Urinary Complications after Radical Hysterectomy in Cervical Cancer: A Retrospective Cohort Study

M. Edo Antariksa P,[1] Sutrisno,[2] Dian Tjahyadi[1]
[1] Department of Obstetrics and Gynecology, Faculty of Medicine, Universitas Padjadjaran – Dr. Hasan Sadikin General Hospital, Bandung, Indonesia
[2]Department of Obstetrics and Gynecology, Faculty of Medicine, Jendral Soedirman University – Margono Hospital, Purwokerto, Indonesia
Correspondence: Muhammad Edo Antariksa Pradoto Email: muhammad22560@mail.unpad.ac.id

Abstract
Objective: Radical hysterectomy and pelvic lymphadenectomy are standard treatments for cervical cancer. A common long-term complication is lower urinary tract dysfunction (LUTD), which can lead to urinary tract infections (UTIs) due to urinary stasis. Incontinence may also increase UTI risk by allowing bacteria to enter through the urethra. This study aims to determine the incidence of LUTD and UTI in cervical cancer patients after radical hysterectomy and to analyze their relationship.
Methods: A retrospective cohort study was conducted on patients with stage IA2–IIA2 cervical cancer who underwent radical hysterectomy at Margono Soekarjo General Hospital. Urinary catheters were placed postoperatively, and bladder training was initiated on postoperative day three. Urine samples were collected on day fourteen or upon the return of bladder sensation to assess for urinary tract infection (UTI). The relationship between lower urinary tract dysfunction (LUTD) and UTI was analyzed using.
Result: LUTD incidence was 13.8%. UTI incidence was significantly higher in patients with LUTD than in those without (7.7% vs. 1.5%, $p < 0.001$). The relative risk of UTI in patients with LUTD was 31.1 (95% CI: 6.396–739.029), likely due to the limited sample size.
Conclusion: There is a significant association between LUTD and UTI in cervical cancer patients after radical hysterectomy. Early detection and monitoring of bladder function are essential in postoperative care.

Keywords: Lower urinary tract dysfunction; radical hysterectomy; urinary tract infection.

Komplikasi Urinaria Setelah Histerektomi Radikal pada Kanker Serviks: Studi Kohort Retrospektif

Abstrak
Tujuan: Histerektomi radikal dan limfadenektomi pelvik merupakan terapi standar untuk kanker serviks. Salah satu komplikasi jangka panjang yang umum adalah disfungsi saluran kemih bagian bawah (Lower Urinary Tract Dysfunction/LUTD), yang dapat menyebabkan infeksi saluran kemih (ISK) akibat stasis urin. Inkontinensia urin juga dapat meningkatkan risiko ISK melalui masuknya bakteri melalui uretra. Penelitian ini bertujuan untuk mengevaluasi insidensi LUTD dan ISK pada pasien kanker serviks pasca-histerektomi radikal tipe II serta hubungan antara keduanya.
Metode: Sebuah studi kohort retrospektif dilakukan pada pasien kanker serviks stadium IA2–IIA2 yang menjalani histerektomi radikal di RSUD Margono Soekarjo. Setelah operasi kateter urin dipasang dan melatih kandung kemih dimulai pada hari ketiga pascaoperasi. Sampel urin dikumpulkan pada hari keempat belas atau saat sensasi kandung kemih kembali untuk menilai adanya infeksi saluran kemih (ISK). Hubungan antara disfungsi traktus urinarius bawah (LUTD) dan ISK dianalisis menggunakan uji Fisher's exact.
Hasil: Penelitian ini menunjukan insidensi LUTD adalah 13,8%. Insidensi ISK secara signifikan lebih tinggi pada pasien dengan LUTD dibandingkan yang tidak mengalami LUTD (7.7% vs. 1.5%, $p < 0.001$). Risiko relatif ISK pada pasien dengan LUTD adalah 31.1 (CI 95%: 6.396–739.029) karena jumlah subjek penelitian sedikit.
Kesimpulan: Terdapat hubungan yang signifikan antara LUTD dan kejadian ISK pada pasien kanker serviks pasca-histerektomi radikal. Deteksi dini dan pemantauan fungsi kandung kemih sangat penting dalam perawatan pascaoperasi.

Kata kunci: Disfungsi urin; histerektomi radikal; infeksi saluran kemih

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Introduction

In 2018, approximately 570.000 women were diagnosed with cervical cancer, and 311.000 women died from the disease.[1,2] Globally, cervical cancer ranks as the fourth most common cancer among women.[2,3] The primary etiological agent of cervical cancer is persistent infection with high-risk Human Papillomavirus (HPV), which accounts for about 99.7% of all cases.[4,5]

Early-stage cervical cancer (International Federation of Gynecology and Obstetrics stage IA-IIA) can be effectively treated with either primary radical surgery or pelvic radiotherapy, with five-year survival rates ranging from 80% to 85% for stage IB and 50% to 65% for stage IIA.[6,7] While both treatment modalities offer comparable survival outcomes, surgery promotes the advantage of preserving ovarian and vaginal function-benefits particularly relevant for younger, reproductive-aged women.[8] When surgery is chosen, radical hysterectomy with pelvic lymphadenectomy is the standard approach.[7,8] However, this procedure is often associated with long-term complications, among which lower urinary tract dysfunction (LUTD) is the most common, with incidence rates ranging from 8% to 80%.[5,8,9]

LUTD following radical hysterectomy is typically caused by partial disruption of the autonomic nerve fibers that innervate the bladder during resection of the anterior, lateral, and posterior parametria and vaginal cuff.[8,10] Patients frequently report sensory loss and voiding difficulties, which may take 6 to 12 months to resolve with appropriate postoperative bladder management.[7,11] Depending on the evaluation method and follow-up duration, LUTD incidence ranges from 12% to 85%.[9,12] Persistent lower urinary tract symptoms, such as urinary incontinence, altered bladder sensation, urinary tract infections (UTIs), and straining to void, have been reported in 20% to 50% of patients.[5,12,13]

Bladder dysfunction following radical surgery often causes urinary stasis, creating an ideal environment for bacterial growth and subsequent UTI development.[5,12] In cases of urinary incontinence, bacteria around the urethral meatus can easily ascend into the urethra, further increasing the risk of UTIs.

Although clinically important, only few studies have explored the link between postoperative lower urinary tract dysfunction and UTI in cervical cancer patients. Therefore, this study aims to assess the relationship between lower urinary tract dysfunction (LUTD) and the occurrence of urinary tract infections (UTIs) in women with cervical cancer who have had a radical hysterectomy. Understanding this connection can help clinicians identify high-risk patients early, apply preventative measures, and improve postoperative urinary health and overall quality of life.

Method

This retrospective cohort study was conducted at Prof. Dr. Margono Soekarjo General Hospital. A total of 78 cervical cancer patients who underwent radical hysterectomy between January and December 2023 were included. The inclusion criteria were patients diagnosed with stage IA2, IB1, IB2, IIA1, or IIA2 cervical cancer who had undergone radical hysterectomy. Meanwhile, the exclusion criteria included patients with pre-existing lower urinary tract dysfunction, those on medications affecting urinary function (e.g., α-blockers), a history of urinary tract surgery, prior radiotherapy or chemotherapy, or urinary fistulas.[14]

The independent variable was the presence of urinary tract infection (UTI), while the dependent variable was lower urinary tract dysfunction (LUTD). Data were collected from medical records, physical examinations, and patient interviews. The surgical procedures were performed by

senior consulting gynecologic oncologists using surgical techniques, such as radical hysterectomy type III with nerve sparing, to minimize the incidence of complications.

Postoperatively, all patients had indwelling urinary catheters to monitor urine output. Bladder training started on postoperative day three and continued until day fourteen or until bladder sensation returned. The training involved intermittent clamping and unclamping of the catheter, supervised by nursing staff and supported by family members.

On day fourteen, patients underwent clinical evaluation, physical examination, and laboratory testing. During the scheduled catheter removal at the outpatient clinic, LUTD symptoms were assessed through anamnesis, and urinalysis was performed to diagnose UTI. A UTI diagnosis was based on laboratory findings of leukocyturia (>10 leukocytes/high-power field) and bacteriuria ($>10^5$ CFU/mL), consistent with the clinical criteria outlined by the Infectious Diseases

Table 1 Description of Variables, Samples, and Characteristics of Research Data

Variables analyzed	n = 59 (100%)
Age	
>35 years	11 (18.6%)
35-37 years	4 (6.7%)
37-40 years	4 (6.7%)
>40 years	40 (67.7%)
BMI	
Underweight (<18.5 kgBW/m^2)	31 (52.5%)
Normal (18.5 – 24.9 kgBW/m^2)	19 (32.2%)
Overweight (25 – 29.9 kgBW/m^2)	9 (15.2%)
Obese (>30 kgBW/m^2)	0
Obstetric Status	
Nullipara	5 (8.4%)
Multipara (≥1)	54 (91.5%)
Stage FIGO	
IA1	2 (3.3%)
IB1	14 (23.7%)
IB2	9 (15.2%)
IB3	5 (8.4%)
IIA1	12 (20.3%)
IIA2	13 (22%)
IIB1	4 (6.7%)
Lower urinary tract dysfunction symptoms	
Yes	9 (15.2%)
No	50 (84.7%)
Leucocyte (Urinary tract infection)	
>10 /HPF	6 (10.1%)
<10 /HPF	53 (89.8%)

Note: If the chi-square condition is not satisfied, the p-value for categorical data is determined using Fisher's exact test. P-value <0.05 for statistically significant.

Society of America (IDSA) and the European Association of Urology (EAU) guidelines.

Voiding dysfunction was assessed clinically after the removal of the urinary catheter on postoperative day 14. Patients were observed for the ability to void spontaneously within six hours, sensations of incomplete bladder emptying, urinary hesitancy, and lower urinary tract symptoms. When urinary retention was suspected, post-void residual (PVR) urine volume was measured using bedside bladder ultrasonography or re-catheterization. A PVR volume exceeding 100 mL was considered indicative of voiding dysfunction. This method aligns with standard clinical criteria for diagnosing postoperative lower urinary tract dysfunction. The number of study participants decreased from 78 to 59 due to various reasons, including participant withdrawal (11 subjects), incomplete data (6 subjects), and failure to meet follow-up requirements (2 subjects).

Data analysis was performed using IBM SPSS version 25.0. Data that were normally distributed are shown as mean ± standard deviation, while non-normally distributed data are shown as median with minimum and maximum values. Fisher's exact test was used to examine the association between variables because the data were not normally distributed. A p-value of <0.05 was considered statistically significant.

We analyzed the data using IBM SPSS Statistics Version 26 (for Windows). Data were tested for normality using the Kolmogorov-Smirnov test, with a normal distribution as the standard deviation. The chi-square test was applied to all variables, resulting in a 95% confidence interval and a p-value of less than 0.05, indicating significant results for all analyzed variables. Then, for correlation, an odds ratio assessment was performed between the incidence of urinary tract infection, urinary disfunction, and clinical symptoms of urinary tract infection.

It was sent to and received by the Ethics and Research Committee of the Development and Research Section at Prof. Dr. Margono Soekarjo Hospital in Purwokerto, Indonesia, Referral number 013/KEPK/PE/V/2025 on May 18, 2025, in accordance with protocol 12/2003. Data from this study's medical records will only be used for this research and will not be shared with anyone other than the researcher and research supervisor. It will be used solely for academic purposes.

Results

Voiding dysfunction was assessed clinically after the removal of the urinary catheter on postoperative day 14. Clinical evaluation included the presence of lower urinary tract symptoms such as urinary hesitancy, straining to void, decreased urine stream, sensation of incomplete bladder emptying, and prolonged time to first spontaneous voiding (>6 hours post-catheter removal). In patients with suspected urinary retention, post-void residual (PVR) volume was measured using bladder ultrasonography or re-catheterization. A PVR volume >100 mL was considered indicative of voiding dysfunction. These criteria are consistent with commonly accepted clinical definitions of postoperative lower urinary tract dysfunction.

There was a strong association between lower urinary tract dysfunction and urinary tract infection (UTI). Among patients with lower urinary tract dysfunction, 7.7% developed a UTI, compared to just one case among those without dysfunction. The relative risk of UTI in patients with lower urinary tract dysfunction was 31.1 (95% CI: 6.396–739.029), indicating a significantly increased risk, although the wide confidence interval reflects considerable uncertainty. A significant association was also identified between clinical symptoms of UTI and confirmed infection. Among

Table 2 Correlation Between Lower Urinary Tract Dysfunction Symptoms, Clinical Signs of Uti, and Urinary Tract Infection Incidence

Correlation Yes		Urinary tract infection		
		No	P-value	
Lower urinary tract dysfunction	Yes	5 (7.7%)	4 (6.2%)	<0.001
	No	1 (1.5%)	44 (84.6%)	
Clinical symptoms	Yes	4 (6.2%)	4 (6.2%)	<0.001
	No	2 (3.1%)	55 (84.6%)	

Note: If the chi-square condition is not satisfied, the p-value for categorical data is determined using Fisher's exact test. P-value <0.05 for statistically significant.

Table 3 Correlation of Clinical Symptoms of Uti and Lower Urinary Tract Dysfunction Symptoms

Correlation Yes		voiding dysfunction		
		No	P-value	
Clinical symptoms	Yes	5 (7.7%)	3 (4.6%)	<0.001
	No	4 (6.2%)	53 (81.5%)	

Note: If the chi-square condition is not satisfied, the p-value for categorical data is determined using the Fisher's exact tests. P-value <0.05 for statistically significant.

patients presenting with UTI symptoms, 6.2% had a confirmed UTI, while 3.1% of asymptomatic patients also tested positive. This difference was statistically significant (p<0.001). Additionally, clinical symptoms of UTI were strongly linked to lower urinary tract dysfunction. Among those with UTI symptoms, 7.7% experienced lower urinary tract dysfunction, compared to 6.2% of those without symptoms (p<0.001).

Discussion

This study examines the incidence of lower urinary tract dysfunction following radical hysterectomy 13.8%.[6,7] Previous studies have documented a broad spectrum of incidence rates, ranging from 8-80%.[7,8] This variation may be due to differences in the definition of lower urinary tract dysfunction and the timing of follow-up.[12] Additionally, variability in surgical techniques may also contribute to this range. The long-term urological complication rates following different types of radical hysterectomy are reported to be 5% for nerve-sparing type II radical hysterectomy, 20% for type II with adjuvant radiotherapy, 30% for non-nerve-sparing type III, and 37% for type III with radiotherapy.[7]

In this study, the incidence of urinary tract infection (UTI) among patients who experienced lower urinary tract dysfunction after radical hysterectomy was 7.7%.[5,12] In addition, this study also found a statistically significant association between lower urinary tract dysfunction (LUTD) and the occurrence of UTI in cervical cancer patients.[12] Our findings show that patients who develop lower urinary tract dysfunction after surgery have a significantly higher risk of developing UTI, with a relative risk of 31.1. However, the 95% confidence interval was very wide (6396 to 739.029), indicating a high level of uncertainty about the true relative risk.[9,12] In studies with limited participants, a small number of events can disproportionately influence the relative risk, leading to exaggerated or unstable effect sizes. As a result, these findings should be interpreted with caution. Acknowledging this limitation and discussing its potential impact on validity is essential.

This study identified a statistically

significant association between lower urinary tract dysfunction and confirmed UTI ($p<0.001$). To our knowledge, this is the first study to evaluate the relationship between post-operative lower urinary tract dysfunction and UTI incidence. Surgical interventions such as radical hysterectomy can lead to urinary tract dysfunction, including bladder atony, incomplete emptying, and urinary retention.[6,8] These conditions create a favorable environment for bacterial growth, thereby increasing the risk of UTI.[13] Lower urinary tract dysfunction has been shown to increase the risk of UTI through several mechanisms.[5,13] First, pathogenic bacteria can more easily access the urinary tract in patients with lower urinary tract dysfunction. These patients are more likely to undergo urinary tract manipulation and prolonged catheterization.[12] Long-term catheterization causes inflammatory damage to epithelial cells and facilitates biofilm formation, which enhances bacterial resistance to host defenses and antimicrobial agents.[9] Second, lower urinary tract dysfunction reduces urine flow and increases post lower urinary tract dysfunction may impair host defenses by decreasing the delivery of immune cells and antibiotics to the bladder wall.[6,15] These factors collectively create a bacterial-friendly environment, leading to a higher incidence of UTIs.[7,15]

This study also demonstrated a significant association between clinical symptoms of UTI and laboratory-confirmed UTI ($p<0.001$).[12,13] These findings align with a cohort study by Dune et al., which reported significant differences in urinary frequency and urgency between women with and without UTIs in the urogynecologic population (p: 0.005 and $p<0.001$, respectively). Dysuria (pain or burning during urination) was significantly more common among UTI-positive patients (self-reported $p<0.001$; standard urine culture $p<0.001$). Their findings suggest that dysuria may be a more reliable clinical indicator of UTI than frequency or urgency alone in this patient population.[8,9,12]

Furthermore, our study found a significant association between clinical UTI symptoms and lower urinary tract dysfunction ($p<0.001$). Previous studies have documented that cervical cancer patients often report symptoms resembling UTIs, such as urgency, frequency, and dysuria, which are also common in lower urinary tract dysfunction caused by treatments such as radiation or surgery.[9,12,13] This highlights the clinical challenge of distinguishing between actual UTI symptoms and those arising from urinary tract dysfunction.[12,13]

Clinically, these findings underscore the importance of careful monitoring and management of lower urinary tract dysfunction in cervical cancer patients undergoing radical hysterectomy.[6,7] Active management strategies for lower urinary tract dysfunction, such as pubovaginal sling procedures, botulinum toxin A injections into the urethral sphincter, transurethral bladder neck incision, or augmentation enterocystoplasty, should be considered when indicated.[5,8,12] Early intervention and preventive strategies may help reduce UTI incidence in this vulnerable population.[8,12]

Although our study provides valuable insights into the association between lower urinary tract dysfunction following radical hysterectomy and the incidence of UTI in cervical cancer patients, several limitations must be acknowledged. First, the sample size was relatively small, which may limit the generalizability of our findings. Larger cohort studies are needed to validate these results and better understand the relationship between LUTD and UTI incidence. Second, we did not control for specifying the surgical techniques used during radical hysterectomy. Variations in surgical methods may influence the incidence of postoperative complications, including LUTD. Future studies should aim to standardize, or at least account for differences in surgical technique, to better

isolate the effects of the hysterectomy itself on postoperative outcomes.

Conclusion

The study found that the incidence of lower urinary tract dysfunction in cervical cancer patients following radical hysterectomy was 13.8%, and the incidence of urinary tract infection (UTI) among those with lower urinary tract dysfunction was 7.7%. This study demonstrated a significant association between lower urinary tract dysfunction after radical hysterectomy and the occurrence of UTI in cervical cancer patients ($p<0.001$). The relative risk of UTI in patients with lower urinary tract dysfunction was 31.1 (95% CI: 6.396-730.029). Therefore, it is essential to monitor urinary function and ensure early detection of lower urinary tract dysfunction in cervical cancer patients who have undergone radical hysterectomy.

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Ethical Compliance: This study was conducted in accordance with the ethical standards of the responsible institution regarding human subjects and the Helsinki Declaration.

Data availability: The datasets used and/or analyzed in the current study are available from the corresponding author on reasonable request.

Consent for publication not applicable.

Author contributions: Study concept and design were done by MEAP and ST; Data collection and statistical analysis by MEAP and DTj; data interpretation and presentation by MEAP and ST; manuscript drafting by MEAP; and research supervision by ST and DTj. All authors discussed the results, contributed to the final manuscript, and approved the version for publication.

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