability across centres in defining major versus minor injuries, intraoperative versus postoperative events, and reoperations, underscoring the need for unified data elements.[8] Broader national datasets such as NSQIP introduce an additional layer of inconsistency by using composite 30-day outcomes that differ markedly from procedure-specific definitions used in endoscopy-focused registries.[9] Professional guidance from the AAGL, Polish Society, ISGE, and ESGE has attempted to standardise terminology for morcellation-related complications, hysteroscopic injury classification, and procedural complexity, yet adoption of these definitions remains inconsistent across practice settings.[11-14] ERAS-compliant studies also show that postoperative infectious morbidity may vary across institutions not only due to genuine differences in quality, but also because of variation in documentation intensity and surveillance practices.[15] Anaesthesia-focused literature also highlights that discipline-specific reporting silos hinder reliable capture of complications such as hyponatraemia, venous air embolism, and circulatory collapse.[10-16]

Differences in follow-up modality further distort complication capture: NSQIP mandates 30-day assessment, whereas European registries rely on shorter questionnaire-based intervals, and office-based or ambulatory hysteroscopy frequently lacks structured follow-up.[17,18] As a result, delayed bowel injury, postoperative infection, and metabolic complications may be inconsistently reported. Variation in case mix adds another layer of complexity; centres performing advanced endometriosis, oncologic procedures, or complex myomectomies inevitably report different risk profiles than those performing predominantly diagnostic procedures, and without adjustment for procedural difficulty, apparent differences may merely reflect differences in institutional activity.[13,14] Prevention-focused hysteroscopy literature further highlights the need for consistent classification of adverse events to support meaningful benchmarking.[19]

Finally, rare but important complications including false passage during hysteroscopy may be inconsistently documented or omitted, further compromising data fidelity.[20]

Collectively, these limitations demonstrate that despite progress in structured data collection, international benchmarking remains constrained by heterogeneous definitions, uneven follow-up, variable case mix, and fragmented reporting pathways. Harmonised frameworks including standardised complication definitions, minimum dataset requirements, integrated cross-disciplinary reporting, and unified severity-grading systems are essential to improving the interpretability, reliability, and comparability of global gynecologic endoscopy data.

RECOMMENDATIONS FOR A STANDARDISED REPORTING AND SAFETY FRAMEWORK

Establish unified definitions and classification systems for endoscopic complications

Early laparoscopic and hysteroscopic studies demonstrated wide variation in defining vascular, visceral, and perforation-related injuries, which impairs cross-centre comparison.[1,2] Institutional audits further confirm that inconsistent classification of major versus minor complications leads to under-recognition of significant events.[3] Mortality analyses highlight the need for uniform definitions to ensure catastrophic events such as delayed bowel injury or vascular trauma are consistently captured.[4] Professional guidance from the AAGL and European societies likewise emphasises uniform terminology for morcellation-related risks, hysteroscopic injuries, and procedural complexity.[11-14] Harmonised definitions across registries are therefore essential to ensure reliability and comparability of outcomes.

Mandate procedure-specific core datasets and standardised reporting elements

Catastrophic event reviews stress the need to capture physiologic complications such as gas embolism, fluid overload, and electrolyte disturbances, which may otherwise be missed without mandatory intraoperative and postoperative documentation fields.[5] Laparoscopic safety reviews similarly highlight critical data elements including trocar entry method, pneumoperitoneum technique, and energy-modality parameters that should be standardised across registries.[6] For hysteroscopy, guideline-based frameworks emphasise routine documentation of distension pressure, media type, and cumulative fluid deficit as part of a minimum dataset to prevent under-reporting.[7,12,13]

Adopt a standardised follow-up timeframe with clear thresholds for capturing delayed complications

Institutions differ widely in follow-up timelines, from immediate postoperative assessment to structured 30-day surveillance. The NSQIP model provides a strong template for standardised 30-day follow-up that reliably captures sepsis, readmission, delayed bowel injury, and thromboembolism.[9] Shorter intervals used in institutional audits and national hysteroscopy registries (e.g., questionnaire follow-up at 2–4 weeks) risk missing delayed complications such as perforation sequelae, electrolyte imbalance, or infection.[7,17,18] A consistent follow-up window is therefore essential to improve data completeness and comparability.

Embed case-mix and procedural complexity adjustment into registry analysis

Evidence consistently demonstrates that complication rates differ by indication and complexity. Advanced endometriosis, oncologic surgery, large-fibroid myomectomy, and technically demanding hysteroscopic resections carry higher risk profiles.[1,2,13,14] Without adjustment for such factors, inter-institutional comparisons are misleading. European registry proposals emphasise that risk-adjusted reporting is essential to distinguish genuine quality variation from differences in case mix.[8]

Strengthen institutional governance, coding accuracy, and cross-disciplinary reporting pathways

Under-reporting in institutional audits is frequently linked to fragmented coding systems, incomplete theatre records, and inconsistent clinician reporting.[3] Anaesthesia and ICU-based reviews show that severe physiological events such as embolism, circulatory collapse, or hyponatraemia often enter anaesthetic or critical-care reporting systems but not surgical registries.[10,16,19] Mortality audits similarly reveal that catastrophic injuries may exit the surgical domain entirely and be documented via medico-legal systems.[4] Integrated, cross-disciplinary reporting pathways are therefore foundational to capturing the true incidence of complications.

PRIORITY INTERVENTIONS TO IMPROVE SAFETY IN GYNECOLOGIC ENDOSCOPY

Advance surgeon training through structured skill progression and credentialing

Early laparoscopic series and multi-institutional audits consistently demonstrate that surgeon experience significantly reduces visceral and vascular injury rates.[1,2] Credentialed training in suturing, hemostasis, hysteroscopic resection, and safe entry techniques has been shown to decrease conversions, operative time, and major complications.

Implement simulation-based crisis training and multidisciplinary drills

Life-threatening complication reviews underscore the value of simulation in preparing surgical and anaesthetic

teams to respond to hemorrhage, embolic events, cardiovascular collapse, and uterine perforation.[5] Device- and technique-focused reviews also recommend simulation for improving safe trocar entry, energy use, and intraoperative troubleshooting.[6]

Enforce procedure-specific safety checklists and intraoperative monitoring standards

Checklists for entry technique, instrument counts, energy settings, and fluid management improve consistency and reduce preventable errors.[4,5] Hysteroscopy-specific guidelines emphasise monitoring of intrauterine pressure, media type, fluid deficit, and electrolytes to prevent overload, embolism, and hyponatraemia.[7,10,12,17]

Integrate device- and technique-specific safeguards into routine practice

Evidence-based recommendations include controlled visual entry, appropriate trocar angulation, safe pneumoperitoneum techniques and energy-modality precautions to reduce thermal spread and organ damage.[16] Hysteroscopic prevention guidelines stress regulated pressure systems, accurate deficit tracking, and device selection tailored to uterine cavity dimensions to minimise perforation risk.[12-14]

Apply ERAS and perioperative optimisation pathways to reduce morbidity

ERAS programmes have demonstrated reduced infectious complications, shorter hospital stay, and improved postoperative recovery through structured interventions such as antibiotic prophylaxis, normothermia maintenance, early catheter removal, avoidance of drains, and early mobilisation.[15] ERAS principles can be extended to benign laparoscopic procedures to improve overall perioperative safety.

Enhance detection and management of rare but serious events

Cases of false passage formation, severe hyponatraemia, embolic phenomena, and bowel or vascular injury remain under-recognised without vigilant monitoring and standardised reporting.[7,18-20] Targeted education, rapid escalation pathways, and multidisciplinary review mechanisms are essential to improving recognition and reducing long-term harm.

CONCLUSION

Large-scale registries and institutional audits over the past decade have substantially enriched understanding of complication patterns in gynecologic laparoscopy and hysteroscopy. While complication rates remain low overall, registry evidence consistently identifies patient comorbidity, procedural complexity, operative duration, and surgeon experience as major determinants of risk. The parallel emergence of structured skills training, simulation-based crisis preparation, ERAS protocols, and device-specific safeguards has contributed to safer operative environments and improved perioperative recovery.

Nonetheless, the capacity of registries to drive meaningful benchmarking is hindered by persistent heterogeneity in complication definitions, inconsistent follow-up intervals, variability in coding practices, and fragmented reporting pathways particularly for rare catastrophic events. Contemporary professional guidelines offer frameworks for standardisation, yet widespread implementation remains incomplete. As MIGS continues to expand into more complex surgical domains, strengthening registry methodology is imperative.

Unified definitions, mandatory core datasets, consistent surveillance windows, and incorporation of case-mix and procedural complexity into routine reporting are critical to enhancing data reliability. Integration of cross-disciplinary reporting spanning surgical, anaesthetic, and critical-care systems will be essential to fully capture physiologic and life-threatening complications. Future research should leverage registry linkage to evaluate the real-world impact of preventive strategies and training interventions.

By advancing standardised reporting and improving the fidelity of global datasets, the field can better refine risk-stratification tools, augment surgeon training, and strengthen perioperative pathways, ultimately enhancing patient safety in minimally invasive gynecologic surgery.

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

REFERENCES

1. Fuentes MN, Rodríguez-Oliver A, Rilo JCN, Paredes AG, Romero MTA, Parra JF. Complications of laparoscopic gynecologic surgery. JSLS. 2014;18(3):e2014-00058.
2. Shastri S, Singh A, Darawade S, Manwani S. Complications of gynaecologic laparoscopy: An audit. Int J Reprod Contracept Obstet Gynecol. 2018;7(12):4870–6.
3. Moores KL, Bentick B. Gynaecological laparoscopic injuries: a 10-year retrospective review at a District General Hospital NHS Trust. Gynecol Surg. 2016;13(2):125–30.
4. Behbehani S, Suarez-Salvador E, Buras M, Magtibay P, Magrina J. Mortality rates in benign laparoscopic and robotic gynecologic surgery: a systematic review and meta-analysis. J Minim Invasive Gynecol. 2020;27(3):603–12.
5. Hemdan M, Helaly M, Idris H, Alosta M. From Theatre to Intensive Care: A Narrative Review of Life-Threatening Complications in Gynaecological

Laparoscopy and Hysteroscopy. Cureus. 2025;17(10):e95649.
6. Giorgi M, Schettini G, La Banca L, Cannoni A, Ginetti A, Colombi I, et al. Prevention and Treatment of Intraoperative Complications During Gynecological Laparoscopic Surgery: Practical Tips and Tricks—A Narrative Review. Adv Ther. 2025;42(5):2089–117.
7. Jansen FW, Vredevoogd CB, Van Ulzen K, Hermans JO, Trimbos JB, Trimbos-Kemper TC. Complications of hysteroscopy: a prospective, multicenter study. Obstet Gynecol. 2000;96(2):266-70.
8. Putz A, Bohlin T, Rakovan M, Putz AM, De Wilde RL. European operative registry to avoid complications in operative gynecology. Best Pract Res Clin Obstet Gynaecol. 2016;35:113–23.
9. Pepin KJ, Cook EF, Cohen SL. Risk of complication at the time of laparoscopic hysterectomy: a prediction model built from the National Surgical Quality Improvement Program database. Am J Obstet Gynecol. 2020;223(4):555.e1-7.
10. Elahmedawy H, Snook NJ. Complications of operative hysteroscopy: an anaesthetist's perspective. BJA Educ. 2021;21(7):240–2.
11. Worldwide AA. AAGL practice report: morcellation during uterine tissue extraction. J Minim Invasive Gynecol. 2014;21(4):517-30.
12. Zimmer M, Pomorski M, Kamiński P, Doniec J, Huras H, Sieroszewski P, et al. Polish Society of Gynecologists and Obstetricians Guidelines for the application of hysteroscopy in gynecology. Ginekol Pol. 2019;90(8):482-9.
13. Loddo A, Djokovic D, Drizi A, De Vree BP, Sedrati A, van Herendael BJ. Hysteroscopic myomectomy: the guidelines of the International Society for Gynecologic Endoscopy (ISGE). Eur J Obstet Gynecol Reprod Biol. 2022;268:121-8.
14. Clark TJ, Antoun L, Sardo AD, Tanos V, Huirne J, Bousma EW, Smith-Walker T, et al. European Society for Gynaecological Endoscopy (ESGE) Good Practice Recommendations on surgical techniques for Removal of Fibroids: Part 2 Hysteroscopic Myomectomy. Facts Views Vis Obgyn. 2024;16(4):383-97.
15. Capozzi VA, De Finis A, Scarpelli E, Gallinelli A, Monfardini L, Cianci S, et al. Infectious complications in laparoscopic gynecologic oncology surgery within an ERAS-Compliant setting. J Pers Med. 2024;14(2):147.
16. Gupta N, Gupta A. Complications during hysteroscopy for gynecological procedures: prevention is better than cure!. Korean J Anesthesiol. 2019;73(1):79–80.
17. Jeong N, Cho A, Koo YJ, Ahn JW, Park H, Lee ES, et al. Clinical practice in office hysteroscopy. Obstet Gynecol Sci. 2025;68(3):175-85.
18. Lach A, Wilczak M, Malinger A, Nowak A, Piekarski P, Mruczyński A, et al. Assessment of Pain Complaints and Perioperative and Delayed Complications of Hysteroscopy Performed Under Local Anesthesia—A Retrospective Analysis. J Clin Med. 2025;14(16):5646.
19. Aas-Eng MK, Langebrekke A, Hudelist G. Complications in operative hysteroscopy–is prevention possible?. Acta Obstet Gynecol Scand. 2017;96(12):1399-403.
20. Hota T, Abuzeid OM, Raju R, Holmes J, Hebert J, Abuzeid MI. Management of false passage complication during operative hysteroscopy. Middle East Fertility Society J. 2022;27(1):11.

Cite this article as: Manchanda R, Gupta R, Arunaa R. Complication trends in gynecologic endoscopy: a global registry review. Int J Reprod Contracept Obstet Gynecol 2026;15:395-403.