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Quality of Life and Surgical Morbidity Following ICG-Guided Sentinel Lymph Node Mapping versus No Nodal Dissection in Endometrial Cancer: A Pilot Study

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Title Page

Quality of Life and Surgical Morbidity Following ICG-Guided Sentinel Lymph Node Mapping versus No Nodal Dissection in Endometrial Cancer: A Pilot Study

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Abstract

Objectives: The optimal extent of nodal assessment in low-risk endometrial cancer remains controversial. This pilot study compares patient-reported quality of life (QOL) and surgical morbidity between indocyanine green (ICG)-guided sentinel lymph node (SLN) biopsy and the complete omission of lymph node dissection.

Materials and Methods: In this prospective-pilot study, 34 patients undergoing laparoscopic surgery for endometrial cancer were divided into two groups: Group 1 (n=18) received hysterectomy with bilateral adnexectomy and ICG-guided SLN mapping; Group 2 (n=16) underwent hysterectomy and adnexectomy alone. QOL was evaluated using three validated instruments: UDI-6, EORTC QLQ-EN24, and EORTC QLQ-SH22.

Results: The SLN detection rate was 100% (mean 3.2 nodes). Group 1 (SLN) demonstrated significantly better overall QOL scores compared to Group 2 (EORTC QLQ-EN24 total: 1.3 vs. 1.56; p=0.02). Specifically, the SLN group reported fewer urological (p=0.01), gastrointestinal (p=0.02), and sexual problems (p=0.04). Lymphedema rates were comparable between cohorts (p=0.2). Higher hair loss scores in the SLN group (p=0.03) likely correlate with the higher proportion of Stage II-III disease requiring adjuvant systemic therapy.

Conclusions: ICG-guided SLN biopsy provides essential staging information without increasing lymphatic morbidity compared to no dissection. The observed QOL advantage in the SLN group suggests that diagnostic certainty may provide psychological benefits that outweigh the minimal surgical extension.

Keywords: Endometrial cancer, Sentinel lymph node, ICG, Quality of Life, Laparoscopy.

Introduction

Endometrial cancer is the most common gynecological malignancy in developed countries, with surgical staging remaining the cornerstone of treatment [1]. The extent of lymph node assessment during surgical staging has been a subject of ongoing debate, as complete pelvic and para-aortic lymphadenectomy, while providing comprehensive nodal information, is associated with increased operative time, blood loss, and significant postoperative morbidity

[2]. In patients with low-risk endometrial cancer (FIGO stage I, endometrioid histology, grades 1-2), the risk of lymph node involvement ranges from 4% to 17%, raising questions about the necessity of routine systematic lymphadenectomy in all cases [1].

Sentinel lymph node (SLN) biopsy has emerged as a less invasive alternative to complete lymphadenectomy, aiming to balance adequate oncological staging with reduced surgical morbidity [3]. This technique is based on the concept that the first lymph node(s) draining a tumor site can be identified and selectively removed for pathological examination, potentially identifying patients who require adjuvant therapy while sparing those with negative nodes from the complications of extensive lymph node dissection [4]. The adoption of SLN biopsy represents a paradigm shift toward personalized, risk-adapted surgical management in endometrial cancer.

Indocyanine green (ICG) has become the preferred tracer for SLN mapping in endometrial cancer due to its high detection rates and compatibility with near-infrared imaging systems [5]. Studies report SLN detection rates approaching 97-100% with ICG, significantly higher than older techniques using blue dye or radioactive tracers alone [2,5]. The standard technique involves cervical injection of ICG at the 3 and 9 o'clock positions, with both superficial and deep injections, followed by visualization using near-infrared laparoscopic cameras [6]. While the learning curve for this technique has been documented, with proficiency typically achieved after approximately 30 procedures, the technical success and safety profile of ICG-guided SLN biopsy have been well established [7].

Despite the technical advantages and oncological safety of SLN biopsy, comprehensive data on patient-reported quality of life (QOL) outcomes remain limited [8]. The potential benefits of reducing the extent of lymph node dissection extend beyond immediate perioperative outcomes to long-term QOL domains including urological function, gastrointestinal symptoms, sexual health, body image, and lymphedema risk [9]. Lymphedema, in particular, represents a significant source of morbidity after complete lymphadenectomy, affecting patients' physical function, psychological well-being, and overall quality of life [10].

Previous studies comparing complete lymphadenectomy with no lymph node dissection have shown that extensive nodal surgery does not improve survival in low-risk endometrial cancer but does increase morbidity [11]. However, direct comparisons of QOL outcomes between SLN biopsy and no lymph node dissection are scarce, leaving a critical knowledge gap regarding the impact of selective nodal assessment on patient-reported outcomes. Understanding these QOL differences is essential for informed surgical decision-making and patient counseling, particularly as the field moves toward increasingly personalized treatment approaches.

The aim of this study was to compare quality of life outcomes between endometrial cancer patients who underwent surgery with ICG-guided sentinel lymph node dissection and those who underwent surgery without lymph node dissection. We hypothesized that the limited extent of nodal assessment in the SLN group would result in comparable or improved QOL outcomes across multiple domains, including urogenital function, disease-specific concerns, and sexual health. By utilizing validated instruments—the Urogenital Distress Inventory-6 (UDI-6), the EORTC QLQ-EN24 endometrial cancer-specific questionnaire, and the EORTC QLQ-SH22 sexual health questionnaire—we sought to provide comprehensive, multidimensional assessment of QOL in these two surgical approaches.

Study Design and Population

This comparative pilot study included 34 patients treated for endometrial cancer at the Department of Gynecology and Obstetrics, Scanmed Hospital in Blachownia, Poland. All procedures were performed via a laparoscopic approach by the same surgical team to ensure technical consistency.

An informed consent was obtained from all subjects and/or their legal guardian(s). The consent was submitted to the bioethics committee at the Medical Unversity in Lublin.

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Surgical Procedure

Patients were assigned to two cohorts based on preoperative risk assessment and clinical protocol:

* Group 1 (SLN Group, n=18): Hysterectomy, bilateral adnexectomy, and ICG-guided SLN mapping. ICG (1 ml superficial, 1 ml deep) was injected at the 3 and 9 o'clock positions of the cervix. Fluorescence imaging was used to identify and excise sentinel nodes.

* Group 2 (No-dissection Group, n=16): Hysterectomy and bilateral adnexectomy only.

Quality of Life Assessment

Data were collected via direct interviews or standardized telephone surveys. Three validated instruments were utilized:

* Urogenital Distress Inventory-6 (UDI-6) for urinary symptoms.

* EORTC QLQ-EN24 for endometrial cancer-specific symptoms.

* EORTC QLQ-SH22 for sexual health assessment.

Ethical Approval and Informed Consent

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Ethics Committee of Medical University of Lublin, BKB/88/04/2025.

	Group 1 – operation with sentinel lymph node	Group 2 – operation without sentinel lymph node
Number of patients	18	16
Age	67,6 (41-80)	66,4 (56-80)
FIGO Stage (postoperative)		
IA	11 (61%)	12 (75%)
IB	3 (16%)	4 (25%)
II	3 (16%)	0
III	1 (5%)	0
Grading – G1	5 (27%)	12 (75%)

Grading – G2	12 (66 %)	3 (18%)
Grading – G3	1 (5%)	1 (6%)
Number of sentinel lymph nodes	3,2 (2-7)	0
Patients with postoperative pathologically examined positive lymph nodes	1 (5%)	Not examined

Results

Questionnaire	Group 1 – operation with sentinel lymph node	Group 2 – operation without sentinel lymph node	p value
UDI-6	12,2 (95% CI: 7,8-16,6)	13,8 (95% CI: 7,7-19,8)	0,33
EORTC QLC-EN24			
Lymphoedema	1,7 (95% CI: 1,4-2,2)	1,6 (95% CI: 1,3-1,9)	0,2
Urological problems	1,4 (95% CI: 1,2-1,6)	1,7 (95% CI: 1,5-2,0)	0,01
Gastrointestinal problems	1,5 (95% CI: 1,3-1,8)	2,0 (95% CI: 1,6-2,2)	0,02
Poor body image	1,4 (95% CI: 1,1-1,7)	1,8 (95% CI: 1,5-2,1)	0,03
Sexual/vaginal problems	0,8 (95% CI: 0,5-1,1)	1,2 (95% CI: 0,8-1,6)	0,04
Back pain	1,9 (95% CI: 1,4-2,4)	1,7 (95% CI: 1,4-1,9)	0,2
Muscle pain	1,7 (95% CI: 1,2-2,2)	1,5 (95% CI: 1,2-1,8)	0,2
Hair loss	1,4 (95% CI: 1,0-1,8)	1,0 (95% CI: 0,9-1,2)	0,03
Tingling/sensibility	1,5 (95% CI: 1,1-1,9)	1,3 (95% CI: 1,0-1,4)	0,1
Taste disturbances	1,6 (95% CI: 1,1-2,0)	1,6 (95% CI: 1,1-2,1)	0,5

Total	1,3 (95% CI: 1,2-1,5)	1,56 (95% CI: 1,4-1,7)	0,02
EORTC QLC-SH22	1,1 (95% CI: 0,8-1,4)	1,3 (95% CI: 1,0-1,6)	0,1

Results – Raw Values of the scales

In both groups quality of life and urogenital symptoms evaluated by the UDI-6 inventory shows no statistical significances. Lightly better was the group of the sentinel nodes.

The same shows us the sexual health questionnaire. There was no statistical significant changes after the operation in both groups.

The EORTC QLC-EN24 was divided to evaluate the different problems of the patients. The total raw score value of the questionnaire shows significant difference in favor of the sentinel node group.

The most important significant differences can be seen in urological, gastrointestinal problems. Poor body image and sexual problems were also worse in the group without sentinel. Statistically significant was the higher hair loss in the sentinel group.

The quality of life in case of lymphedema was comparable in both groups. Back pain and muscle pain ware also statistically not different. Patients from both groups experienced sensory and taste disturbances with comparable frequency.

In this cohort of patients, the rate of the positive sentinel lymph node was 5%.

Discussion

This comparative study demonstrates that endometrial cancer patients who underwent surgery with ICG-guided sentinel lymph node dissection experienced significantly better overall quality of life compared to those who underwent surgery without any lymph node dissection, as measured by the EORTC QLQ-EN24 total score (p=0.02). This finding challenges

the assumption that avoiding lymph node surgery entirely results in optimal QOL outcomes and suggests that selective, targeted nodal assessment may offer benefits beyond simple minimization of surgical intervention.

Quality of Life Domain-Specific Findings

The most striking differences between groups were observed in several specific QOL domains. Patients in the no-lymph-node-dissection group reported significantly worse urological problems (1.7 vs. 1.4, p=0.01), gastrointestinal problems (2.0 vs. 1.5, p=0.02), poor body image (1.8 vs. 1.4, p=0.03), and sexual/vaginal problems (1.2 vs. 0.8, p=0.04) compared to the sentinel node group. These findings are particularly noteworthy because they suggest that the absence of nodal staging may be associated with other factors that negatively impact QOL, potentially including differences in adjuvant treatment decisions, psychological factors related to incomplete staging, or baseline disease characteristics.

The urological and gastrointestinal symptom differences observed in our study warrant careful interpretation. While complete lymphadenectomy has been associated with increased risk of these complications due to nerve injury, vascular compromise, and lymphatic disruption [12], our results suggest that patients without any nodal assessment experienced more symptoms in these domains. This paradoxical finding may reflect differences in patient selection, as the no-lymph-node-dissection group may have included patients with medical comorbidities or other factors that influenced both the surgical decision and baseline symptom burden. Alternatively, differences in adjuvant treatment (particularly radiation therapy) between groups could contribute to these symptoms, though we did not capture detailed adjuvant treatment data in this analysis.

The body image and sexual function differences are consistent with emerging literature suggesting that psychological factors, treatment-related anxiety, and perceived completeness of cancer treatment may significantly impact these QOL domains [13]. Patients who undergo

SLN biopsy may experience reassurance from having nodal staging performed, potentially reducing cancer-related worry and its downstream effects on body image and sexual function. This hypothesis is supported by psycho-oncology research demonstrating that perceived treatment adequacy influences psychological adjustment and QOL in cancer survivors [14].

Lymphedema and Lymphatic Morbidity

Contrary to expectations, we found no significant difference in lymphedema between groups (1.7 vs. 1.6, p=0.2). This finding aligns with recent literature suggesting that the risk of clinically significant lymphedema after SLN biopsy is very low, approaching that of no lymph node dissection [15]. The mean number of sentinel lymph nodes removed in our study was 3.2 (range 2-7), representing a minimal lymphatic burden compared to complete pelvic lymphadenectomy, which typically involves removal of 20-40 nodes [16]. Our results support the concept that SLN biopsy occupies an intermediate morbidity profile between no nodal assessment and complete lymphadenectomy, but in practice, the lymphedema risk of selective SLN removal approaches that of no nodal surgery [1].

The comparable lymphedema rates between groups provide important reassurance for patients and clinicians considering SLN biopsy. Lymphedema represents one of the most feared complications of lymph node surgery, with significant impact on physical function, quality of life, and healthcare costs [17]. Our data suggest that the oncological benefits of nodal staging can be achieved through SLN biopsy without incurring the lymphedema risk associated with more extensive lymphadenectomy.

Sentinel Node Detection and Clinical Utility

The sentinel lymph node detection rate in our study was 100% (18/18 patients), consistent with published ICG detection rates of 97-100% in experienced hands [2,5]. We identified

pathologically positive lymph nodes in 1 patient (5.6%), which falls within the expected range of 4-17% for low-risk endometrial cancer populations [1]. This detection of nodal metastasis in a patient who would otherwise have been incompletely staged highlights the clinical value of SLN biopsy, as this information directly impacts adjuvant treatment decisions and prognostic counseling.

The high detection rate achieved in our series reflects the technical advantages of ICG with near-infrared imaging and suggests that our surgical team had achieved proficiency with the technique. Literature indicates that the learning curve for ICG-guided SLN biopsy extends over approximately 30 cases, with progressive improvement in detection rates and reduction in empty lymph node packets [7]. Our results support the feasibility and reliability of this technique when performed by experienced surgeons in a dedicated gynecologic oncology setting.

Unexpected Finding: Hair Loss

An unexpected finding in our study was significantly higher hair loss scores in the sentinel node group (1.4 vs. 1.0, p=0.03). This result is difficult to explain based on the surgical intervention alone, as neither SLN biopsy nor the absence of lymph node dissection would be expected to cause alopecia. Several potential explanations warrant consideration. First, this may represent a chance finding given the multiple comparisons performed in the analysis. Second, differences in adjuvant chemotherapy administration between groups could account for this difference, though we did not systematically capture chemotherapy data. Third, the slightly higher proportion of patients with advanced stage (stages II and III) in the sentinel node group (21% vs. 0%) may have resulted in more aggressive adjuvant treatment in this cohort.

The stage distribution differences between groups deserve further comment. The sentinel node group included patients with stage II (16%) and stage III (5%) disease, while all patients in the no-lymph-node-dissection group had stage I disease. This difference likely reflects

appropriate patient selection, as higher-risk patients would be expected to undergo nodal staging while the lowest-risk patients might be managed without lymphadenectomy. However, this stage imbalance represents a limitation of our study design and may confound some of the QOL comparisons, particularly those related to adjuvant treatment effects such as hair loss.

Urogenital and Sexual Health Assessment

The UDI-6 urogenital distress inventory showed no significant difference between groups (12.2 vs. 13.8, p=0.33), suggesting comparable urinary symptom burden. This finding contrasts with the EORTC QLQ-EN24 urological problems domain, which showed a significant difference favoring the sentinel node group. This discrepancy may reflect the different constructs measured by these instruments; the UDI-6 focuses specifically on urinary incontinence and urgency symptoms, while the EORTC QLQ-EN24 urological domain encompasses a broader range of urinary concerns relevant to endometrial cancer treatment [18].

Similarly, the EORTC QLQ-SH22 sexual health questionnaire showed a trend toward better scores in the sentinel node group (1.1 vs. 1.3, p=0.1), though this did not reach statistical significance. The sexual/vaginal problems domain of the EORTC QLQ-EN24, however, showed a significant difference (0.8 vs. 1.2, p=0.04). These results highlight the multidimensional nature of sexual health after endometrial cancer treatment and suggest that different aspects of sexual function may be differentially affected by surgical approach and other treatment factors [19].

Clinical Implications and Recommendations

Our findings support the adoption of ICG-guided sentinel lymph node biopsy as the preferred staging approach for endometrial cancer patients requiring nodal assessment. The technique

provides reliable nodal staging information while maintaining quality of life outcomes that are superior to or comparable with no lymph node dissection across most domains. This represents a significant advantage over the historical approach of complete lymphadenectomy, which has been shown to increase morbidity without improving survival in low-risk patients [11].

For clinical practice, these results suggest that the decision between SLN biopsy and no lymph node dissection should be based primarily on oncological risk assessment rather than QOL concerns. Patients at sufficient risk to warrant nodal staging (based on preoperative grade, depth of invasion, and other risk factors) can be reassured that SLN biopsy is unlikely to significantly compromise their quality of life compared to avoiding lymph node surgery entirely. This information is valuable for shared decision-making discussions and may help reduce patient anxiety about undergoing nodal staging.

The comparable lymphedema rates between groups provide particularly important reassurance, as lymphedema concerns often influence patient preferences regarding extent of surgery. Our data suggest that when limited to sentinel node removal (mean 3.2 nodes), the lymphatic disruption is insufficient to significantly increase lymphedema risk above baseline. This finding supports current guidelines recommending SLN biopsy over complete lymphadenectomy for most endometrial cancer patients [20].

Study Limitations

Several limitations of this study warrant acknowledgment. First, the sample size was relatively small (18 patients in the SLN group and 16 in the no-lymph-node-dissection group), which may limit statistical power to detect small but clinically meaningful differences in some QOL domains. The study design was retrospective and non-randomized, introducing potential selection bias, as evidenced by the stage distribution differences between groups. Patients in

the sentinel node group had more advanced disease (21% stage II-III vs. 0%), which may have influenced adjuvant treatment decisions and subsequent QOL outcomes.

Second, we did not systematically collect data on adjuvant treatment (chemotherapy and radiation therapy), which represents an important confounding variable that could significantly impact QOL outcomes. The hair loss finding in particular suggests potential differences in chemotherapy administration between groups that we were unable to account for in the analysis. Future studies should include detailed adjuvant treatment data to better isolate the effect of surgical approach on QOL outcomes.

Third, the timing of QOL assessment was not standardized, and we used a combination of direct patient interviews and telephone surveys, which may introduce measurement variability. Ideally, QOL should be assessed at multiple standardized time points (preoperatively, early postoperatively, and at long-term follow-up) using consistent administration methods. The cross-sectional nature of our assessment prevents evaluation of QOL trajectories over time and recovery patterns.

Fourth, we did not include a complete lymphadenectomy comparison group, which limits our ability to fully contextualize the SLN biopsy results within the spectrum of nodal staging options. While the literature clearly demonstrates increased morbidity with complete lymphadenectomy [12], direct three-way comparisons within a single institution would strengthen the evidence base.

Finally, our study was conducted at a single institution with surgeons experienced in ICG-guided SLN biopsy, which may limit generalizability to centers early in their learning curve. The excellent detection rate and low complication rate we observed may not be immediately replicable at all centers, particularly given the documented learning curve of approximately 30 cases [7].

Future Directions

Future research should focus on prospective, multicenter studies with larger sample sizes and standardized QOL assessment at multiple time points. Randomized controlled trials comparing SLN biopsy, no lymph node dissection, and complete lymphadenectomy would provide the highest level of evidence, though such trials face ethical and practical challenges given existing evidence of harm from complete lymphadenectomy in low-risk patients [11].

Conclusions

This study demonstrates that ICG-guided sentinel lymph node biopsy in endometrial cancer is associated with significantly better overall quality of life compared to surgery without lymph node dissection, with particular advantages in urological function, gastrointestinal symptoms, body image, and sexual health. Importantly, lymphedema rates were comparable between groups, indicating that the limited extent of nodal removal in SLN biopsy does not significantly increase lymphatic morbidity. These findings support the adoption of SLN biopsy as the preferred staging approach for endometrial cancer patients requiring nodal assessment, offering reliable oncological information without compromising quality of life. The results challenge the assumption that avoiding lymph node surgery entirely optimizes QOL outcomes and highlight the complex interplay between surgical approach, disease characteristics, adjuvant treatment, and patient-reported outcomes. Further prospective research with larger sample sizes and standardized long-term follow-up is needed to confirm these findings and guide evidence-based surgical decision-making in endometrial cancer management.

ICG-guided SLN biopsy in endometrial cancer provides reliable staging while maintaining a QOL profile that is superior to or comparable with no lymph node dissection.

These results support SLN mapping as the preferred approach for patients requiring nodal assessment, balancing surgical precision with long-term patient well-being.

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Statements and Declarations

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