International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Hota BM et al. Int J Reprod Contracept Obstet Gynecol. 2026 Jun;15(6):2060-2064
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20261609

Original Research Article

Analysis of iatrogenic bladder injury in benign hysterectomy and risk factors in a tertiary care hospital

Basanta Manjari Hota*, Naimisha Movva, Geetha Lokam, Kavitha Bakshi

Department of Obstetrics and Gynaecology, Mamata Medical College, Khammam, Telangana, India

Received: 29 March 2026
Revised: 12 May 2026
Accepted: 13 May 2026

***Correspondence:**
Dr. Basanta Manjari Hota,
E-mail: drmanjarihota@gmail.com

ABSTRACT

Background: Hysterectomy is the most common major gynecological surgery, and iatrogenic bladder injury is the commonest visceral injury during the procedure. High morbidity, economic, and legal implications are expected if not diagnosed and managed intra-operatively. Though the high-risk factors increase the incidence of this complication in benign hysterectomy, it may occur without any risk factor. This study was aimed at finding the incidence of iatrogenic bladder injury in benign hysterectomy, the risk factors and their significance level, and to discuss the methods to avoid this complication.
Methods: This retrospective observational cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Mamata Medical College and Hospital, Khammam, over four years, including all gynecological hysterectomy cases for benign indications, excluding obstetric and malignant cases. All the relevant data predicting iatrogenic bladder injury, and also no risk cases, were collected from the medical records of the institution. Statistical analysis was done by standard descriptive statistics, frequency tables, and percentages for categorical variables using Microsoft excel-2021. The significance of risk factors was assessed by calculating p values, ORs, and 95% CIs. A $p<0.05$ was considered significant.
Results: Total abdominal hysterectomy (TAH) was the major approach (72.04%) of surgery. The overall incidence of bladder injury was 01.09%. and such injury occurred in 01.51% in TAH, as all the 19 cases of bladder injury occurred in this approach. The maximum number (n=11) of bladder injury occurred in post-caesarean cases (p=0.0041), followed by pelvic inflammation (n=06) with a p=0.0450.
Conclusions: Thorough knowledge of regional anatomy, risk factor assessment, careful and sharp dissection, and supervision by a surgeon of high volume will reduce the incidence of bladder injury in hysterectomy for benign indications.

Keywords: Hysterectomy, Bladder injury, Risk factor, PID, Caesarean, Regional anatomy

INTRODUCTION

Hysterectomy is the most common gynecological major surgery. Bladder injury is the commonest iatrogenic visceral injury during hysterectomy, even in benign indications.[1-3] Though rare, it is the most devastating complication of hysterectomy, leading to increased morbidity, need for reoperation, prolonged hospitalization, and legal implications. Proximity to the uterus, supra-vaginal cervix, and vagina are anatomical reasons for inadvertent bladder injury during hysterectomy.[4] The risk factors for this complication in benign cases of hysterectomy are the approach to the surgery; pelvic adhesions due to previous abdominopelvic surgery, pelvic inflammatory disease (PID), endometriosis, and deficient expertise of the surgeon.[5,6] Route of surgery as a risk factor for bladder injury shows conflicting data in various studies. Low incidence of this complication is another reason to reach a conclusion regarding an approach to the surgery as a risk factor. Reports indicate an increased

incidence of bladder injury in transvaginal hysterectomy (TVH) and laparoscope-assisted vaginal hysterectomy (LAVH). Studies also report a high incidence of bladder injury in TAH, primarily due to the high-risk nature of these cases. Some authors suggest higher age, increased body mass index (BMI), prolonged operative time, and enlarged uterus as risk factors for intraoperative bladder injury in hysterectomy.[8] High incidence of this complication in total laparoscopic hysterectomy (TLH) is reported by some authors.[9] But others consider it a lack of expertise. The incidence of iatrogenic bladder injury during hysterectomy is found to be 0.13 to 3.6%.[9-11] It is reported as 0.9%, 0.6%, and 1% in abdominal, vaginal, and laparoscopic hysterectomy in some studies.[12] Intra-operative detection rate of bladder injury is very high. Diagnosis is by visual inspection, finding urine in the operative field or blood-stained urine in the urobag, and confirmed by transurethral dye installation into the bladder. Cystoscopy is required in doubtful cases, and the detection rate without and with routine cystoscopy is 84% and 94%, respectively.[13] Treatment is a two-layer closure of the rent with 3-0 Polyglactin 910 and continuous bladder drainage for 10-20 days, depending on the type and grade of injury. We conducted this study intending to find the incidence of iatrogenic bladder injury during hysterectomy for benign indications, the risk factors involved, and suggestions for prevention of complication.

METHODS

This retrospective, descriptive, and cross-sectional study was carried out in the Department of Obstetrics and Gynecology, Mamata Medical College and Hospital, Khammam from January 2021 to December 2024 after obtaining permission from the ethical committee of the institution. Women who had undergone hysterectomy for benign indications were included, whereas the malignant cases and caesarean hysterectomy cases were excluded from the study. All the relevant data, like previous pelvic or abdominal surgery, history of PID, BMI, large uterus measuring >400 gm, and also cases without any known risk for intraoperative iatrogenic bladder injury, were collected from the medical records of the institution with due permission. Data analysis was done by standard descriptive statistics, frequency table, and percentage for categorical variables. Microsoft excel-2021 was used as the tool for analysis. Significance of risk factors was found with interventional analysis, with p value, OR, and 95% CI calculation, for which the total number of cases of TAH was considered, as all cases of bladder injury occurred in this approach of surgery. A $p<0.05$ was considered significant as a risk factor. The observation was discussed critically and compared with that of other studies. Preventive measures were suggested to avoid inadvertent iatrogenic bladder injury during benign hysterectomy.

RESULTS

The hospital, being located in a district headquarter, all women belonged to rural area and low socio-economic section. They were either illiterate or studied up to class five. Majority of them were daily wagers except those with advanced age who were home makers. Age groups of the women in the study are presented in Figure 1. Major age group of patients undergoing hysterectomy was >45 to 55 years and constituted 1135 cases (65.15%). The total number of hysterectomies performed for various benign indications over the study period was 1742. All surgeries were elective. TAH with or without salpingectomy and/or oophorectomy was 1255 (72.04%). It was the major route chosen, considering intrapritoneal adhesions for different reasons, large uterine size, or other pelvic pathology. TVH of 434 (24.91%) cases was the next in frequency, done for genital prolapse and nondescend vaginal hysterectomy (NDVH). TVH and LAVH were not done for cases with a history of lower segment caesarean section (LSCS), expecting bladder adhesion to the supravaginal cervix and uterus. TLH was the third in the mode of approach to the surgery. TLH was done only in 32 (01.84%) cases, as the procedure started late in the institution, and post-LSCS cases were excluded. The patients also did not give consent for the procedure due to a lack of awareness. LAVH was done in 21 (01.21%) cases. Figure 2 shows the frequency of different approaches to hysterectomy in the institution during the study period.

The number of cases of iatrogenic bladder injury was 19, making the incidence 01.09% of total hysterectomies (n=1742). All the bladder injuries occurred in TAH cases (n=1255), as the high-risk cases for bladder injury were dealt with by this procedure. The incidence of bladder injury was 01.51% among all the TAH cases. Table 1 shows the frequency of different risk factors in bladder injury cases. Of the total cases of 19 bladder injury, 11 (57.89%) had history of LSCS; obesity (BMI ≥30 kg /m^2) in 07 (36.84%) cases of which all had history of previous LSCS; large uterus of >400 gm. due to fibroid in 06 (31.58%) cases of which 05 cases had history of LSCS and 06 (31.58%) cases had PID as the risk factors. There was no case of endometriosis, and LSCS was the only previous abdominopelvic surgery, excluding bilateral tubal sterilization. There was no known risk factor in 01 (05.26%) cases of bladder injury. The center, being a medical college hospital, specialists with different grades of expertise handled the cases, which may be the reason for this. Hysterectomy in previous LSCS cases had the maximum number of iatrogenic bladder injury in comparison to those without LSCS, with a p=0.0041, which was significant with OR: 3.8382, 95% CI: 1.5304-9.6261. Adhesion of the bladder to the lower uterus and supravaginal cervix was the cause, though sharp dissection was the method of separation of the two. PID as an indication of hysterectomy had 06 cases of bladder injury, which was significant with a p=0.0450, OR: 2.7254 and 95% CI of 1.0226-7.2634 as compared to those cases without PID. In some cases, particularly multiple LSCS and PID, with existing fibrosis peritoneal and adhesions, inadvertent intraperitoneal injury to the bladder occurred during opening the abdomen. Other risk factors did not show a statistically significant difference for this serious

intraoperative complication of hysterectomy. Table 2 shows the significance of different risk factors for iatrogenic bladder injury during hysterectomy.

As mentioned earlier, some cases of bladder injury had more than one risk factor. All cases of bladder injury were diagnosed intra-operatively by the occurrence of hematuria, direct observation, or suspicion and confirmed with transurethral instillation of 200 ml of normal saline diluted with methylene blue into the bladder. Cystoscopy was required in 05 (26.32%) cases of injury at the base of the bladder near the ureterovesical junction and in suspicion of associated ureteric injury. Intraperitoneal injury was 07 (36.84%) cases, and 12 (63.16%) cases were retroperitoneal. Management was executed by a urologist with repair of the rent in two layers with 3-0 Polyglactin 910 and continuous bladder drainage for 10-21 days, depending on the extent of the injury. There was no case of fistula postoperatively or on follow-up.

Table 1: Frequency of risk factors in bladder injury in TAH (n=1255).

Risk factor	N	Percentage (%)
Post LSCS	11	0.88
BMI: ≥30 kg/m²	07	0.56
Uterus >400 gm	06	0.48
PID	06	0.48
No risk	01	0.08

Table 2: Significance of risk factors for iatrogenic bladder injury in TAH (n=1255).

Risk factor	Bladder injury, (n=19)	No bladder injury, (n=1236)	Total, (n=1255)	P value
Post LSCS	11 (03.26%)	326	337	0.0041
BMI: ≥30 kg/m²	07 (02.73%)	249	256	-
Uterus >400 gm	06 (02.20%)	267	273	-
PID	06 (03.24%)	179	185	0.0450
No risk	01 (01.20%)	203	204	-
Total=19 (01.51%)	1236	1255		

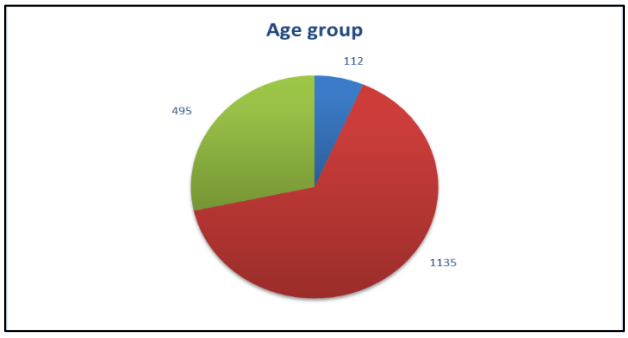

Figure 1: Age groups of patients included in the study, (n=1742).

*Group-1: 40-45 years (n=112), Grop-2: >45-55 years (n=1135), group-3: >55 years (n=495).

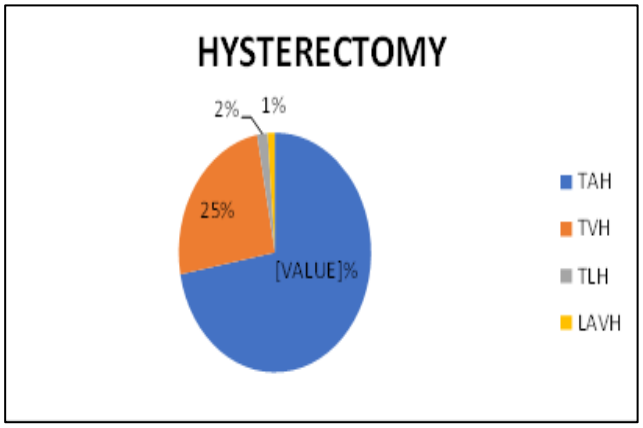

Figure 2: Various approaches to hysterectomy.

DISCUSSION

Iatrogenic bladder injury, the gynecologists' nightmare, though rare in incidence, has high morbidity, prolonged hospitalization, re-surgery, financial loss, and legal implications. The incidence in our study is 01.51% in TAH and 01.09% in total benign hysterectomies. The rate of occurrence of this complication is affected by many factors. Studies by different authors show the overall incidence to be 0.13 to 3.6%.[9-11] Study by Neumann et al reported it to be 01.5% during hysterectomy by different methods.[14]All cases of bladder injury were in TAH cases in the present study. A multicenter case-control study on hysterectomy for benign indications reported majority of bladder injuries were found in TAH as the mode of surgery.[15] It may be explained by the criteria for selecting the surgical approach, as all complicated cases with high risk for inadvertent bladder injury during surgery are done by TAH. The present study found abdominopelvic adhesion as the main risk factor for bladder injury, which occurred in 17 out of 19 (89.47%) cases of bladder injury, including previous LSCS and PID cases.

The history of LSCS was in 11(57.89%) cases of iatrogenic bladder injury as a risk factor for such complications. Neumann et al reported it as 34.10% of total cases of bladder injury.[14] A study by Rooney et al found that previous LSCS was responsible for 26.4% of bladder injury during benign hysterectomy.[15] Bladder injury during hysterectomy in post LSCS cases with an OR of 2.9 and a 95% CI of 1.75 was reported by Mamata M Malik et al,[16] whereas in this study, it was OR: 3.8382, and a 95% CI: 1.5304-9.6261. Many authors did not find a

significant correlation between high BMI and iatrogenic bladder injury during hysterectomy for benign indications.[17,18] Tan-Kim et al have reported increased incidence of urinary tract injury during hysterectomy in patients with a BMI of ≤25 kg/m^2.[19] The present study also did not find a significant correlation between high BMI and iatrogenic bladder injury during hysterectomy. Though 07 of our cases with bladder injury had a high BMI of ≥30 kg/m^2, all were post-LSCS cases, as a major risk factor for the complication due to adhesion and distorted anatomy. Increased uterine size, as a risk factor, was not a significant factor in the present study. Out of 06 cases with bladder injury in this category, 05 were post-LSCS cases. Wallis reported increased uterine size as a risk factor for bladder injury during hysterectomy.[20] It may be because of more bleeding and distorted anatomy. PID was a significant risk factor in this study, causing adhesions and difficulty in getting tissue planes. We found that 06 of bladder injury cases had PID as the risk factor with an OR of 2.7254 and a 95% CI of 1.0226-7.2634, as compared with cases without PID. Singh et al reported one-third of the bladder injury cases in their study with PID as the indication for hysterectomy.[21] This study did not find any known risk factor for iatrogenic bladder injury during hysterectomy in 01out of 19 (05.26%) cases compared to 35.9% in the study by Samal et al.[22] Veer et al reported surgeon's volume and experience are not significant as risk factor for urinary tract injury during hysterectomy.[23] Whereas, the study by Wallenstein et al found that the rate of bladder injury is less with a high volume surgeon than with a low volume surgeon.[24] No difference in urinary tract injury was noted in the report by Khair et al between cases done by a gynecologist and a subspecialist.[25]

Inadvertent bladder injury during hysterectomy for benign indications cannot be prevented completely, but efforts should be made to reduce the incidence. Thorough knowledge of regional anatomy, adequate exposure of the operative field, supervision by a surgeon of high volume in need, and sharp dissection of adhesions are the basic principles in avoiding this complication. With history suggestive of distorted anatomy, the abdomen should be opened carefully. In case of doubt, retrograde filling of the bladder with sterile normal saline (NS) delineates the boundary and differentiates it from the peritoneum. In some cases of high adhesion of the bladder to the uterus, it should be retracted down by sharp dissection even before clamping the round ligaments. The uterovesical fold of the peritoneum may be opened through a lateral approach if needed. Thermal unit, if required, particularly in laparoscopy cases, should be carefully used. The bladder must be adequately pushed down before clamping the uterine artery pedicles in all cases. At any stage of surgery color of urine in the urobag, as well as the connecting pipe, must be checked for hematuria if there is doubt about the integrity of the bladder. At the end of the procedure, again, the color of urine must be checked irrespective of the volume of the surgeon. Despite all precautions, if there is a doubt of injury to the bladder occurring, one should go for a methylene blue test by transurethral installation of 200 ml of dilute NS with methylene blue and checking for leak. In still doubtful cases, cystoscopy must be requested by a urologist. The rent is repaired on priority with 3 '0' polyglactin 910 suture in two layers, and the patient is kept on continuous bladder drainage for 10-20 days, depending on the type and grade of injury. The outcome is good in the majority of cases.

Limitations

Though the article aimed at studying the bladder injury in different approaches to hysterectomy, majority (72.04%). of the cases were by abdominal route. The cases of TLH were only 01.84% during the study period which is very low for a reliable comparison of bladder injury in different approaches.

CONCLUSION

Perioperative iatrogenic bladder injury is a rare but serious complication of hysterectomy. Intra-abdominal and pelvic adhesions due to previous LSCS are the commonest risk factor followed by PID. This unpredictable complication may occur without any risk factors. Though not completely preventable, it can be limited by taking precautions. Knowledge of pelvic anatomy, risk assessment, meticulous and sharp dissection is the key to avoid this complication. Preoperative patient counseling, intraoperative diagnosis, and management reduce morbidity and litigation. Excluding hematuria in the urine collection bag as well as the connecting tube to the catheter is mandatory after surgery in all hysterectomy cases, irrespective of the surgeon's volume.

Known risk factors like previous LSCS and PID vary; preoperative identification of significant risk factors in each case warrants the need for exclusive counselling of the patient and supervision by experienced surgeons. Improvised techniques prevent complications of bladder injury and lawsuits.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee MMC/ICE/2022/2945/02/2025

REFERENCES

1. Mathevet P, Valencia P, Cousin C, Mellier G, Dargent D. Operative injuries during vaginal hysterectomy. Eur J Obstet Gynecol Reprod Biol. 2001;97(1):71-5.
2. Cosson M, Lambaudie E, Boukerrou M, Querleu D, Crépin G. Vaginal, laparoscopic, or abdominal hysterectomies for benign disorders: immediate and early postoperative complications. Eur J Obstet Gynecol Reprod Biol. 2001;98(2):231-6.
3. Ottosen C, Lingman G, Ottosen L. Three methods for hysterectomy: a randomised, prospective study of short term outcome. BJOG. 2000;107(11):1380-5.

4. Wong JMK, Bortoletto P, Tolentino J, Jung MJ, Milad MP. Urinary Tract Injury in Gynecologic Laparoscopy for Benign Indication: A Systematic Review. Obstet Gynecol. 2018;131(1):100-108.
5. Rahman MS, Gasem T, Al Suleiman SA, Al Jama FE, Burshaid S, Rahman J. Bladder injuries during cesarean section in a University Hospital: a 25-year review. Arch Gynecol Obstet. 2009;279(3):349-52.
6. Aydın C, Mercimek MN. Laparoscopic management of bladder injury during total laparoscopic hysterectomy. Int J Clin Pract. 2020;00:e13507.
7. Frankman EA, Wang L, Bunker CH, Lowder JL. Lower urinary tract injury in women in the United States, 1979-2006. Am J Obstet Gynecol. 2010 May;202(5):495.e1-5.
8. Vakili B, Chesson RR, Kyle BL, Shobeiri SA, Echols KT, Gist R, et al. The incidence of urinary tract injury during hysterectomy: a prospective analysis based on universal cystoscopy. Am J Obstet Gynecol. 2005;192(5):1599-604.
9. Härkki-Sirén P, Sjöberg J, Tiitinen A. Urinary tract injuries after hysterectomy. Obstet Gynecol. 1998;92(1):113-8.
10. Ibeanu OA, Chesson RR, Echols KT, Nieves M, Busangu F, Nolan TE. Urinary tract injury during hysterectomy based on universal cystoscopy. Obstet Gynecol. 2009;113(1):6-10.
11. Jelovsek JE, Chiung C, Chen G, Roberts SL, Paraiso MF, Falcone T. Incidence of lower urinary tract injury at the time of total laparoscopic hysterectomy. JSLS. 2007;11(4):422-7.
12. Brummer TH, Jalkanen J, Fraser J, Heikkinen AM, Kauko M, Mäkinen J, et al. FINHYST, a prospective study of 5279 hysterectomies: complications and their risk factors. Hum Reprod. 2011;26(7):1741-51.
13. Askew AL, Myers ER, Dieter AA. Cost-effectiveness of agents used for evaluation of ureteral patency during intraoperative cystoscopy in gynecologic and urogynecologic surgery. Am J Obstet Gynecol. 2022;226(1):100.e1-100.e6.
14. Neumann G, Rasmussen KL, Lauszus FF. Peroperative bladder injury during hysterectomy for benign disorders. Acta Obstet Gynecol Scand. 2004;83(10):1001-2.
15. Rooney CM, Crawford AT, Vassallo BJ, Kleeman SD, Karram MM. Is previous cesarean section a risk for incidental cystotomy at the time of hysterectomy? A case-controlled study. Am J Obstet Gynecol. 2005;193(6):2041-4.
16. Mamik MM, Antosh D, White DE, Myers EM, Abernethy M, Rahimi S, et al. Risk factors for lower urinary tract injury at the time of hysterectomy for benign reasons. Int Urogynecol J. 2014;25(8):1031-6.
17. McMahon MD, Scott DM, Saks E, Tower A, Raker CA, Matteson KA. Impact of obesity on outcomes of hysterectomy. J Minim Invasive Gynecol. 2014;21(2):259-65.
18. Nayak AL, Breau R, Hickling D, Clancy A. Risk Factors for Urologic Injury in Women Undergoing Hysterectomy for Benign Indication. J Obstet Gynecol Canada. 2022;44(3):247-254.
19. Tan-Kim J, Menefee SA, Reinsch CS, O'Day CH, Bebchuk J, Kennedy JS, et al. Laparoscopic Hysterectomy and Urinary Tract Injury: Experience in a Health Maintenance Organization. J Minim Invasive Gynecol. 2015;22(7):1278-86.
20. Wallis CJ, Cheung DC, Garbens A, Kroft J, Carr L, Nathens AB, et al. Occurrence of and Risk Factors for Urological Intervention During Benign Hysterectomy: Analysis of the National Surgical Quality Improvement Program Database. Urology. 2016;97:66-72.
21. Singh PS, Doshi HU. Study of iatrogenic bladder injury in vaginal hysterectomy: our experience. Int J Reproduct Contracept Obstet Gynecol. 2018;7(3):903-6.
22. Samal SK, Rathod S, Thangavel K. A retrospective study of urological injuries during obstetrics and gynecological procedures. Int J Reprod Contracept Obstet Gynecol. 2020;9:2746-50.
23. Vree FE, Cohen SL, Chavan N, Einarsson JI. The impact of surgeon volume on perioperative outcomes in hysterectomy. JSLS. 2014;18:174-81.
24. Wallenstein MR, Ananth CV, Kim JH, Burke WM, Hershman DL, Lewin SN, et al. Effect of surgical volume on outcomes for laparoscopic hysterectomy for benign indications. Obstet Gynecol. 2012;119:709-16.
25. Khair E, Afzal F, Kulkarni S, Duhe' B, Hagglund K, Aslam MF. Urinary tract injury during hysterectomy: Does surgeon specialty and surgical volume matter? World J Methodol. 2023;13(2):18-25.

Cite this article as: Hota BM, Movva N, Lokam G, Bakshi K. Analysis of iatrogenic bladder injury in benign hysterectomy and risk factors in a tertiary care hospital. Int J Reprod Contracept Obstet Gynecol 2026;15:2060-4.