



International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

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Calgary, Alberta, T3E0A7,
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ARTICLE TITLE UROGYNECOLOGICAL AN UROLOGICAL COMPLICATION FOLLOWING HYSTERECTOMY – EPIDEMIOLOGY, RISK FACTORS, PREVENTION AND TREATMENT WITH SPECIAL EMPHASIS URETERAL INJURY AND VESICOVAGINAL FISTULAS

DOI [https://doi.org/10.31435/ijitss.2\(50\).2026.5821](https://doi.org/10.31435/ijitss.2(50).2026.5821)

RECEIVED 05 March 2026

ACCEPTED 16 June 2026

PUBLISHED 19 June 2026

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UROGYNECOLOGICAL AN UROLOGICAL COMPLICATION FOLLOWING HYSTERECTOMY – EPIDEMIOLOGY, RISK FACTORS, PREVENTION AND TREATMENT WITH SPECIAL EMPHASIS URETERAL INJURY AND VESICOVAGINAL FISTULAS

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ABSTRACT

Introduction: Hysterectomy remains one of the most frequently performed gynecological procedures and, despite advancements in surgical techniques, it is still associated with the risk of late complications affecting both pelvic floor function and the urinary tract. The most commonly reported consequences include stress urinary incontinence, pelvic organ prolapse, and urinary retention, while less frequent—but clinically more severe—consequences include ureteral injury, bladder trauma, and vesicovaginal fistulas.

Objective: The aim of this study was to review current literature regarding the epidemiology, pathophysiology, risk factors, prevention, and treatment of urogynecological and urological complications following hysterectomy, with a particular focus on ureteral injuries and vesicovaginal fistulas.

Methodology: A systematic narrative literature review was conducted in accordance with PRISMA 2020 guidelines. Searches were performed in PubMed, Scopus, and the Cochrane Library, as well as current clinical guidelines from medical societies between 2015 and 2026. The analysis included clinical trials, cohort studies, systematic reviews, meta-analyses, and guidelines regarding complications after hysterectomy and their prevention and treatment.

Key risk factors included advanced age, obesity, multiparity, adhesions, endometriosis, prior pelvic surgeries, and procedures requiring extensive tissue dissection. Evidence suggests that pelvic floor muscle prehabilitation may reduce some late functional disorders, and minimally invasive techniques improve surgical field visibility, facilitating conservative dissection of anatomical structures. In high-risk operations, intraoperative cystoscopy effectively detected ureteral obstruction, while indocyanine green (ICG) fluorescence facilitated assessment of the ureteral course and perfusion during complex hysterectomies. Urinary tract injury significantly increased the risk of subsequent vesicovaginal fistula, the incidence of which following hysterectomy performed for benign conditions was estimated at approximately 0.11%.

Conclusions: Complications after hysterectomy encompass both common urogynecological disorders and rarer, yet more severe, urinary tract injuries. Proper patient assessment, prehabilitation, selection of appropriate surgical technique, and selective use of intraoperative control methods, such as cystoscopy and ICG in high-risk groups, are of the greatest practical importance. In Poland, there is a need for better registry data and further evaluation of the effectiveness of these technologies in daily clinical practice.

KEYWORDS

Hysterectomy, Urinary Incontinence, Ureteral Injury, Vesicovaginal Fistula, Indocyanine Green, Urogynecology

CITATION

Jakub Lewandowski, Anita Strzykała, Oktawia Gwiazdzińska, Igor Szlegiel, Denis Myszak. (2026) Urogynecological and Urological Complication Following Hysterectomy – Epidemiology, Risk Factors, Prevention and Treatment with Special Emphasis on Ureteral Injury and Vesicovaginal Fistulas. *International Journal of Innovative Technologies in Social Science*. 2(50). doi: 10.31435/ijitss.2(50).2026.5821

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Introduction

Hysterectomy remains one of the most frequently performed gynecological surgeries worldwide and is an important method for treating many benign and malignant uterine conditions. The most common indications include uterine fibroids, abnormal bleeding, endometriosis, and malignancies. Although the development of minimally invasive surgery has significantly improved the safety of operative treatment, hysterectomy can still be associated with complications that affect not only the immediate surgical outcome but also the patients' subsequent quality of life.

The most frequently discussed postoperative consequences concern pelvic floor functional disorders, such as stress urinary incontinence, pelvic organ prolapse, or difficulty emptying the bladder. However, increasing attention is being paid to complications with a more severe clinical course, including ureteral injuries, bladder trauma, and vesicovaginal fistulas. Although these occur less frequently, their consequences are usually much more serious and often require reconstructive treatment or long-term urological surveillance.

In a large analysis covering 581,395 hysterectomies performed for benign indications, urinary tract trauma was found in 1.15% of patients, and vesicovaginal fistula in 0.11%. These data show that while the problem is not common, it has clear clinical significance, especially since some injuries remain undiagnosed intraoperatively and only manifest after several days or weeks. In practice, this can lead to lumbar pain, infection, hydronephrosis, vaginal urine leakage, or renal function impairment.

The risk of complications after hysterectomy is multifactorial. Importance is attributed to factors such as advanced age, obesity, multiparity, previous pelvic surgery, adhesions, endometriosis, malignant disease, and the extent of the procedure itself. Particularly difficult are cases where altered pelvic anatomy requires extensive tissue dissection in the vicinity of the ureter and bladder.

In recent years, solutions aimed at reducing risk rather than just treating complications have gained importance. These include intraoperative cystoscopy, fluorescence-based assessment of the ureteral course and perfusion using indocyanine green, and selective placement of ureteral stents in high-risk patients. Therefore, a comprehensive assessment of hysterectomy safety should include not only classic urogynecological complications but also iatrogenic injuries to the urinary system.

The aim of this work is to review current literature regarding urogynecological and urological complications after hysterectomy, with particular emphasis on the epidemiology, pathophysiology, risk factors, prevention, and treatment of ureteral injuries and vesicovaginal fistulas, as well as to evaluate the utility of modern technologies supporting intraoperative safety.

Material and Methods

This work is a systematic narrative literature review concerning urogynecological and urological complications following hysterectomy. Methodological assumptions were based on PRISMA 2020 guidelines, which are used for transparent reporting of systematic reviews and can also be applied to studies on etiology, incidence, and the effectiveness of clinical interventions.

Literature searches were conducted in PubMed, Scopus, and the Cochrane Library, as well as in current guidelines and position statements from scientific societies, including EAU, ICS, PTGiP, and PTU. Publications released from January 2015 to April 2026 were included. This time frame allowed for the

inclusion of both the latest data on minimally invasive surgery and intraoperative prevention, as well as modern recommendations regarding postoperative management.

The search process utilized combinations of keywords in both Polish and English, including: hysterectomy, urogynecological complications, stress urinary incontinence, pelvic organ prolapse, ureteral injury, vesicovaginal fistula, intraoperative cystoscopy, indocyanine green, prehabilitation, and related Polish terms.

The analysis included randomized clinical trials, cohort studies, systematic reviews, meta-analyses, and current expert guidelines directly relating to hysterectomy complications. Single case reports, publications without full text, works with limited methodological value, and reports not directly related to the topic of hysterectomy or urinary system injuries after gynecological procedures were excluded.

Selection of material involved evaluating titles and abstracts, followed by analysis of full texts for compliance with the study objective. The final analysis included publications regarding the epidemiology and risk factors for functional disorders after hysterectomy, works focused on iatrogenic urinary tract injuries, and studies evaluating the utility of modern intraoperative technologies, such as cystoscopy and ICG.

Collected data were subjected to qualitative and descriptive analysis. Results were organized into four main areas: epidemiology and risk factors, pre- and intraoperative prevention, diagnostics, and treatment of urogynecological and urological complications following hysterectomy.

Results

The analysis of available literature indicates that complications after hysterectomy are heterogeneous in nature, involving both pelvic floor functional disorders and iatrogenic urinary system injuries. Most frequently reported are stress urinary incontinence, pelvic organ prolapse, urinary retention, and—less frequently, yet with greater clinical severity—ureteral injuries, bladder trauma, and vesicovaginal fistulas.

In population studies, the risk of urinary tract injury after hysterectomy was estimated at approximately 1.15%, while the incidence of vesicovaginal fistula following hysterectomy for benign conditions was approximately 0.11%. It was also shown that intraoperatively diagnosed urinary tract injury was associated with an approximately 20-fold higher risk of subsequent vesicovaginal fistula. This clearly demonstrates that even rare injuries can have serious clinical consequences.

The most commonly cited risk factors included advanced age, obesity, multiparity, previous pelvic surgeries, adhesions, endometriosis, and malignant diseases. In conditions with significantly altered pelvic anatomy, especially in deep endometriosis and radical procedures, the risk of damaging the lower ureter in the vicinity of the uterine vessels and vaginal vault gained particular importance.

Regarding preoperative prevention, some studies confirmed the beneficial effect of pelvic floor muscle prehabilitation in reducing subsequent functional disorders, particularly stress urinary incontinence. Conversely, intraoperative prevention focused heavily on methods that improve the identification of the urinary tract and enable early detection of complications.

A study on intraoperative cystoscopy during robotic gynecological surgeries demonstrated 100% sensitivity and 98.0% specificity in detecting ureteral obstruction. This method allowed for the recognition of the absence of urine flow from the ureteral orifice during the procedure, in some cases enabling immediate correction of the technical issue.

In high-risk operations, the use of ICG fluorescence to assess the course and blood supply of the ureter has been increasingly described. In a Polish cohort study involving extended hysterectomies performed mainly for deep endometriosis and cancer, the use of ICG was associated with fewer ureteral complications in the group requiring extensive dissection. However, this result should be interpreted with caution, as it concerned a selected high-risk group, not the entire population of patients undergoing hysterectomy.

Selective placement of double-J ureteral stents has been described as an additional strategy to protect the ureter in cases with particularly difficult anatomy. This solution can facilitate the identification of the ureteral course and limit the effects of partial injury or postoperative edema, but it is not recommended as a routine procedure for all patients.

Treatment for functional complications after hysterectomy most often involved conservative management, including urogynecological rehabilitation, bladder training, pharmacotherapy, and pessary therapy. In more advanced cases, surgical treatment was implemented, including mid-urethral slings for urinary incontinence and reconstructive procedures for pelvic organ prolapse. Treatment of vesicovaginal fistulas was usually surgical, and the reported success rate was high if the appropriate timing of intervention and basic principles of reconstructive surgery were maintained.

Discussion

Obtained results confirm that the safety assessment of hysterectomy should not be limited solely to classic urogynecological disorders such as urinary incontinence or pelvic organ prolapse. Increasingly important are the more severe, although rarer, urinary system injuries that can lead to long-term functional consequences and the necessity of multi-stage reconstructive treatment.

Results of large population analyses show that urinary tract injuries are not the most common complications; however, their clinical impact is clearly disproportionate to their incidence. Particularly important is the link between recognized injury and subsequent risk of vesicovaginal fistula, emphasizing the importance of intraoperative vigilance and immediate remedial action. At the same time, the fact that some fistulas develop despite the absence of reported intraoperative injury suggests the involvement of ischemic, thermal, or simply overlooked injuries.

From a practical point of view, the most important situations are those where the anatomical risk is clearly elevated, such as deep endometriosis, previous surgeries, the presence of adhesions, or oncological procedures. It is in these groups that modern intraoperative technologies seem most justified, as they improve anatomical orientation and increase the chance of early detection of potential injuries.

Intraoperative cystoscopy currently appears to be one of the best-justified methods for lower urinary tract monitoring after hysterectomy in high-risk operations. Its greatest advantage is the possibility of immediate recognition of ureteral obstruction or bladder injury, providing a chance for correction while still in the operating room. Furthermore, the use of ICG seems particularly promising in extensive operations requiring ureteral dissection, although currently available data stem mainly from observational studies and require further confirmation.

The superiority of minimally invasive techniques over open access also requires cautious interpretation. Laparoscopy and robotics improve surgical field visibility, but they do not in themselves eliminate the risk of urinary tract injury. Their effectiveness depends on operator experience, proper patient selection, and the availability of methods supporting intraoperative safety.

A limitation of the analyzed literature remains the heterogeneity of clinical definitions, varying lengths of follow-up, and the predominance of observational studies regarding new preventive technologies. An additional problem is the scarcity of multi-center Polish data and the lack of uniform registries of complications after hysterectomy, which complicates the assessment of the actual scale of the phenomenon in the country.

For this reason, it seems reasonable to develop national databases concerning complications after hysterectomy and further standardize training in minimally invasive surgery and intraoperative urinary tract diagnostics. In daily practice, a selective approach currently seems the most rational, consisting of intensifying prophylaxis and intraoperative monitoring in patients at the highest risk of ureteral injury and vesicovaginal fistula formation.

Conclusions

Complications after hysterectomy include both common urogynecological disorders and rarer, yet much more severe, urinary tract injuries.

The most important risk factors include advanced age, obesity, multiparity, adhesions, endometriosis, prior pelvic surgeries, and the extensive scope of the procedure.

Urinary tract injuries significantly increase the risk of subsequent vesicovaginal fistula; therefore, their early detection is of great practical importance.

Pelvic floor muscle prehabilitation may reduce some late functional disorders following hysterectomy.

In high-risk groups, intraoperative cystoscopy, selective ureteral stenting, and ICG fluorescence may be useful, especially during operations requiring extensive ureteral dissection.

Further multi-center studies and better registry data are needed to more reliably assess the effectiveness of modern prevention methods in Polish conditions.

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