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Original Article

Sentinel Lymph Node Biopsy Vs Pelvic Lymphadenectomy In Early-Stage Endometrial Cancers: Feasibility, Safety and Lymphatic Morbidity

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ABSTRACT

Objective: To compare sentinel lymph node biopsy (SLNB) and pelvic lymphadenectomy (PLND) in early-stage endometrial cancers in terms of feasibility, operative outcomes, lymphatic and other complications.
Study Design: Quasi experimental study.
Place and duration of study: Department of Obstetrics and Gynecology, Combined Military Hospital (CMH), Rawalpindi, Jun 2023 to Jun 2025
Methodology: This study retrospectively analyzed 28 women, with histologically confirmed, early stage (I-II) endometrial cancer, who had undergone complete surgical staging. Using Technetium 99 and blue dye, 16 patients had undergone sentinel lymph node biopsy whereas 12 patients had pelvic lymphadenectomy. Both groups were compared in terms of demographics, tumor characteristics, operative factors, postoperative outcomes including length of hospital stay, incidence of postoperative infection and lower limb lymphedema. Patients were followed up for 30 days post-surgery.
Results: Mean age of patients was 56.07±6.57 years. There was no significant difference between the groups regarding demographics and tumor characteristics (p>0.05). Endometrioid adenocarcinoma was the most common histology (85.70%). Mean operative time was significantly shorter in the sentinel lymph node biopsy group as compared to pelvic lymphadenectomy (125.80 ± 44.00 vs 247.90 ± 48.40 min, p <0.001). Incidence of lower limb lymphedema was also lesser with sentinel lymph node biopsy (0.00% vs 50.00%, p=0.002). No significant differences were observed in blood loss, nodal positivity or post-operative infection (p>0.05).
Conclusion: Sentinel lymph node biopsy in early-stage endometrial cancer is associated with significantly shorter operative time and a lower incidence of lower limb lymphedema compared with pelvic lymphadenectomy, making it a feasible alternative that warrants further validation.

Keywords: Endometrial Neoplasms, Lymphedema, Sentinel lymph node biopsy

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INTRODUCTION

Endometrial cancer is one of the most common gynecologic malignancies worldwide, with rising incidence reported across high-and middle-income countries, showing a steady annual increase in disease related morbidity[1]. South Asian countries have reported similar shifts, yet the true burden remains difficult to estimate, as hospital-based data from Pakistan, indicates that endometrial cancer accounts for 20–22% of gynecologic cancers[2], making it an increasingly important contributor to women's cancer morbidity. Accurate assessment of lymph node status is central to staging early-stage endometrial cancer and in determining the need for adjuvant therapy. Conventional pelvic and para-aortic lymphadenectomy is normally done but the procedure carries drawbacks, including longer operative times, higher blood loss and a substantial risk of lymphatic complications[3]. Sentinel lymph node biopsy (SLNB) has gained attention as a comparable alternative where tracers such as indocyanine green, technetium or blue dye allow identification of first-draining nodes [4]. Large multicenter studies demonstrate high detection rates, good negative predictive value and reduced morbidity compared with complete lymphadenectomy.[5,6]. Despite the expanding global experience, evidence from Pakistan remains limited. Most local studies have focused on pelvic lymphadenectomy alone, with almost no direct comparison between SLNB and lymphadenectomy. Selective dissection has improved staging accuracy, although survival benefit remains uncertain[7]. Imaging based work from tertiary oncology units, including diffusion weighted MRI, shows moderate diagnostic performance [8], but preoperative imaging alone cannot replace intraoperative nodal evaluation. At the same

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time, concerns regarding morbidity, including lymphedema and wound complications remain[9]. Given the rising burden of disease and the lack of regional data comparing these two nodal strategies, a direct evaluation is needed. This study reports our experience with SLNB and pelvic lymphadenectomy, focusing on feasibility, safety and perioperative outcomes to inform local practice and guide decision making in comparable resource settings.

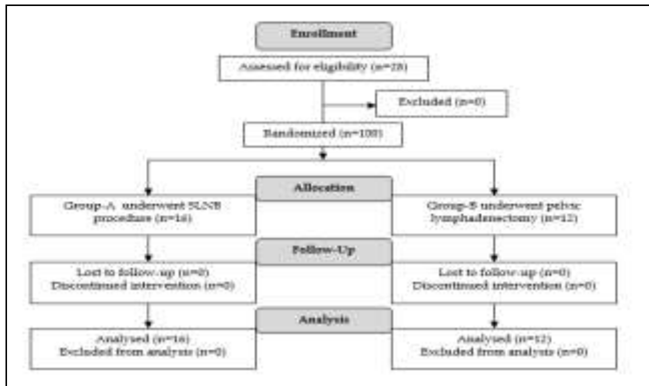

Figure: Patient Flow Diagram (n=28)

METHODOLOGY

This quasi-experimental study was carried out at the Department of Gynecology and Obstetrics, at a tertiary care hospital, Rawalpindi, from June 2023 to June 2025. Ethics approval was taken from the institutional review board (vide letter no 942 dated 18 Sep 2025), to perform a retrospective analysis of the data. Informed and written consent was already taken from all patients at the time of surgery. Patient data was collected from hospital records and oncology registries. All patient records were kept anonymous, and data was dealt with utmost confidentiality. As the study was retrospective, no formal a priori sample size calculation was performed. A total of 28 cases were included , from which 16 had undergone sentinel lymph node biopsy and 12 underwent complete pelvic lymphadenectomy.

Inclusion Criteria: Women aged 20 to 65 years with histologically confirmed (through endometrial biopsy) untreated low grade, early-stage endometrial carcinoma (Grade 1–2, clinical Stage I–II), Eastern Cooperative Oncology Group (ECOG) performance status 0–2 and declared fit for surgical treatment by anesthesia were included in the study.

Exclusion Criteria: Women with disease outside the uterus, as identified on Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) scan, those with history of prior pelvic radiation or chemotherapy, history of prior pelvic or para-aortic lymph node dissection, or incomplete operative or pathology records were excluded.

Complete surgical staging was performed in all patients through open approach with total abdominal hysterectomy, bilateral salpingo-oopherectomy and omental biopsy. For nodal assessment patients underwent one of the following procedures: Group A, with 16 patients, underwent SLNB procedure where a dual-tracer technique was employed using Technetium-99m nano-colloid (in a dose of 4 mCi) injected into the cervix at four quadrants a day before surgery, followed by 4 ml patent blue V dye (superficial and deep at 3 and 9 o'clock positions on the cervix) 30 minutes preoperatively after which lymphatic mapping was done intraoperatively with a gamma probe and direct visualization with all identified sentinel nodes excised and sent for standard histopathology. Group B underwent PLND in which external iliac, obturator, and internal iliac nodal basins were systematically dissected. All surgeries were performed by experienced gynecological oncology surgeons in collaboration with vascular surgery team under general anesthesia, following uniform perioperative protocols. A structured proforma was used to collect data on demographics, such as, age, Body Mass Index (BMI), comorbidities, tumor characteristics, such as histological subtype, grade, International Federation of Gynecology and Obstetrics (FIGO) stage, depth of myometrial invasion, operative factors, such as surgical time, blood loss, nodal positivity in both groups, postoperative outcomes including incidence of postoperative infection, such as, wound infection, fever and lower extremity lymphedema, for which patients were asked to complete a 13 items Self-report Lower-extremity Lymphedema Questionnaire (LELQ) with score range of 0-52, with a score of ≥ 5 indicating positive lymphedema.10 Patients were followed up postoperatively until hospital discharge and for 30 days post-surgery for complications. Data was analyzed using Statistical Package For Social Sciences (SPSS) version 25.00. Normality of continuous variables was assessed using Shapiro-Wilk test. Both age and operative time were normally distributed (*p* 0.070 and 0.087 respectively) and they were reported as mean ± standard deviation (SD) and compared using independent samples t-test. Categorical variables were summarized as frequencies and percentages and analyzed with chi-square or Fisher's

exact test, where a *p*-value ≤ 0.05 was considered as statistically significant.

RESULTS

A total of 28 cases were included in the final analysis. Mean age of patients was 56.07± 6.57 years. Mean BMI of patients undergoing SLNB was 33.80±2.90, whereas in the PLND group it was 34.50±2.70. Out of the total patients, 23(82.10%) had diabetes mellitus and 18(64.30%) were hypertensive. There was no statistically significant difference in the demographics of patients undergoing the two types of procedures. Demographic details of patients are shown in Table I.

Table-I: Demographic Characteristics of Patients (n=28)

Characteristics	Type of Nodal Assessment		*p*-value
	Sentinel Lymph Node Biopsy (n=16)	Pelvic Lymphadenectomy (n=12)	
Age (years) mean ±SD	56.20±6.50	55.80 ±6.80	0.872
Body Mass Index (kg/m2) mean ±SD	33.80±2.90	34.50 ±2.70	0.530
Diabetes Mellitus mean±SD	13 (81.00%)	10 (83.30%)	1.000
Hypertension mean ±SD	11 (68.70%)	7 (58.30%)	0.698

Tumor characteristics were compared between the patients undergoing both procedures, as shown in Table II. Endometrioid adenocarcinoma was the most common histology (87.50% in SLNB and 83.30% in PLND), there was however no statistically significant difference as far as the histology was concerned (*p*=0.75). In patients who underwent SLNB, 12(75.00%) had Grade 1 tumor as compared to those 6(50.00%) patients who had PLND (*p*=0.243). In both groups, more patients had FIGO Stage I tumor as compared to Stage II (12 versus 4 in SLNB and 9 versus 3 in PLND), however, the difference was not statistically significant (*p*=1.000). Similarly, there was no significant difference in the depth of myometrial invasion in patients who had undergone both procedures (*p* 1.000).

The mean operative time was 125.80±44.00 minutes in SLNB group and 247.90±48.40 minutes in the PLND group. The difference was statistically significant (*p* 0.00). Blood loss of more than 100 ml occurred in 1(6.25%) case of SLNB group and 4(33.30%) cases of PLND group, the difference was however statistically not significant (*p*=0.133). A total of 4 positive lymph nodes were detected by the sentinel lymph node method and 1 by PLND (*p*=0.355) as shown in Table III.

Table-II: Histopathological Tumor Characteristics (n=28)

Variable	Sentinel Lymph Node Biopsy(n=16)	Pelvic lymphadenectomy (n=12)	*p*-value
Histology Endometrioid Serous Clear cell	 14(87.50%) 1(6.25%) 1(6.25%)	 10(83.30%) 2(16.60%) 0(0.00%)	0.75 a
Tumor grade Grade 1 Grade 2	 12(75.00%) 4(25.00%)	 6(50.00%) 6(50.00%)	0.243 a
FIGO Stage Stage I Stage II	 12(75.00%) 4(25.00%)	 9(75.00%) 3(25.00%)	1.00 a
Depth of myometrial invasion <50% ≥50%	 9(56.20%) 7(43.80%)	 7(58.30%) 5(41.70%)	1.00 b

a. Fisher's exact test
b. Pearson Chi square test

The incidence of lower limb lymphedema was 0.00% in SLNB versus 50.00% in PLND (*p*=0.002). Incidence of postoperative infection was 6.25% in SLNB and 41.60% in PLND (*p*=0.057) as shown in Table IV.

Table-III: Comparison of Operative Factors (n=28)

Type of Surgery		Sentinel Lymph Node Biopsy (n=16)	Pelvic lymphadenectomy (n=12)	*p*-value
Operative Time (min)		125.8±44.0	247.90±48.40	<0.001
Blood Loss (mL)	<100mL	15(93.80%)	8(66.70%)	0.133
	≥100mL	1(6.20%)	4(33.30%)	
Lymph Node Status	Negative	12(75.00%)	11(91.60%)	0.355
	Positive	4(25.00%)	1(8.30%)	

Table-IV: Postoperative Outcomes in Sentinel Lymph Node Biopsy and Pelvic Lymphadenectomy Groups (n=28)

Outcome	Sentinel Lymph Node Biopsy (n=16)	Pelvic Lymphadenectomy (n=12)	*p*-value
Post-operative Infection	1(6.25%)	5(41.60%)	0.057
Lower Limb Lymphedema	0(0.00%)	6(50.00%)	0.002

DISCUSSION

Our study demonstrated that SLNB offers clear perioperative and postoperative advantages over PLND in women undergoing surgery for early-stage endometrial cancer, where SLNB was associated with significantly shorter operative time ($p < 0.001$), markedly less lower extremity lymphedema (0.00% vs 50.00%; $p = 0.002$) and comparable nodal detection rates between both groups ($p = 0.355$). When compared with existing literature, our statistical results closely align with previously published international data11-15. One author reported significantly fewer postoperative complications with SLNB 11, which correlates with our significantly lower morbidity rates. Similarly, our finding of 0.00% lower limb lymphedema with SLNB is consistent with another author, who demonstrated substantially lower rates of symptomatic lymphedema in the SLNB group ($p = 0.002$).13 Another study also supports our outcomes by reporting low short-and long-term incidence of lymphedema following SLNB in low-risk endometrial cancer patients.14 In larger comparative studies, SLNB was associated with a lymphedema rate of 1.23% compared with 6.37% in PLND, demonstrating a statistically significant reduction in lymphatic morbidity ($p< 0.05$),15 similar to our observed difference. The higher lymphedema rate observed in our PLND group (50.00%) compared with literature may be explained by the small sample size which might exaggerate statistical differences. Another reason could be the use of subjective patient self-report questionnaire for lymphedema instead of objective limb measurement. Our study showed a significantly shorter operative duration in the SLNB group ($p < 0.001$), which mirrors the findings of another study which also reported significantly reduced operative time with SLNB ($p < 0.001$).16 However, conflicting evidence also exists where no statistically significant difference in operative time or postoperative complications between SLNB and PLND was noted.17 In a large retrospective analysis, SLNB was shown to have significantly shorter operative time (mean 138.00 vs 222.80 minutes, $p <0.001$) and less blood loss (median 50 vs 100ml, $p< 0.001$) compared with PLND18 similar to our findings. Local data from Pakistan remains limited, with most studies historically focused on conventional lymphadenectomy. A retrospective analysis from Aga Khan University reported acceptable oncologic outcomes using selective lymphadenectomy, supporting a shift toward less aggressive nodal dissection.7 Furthermore, many institutions in low-resource environments continue to rely on PLND due to restricted access to tracers and fluorescence technology.3 By incorporating a hybrid tracer technique, our study provides local quantitative evidence supporting the feasibility of SLNB even in resource constrained settings.

LIMITATIONS OF STUDY

This quasi-experimental study's retrospective design and small sample size from a single center severely limit statistical power and generalizability to broader populations or other institutions. The imbalance between groups (16 SLNB versus. 12 PLND) and lack of randomization introduce potential selection bias and confounding, despite comparable demographics. Usage of short 30-day follow-up may miss delayed complications like lymphedema, while absence of long-term oncologic outcomes (e.g., recurrence, survival) prevents comprehensive assessment of efficacy. Larger, prospective randomized multicenter trials are needed for validation.

CONCLUSION

Sentinel lymph node biopsy in early-stage endometrial cancer is associated with significantly shorter operative time and a lower incidence of lower limb lymphedema compared with pelvic lymphadenectomy, making it a feasible alternative that warrants further validation.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SS & UG: Data acquisition, data analysis, critical review, approval of the final version to be published.

UU & SK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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