

Prevention of Lymphatic Complications (Lymphocele and Lymphedema) after Inguinal Lymphadenectomy and the Role of Sentinel Lymph Node Biopsy in Patients with Vulvar Cancer: A Systematic Review

Ana Patrícia Pereira Felicidade Carvalho

M

2026



Prevention Of Lymphatic Complications (Lymphocele and Lymphedema) After Inguinal Lymphadenectomy And The Role Of Sentinel Lymph Node Biopsy In Patients With Vulvar Cancer: A Systematic Review

Dissertação De Candidatura ao Grau de Mestre em Medicina,
Submetida ao Instituto De Ciências Biomédicas Abel Salazar – Universidade Do Porto

Autora: Ana Patrícia Pereira Felicidade Carvalho

Estudante do 6º ano de Mestrado Integrado em Medicina

Afiliação: Instituto de Ciências Biomédicas Abel Salazar – Universidade do Porto

Endereço Eletrónico Institucional: up202007759@icbas.up.pt

Orientador: Prof. Doutor Hélder Ferreira

Assistente Graduado de Ginecologia e Obstetrícia, Unidade Local de Saúde de Santo António - Centro Materno-Infantil do Norte

Professor Associado Convidado no Instituto de Ciências Biomédicas Abel Salazar - Universidade do Porto

Endereço eletrónico: helferreira@hotmail.com

Coorientador: Dra Ana Andrade

Assistente de Ginecologia e Obstetrícia, Unidade Local de Saúde de Santo António - Centro Materno-Infantil do Norte

Colaboradora Externa no Instituto de Ciências Biomédicas Abel Salazar - Universidade do Porto

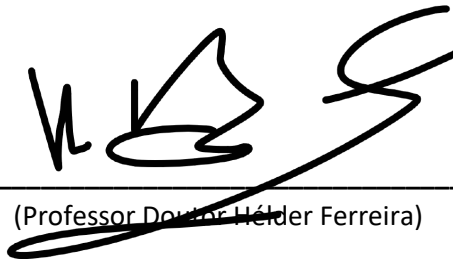
Endereço eletrónico: ana.r.a.andrade@gmail.com

**Prevention Of Lymphatic Complications (Lymphocele and Lymphedema) After Inguinal
Lymphadenectomy And The Role Of Sentinel Lymph Node Biopsy In Patients With
Vulvar Cancer: A Systematic Review**

Porto, Julho 2026


(Aluna Ana Patrícia Pereira Felicidade Carvalho)

O Orientador:


(Professor Doutor Hélder Ferreira)

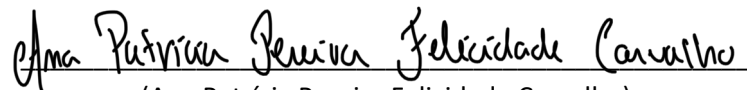
A Coorientadora:



(Doutora Ana Andrade)

Declaração de Integridade Científica

Eu, Ana Patrícia Pereira Felicidade Carvalho, nº 202007759, estudante do 6º ano do Mestrado Integrado em Medicina do Instituto de Ciências Biomédicas Abel Salazar - Universidade do Porto, declaro que esta dissertação é da minha autoria e não foi utilizada em qualquer outro curso ou unidades curriculares, desta ou de outra instituição. As referências a outros autores (afirmações, ideias, pensamentos) respeitam escrupulosamente as regras de atribuição e estão devidamente indicadas no texto e nas referências bibliográficas, de acordo com as regras de referência. Tenho conhecimento de que a prática de plágio e autoplágio constitui uma infração académica.


(Ana Patrícia Pereira Felicidade Carvalho)

Agradecimentos

Ao Professor Doutor Hélder Ferreira, expresso a minha gratidão por ter aceitado orientar esta dissertação e pela confiança depositada. O seu acompanhamento, orientação e os seus contributos foram fundamentais para a concretização desta tese.

À Doutora Ana Andrade, agradeço, especialmente, pela paciência que demonstrou todo este ano letivo, pela disponibilidade para construir este trabalho comigo e também pela partilha pelo gosto da área de Ginecologia. Os meus sinceros agradecimentos por ter co-orientado esta tese.

Ao meu porto seguro, agradeço aos meus pais. A eles, que sempre me apoiaram e que me motivaram para alcançar até os objetivos mais difíceis. Estes seis anos foram repletos de muitas noites sem dormir, de muitas viagens ao Porto, e, se cheguei até aqui, muito mérito atribuo às pessoas que me criaram. Ensinaram-me valores inerentes e essenciais para ser uma profissional de saúde que, talvez, um dia, possa fazer uma pequena diferença na vida de alguém. Não só pelos conhecimentos médicos que adquiri ao longo do curso, mas pela sensibilidade e humanidade que sempre fizeram questão de sublinhar. Na realidade, tratamos pessoas, não doenças.

Em cada etapa deste extenso percurso, valorizaram também as minhas ambições de abrir os meus horizontes noutros países, ainda com o inicial receio de deixar a filha única abrir, um bocadinho, as asas. Mas, à semelhança de uma criança que dá a mão para atravessar a estrada, também eles estiveram ao meu lado e nunca me deixaram só. Mãe e pai, todas as minhas conquistas também são vossas.

Aos meus amigos do Porto, um especial obrigada. São inúmeros os momentos partilhados que tornaram este curso numa bonita caminhada. Alguns estão comigo desde o primeiro ano, outros conheci mais tarde, mas agora atravessamos juntos a reta final e foi uma honra que tenha sido convosco. No meio de exames, aulas, paneladas, viagens e festas, ficam para trás muitas memórias que refletem muita felicidade, muito esforço e, principalmente, muita ternura. Dizem que os amigos são a família que escolhemos, mas penso que, na realidade, apenas fui eu que tive muita sorte.

Aos meus amigos espalhados por Barcelos, Braga e outros países, obrigada por fazerem parte da minha vida e pelo apoio constante mesmo estando a alguns (ou muitos) quilómetros de distância. A pessoa que sou e a médica que serei também é devido a todos os passos que dei fora da cidade do Porto.

Índice

Agradecimentos	i
Índice	i
Lista de Figuras	ii
Lista de Tabelas	iii
Resumo	iv
Abstract	v
Abbreviations	vi
Introduction	1
Materials and methods	3
Results	4
1. Surgical and Reconstructive Techniques	4
2. Sentinel Lymph Node Biopsy (SLNB)	6
3. Other Interventions	6
Discussion	8
Limitations	10
Future research	11
Conclusion	11
References	25

Lista de Figuras

Figure 1 Flow-chart of the literature research (PRISMA 2020)

Lista de Tabelas

Table I Summary of Evidence

Resumo

Objetivo Analisar a evidência disponível proveniente da literatura atual sobre intervenções destinadas a prevenir linfocelo e linfedema após linfadenectomia inguinfemoral, avaliando diferentes técnicas cirúrgicas e o papel da biópsia do gânglio sentinela na prevenção destas complicações linfáticas no pós-operatório.

Métodos Foi realizada uma revisão sistemática da literatura, de acordo com as diretrizes do PRISMA 2020 na base de dados PubMed/MEDLINE, abrangendo artigos publicados entre Janeiro 1990 e Dezembro de 2025. A qualidade de evidência foi avaliada de acordo com Oxford Centre for Evidence-Based Medicine (OCEBM) Levels of Evidence.

Resultados Foram incluídos 27 estudos, de acordo com os critérios de inclusão. Os artigos que avaliaram a biópsia do gânglio sentinela demonstraram menor incidência de linfedema e linfocelo comparativamente à linfadenectomia inguinfemoral, em doentes criteriosamente selecionados. Nos casos em que a linfadenectomia é necessária, a preservação da veia safena magna, a realização de disseções menos extensas e abordagens minimamente invasivas (como *video endoscopic inguinal lymphadenectomy*) e reconstrutivas mostraram potencial para reduzir a morbidade pós-operatória. Em contrapartida, a evidência disponível relativa à utilização de *fibrin-sealants*, estratégias de drenagem, meias de compressão e outras intervenções foi inconsistente, com necessidade de estudos com maior poder estatístico para confirmar ou não a sua eficácia.

Conclusão Esta revisão sistemática evidencia que a biópsia do gânglio sentinela é a estratégia com maior benefício na prevenção das complicações linfáticas, favorecendo abordagens cirúrgicas menos radicais. Além disso, modificações cirúrgicas podem reduzir a morbidade linfática quando a linfadenectomia inguinfemoral é necessária. Para uma definição rigorosa de estratégias preventivas e padronizadas, a realização de estudos metodologicamente robustos é essencial.

Palavras-chave: *Cancro da Vulva; Linfadenectomia Inguinal; Biópsia do Gânglio Sentinela; Linfedema; Linfocelo*

Abstract

Objective To systematically review the available literature on preventive strategies for lymphocele and lymphedema following groin surgery in patients with vulvar cancer, with emphasis on surgical and reconstructive techniques, sentinel lymph node biopsy (SLNB), and adjunctive interventions.

Methods A systematic literature review was conducted following PRISMA 2020 guidelines. The search was performed across PubMed/MEDLINE database, covering articles published between January 1990 and December 2025. Randomized controlled trials, prospective and retrospective cohort studies and case-control studies were included. The level of evidence was assessed using Oxford Centre for Evidence-Based Medicine (OCEBM) Levels of Evidence.

Results Twenty-seven studies met the inclusion criteria. Among the included articles, SLNB consistently demonstrated the strongest evidence for reducing postoperative morbidity, with significantly lower rates of lymphocele and lower-limb lymphedema. Among patients requiring lymphadenectomy, preservation of the great saphenous vein, less extensive nodal dissection and selected minimally invasive or reconstructive techniques were associated with reduced rates of lymphedema. Evidence regarding drainage strategies, fibrin sealants, compression therapy and other adjunctive interventions was inconsistent, precluding routine recommendations.

Conclusion This systematic review, based on the analysis of 27 articles, demonstrates that sentinel lymph node biopsy represents the most effective strategy to reduce postoperative lymphatic complications. Also, surgical modifications may further reduce morbidity when inguinofemoral lymphadenectomy is required. Further high quality prospective multicentre studies are required to strengthen the evidence base and guide clinical decision making.

Keywords: *Vulvar Cancer; Inguinal Lymphadenectomy; Sentinel Lymph Node Biopsy; Lymphocele; Lymphedema*

Abbreviations

IFL	<i>Inguinofemoral lymphadenectomy</i>
SLNB	<i>Sentinel Lymph Node Biopsy</i>
HPV	<i>Human Papillomavirus</i>
ESGO	<i>European Society of Gynaecological Oncology</i>
GROINSS-V	<i>Groningen International Study on Sentinel Nodes in Vulvar Cancer</i>
PRISMA	<i>Preferred Reporting Items for Systematic Reviews and Meta-Analysis</i>
GRADE	<i>Grading of Recommendations Assessment, Development and Evaluation</i>
VEIL	<i>Video Endoscopic Inguinal Lymphadenectomy</i>
OIL	<i>Open Inguinal Lymphadenectomy</i>
L-SCIP flap	<i>Lymphatic Superficial Iliac Artery Perforator flap</i>
VH fibrin	<i>Vapor-Heated fibrin</i>

Introduction

Vulvar cancer is a relatively uncommon gynaecological malignancy, accounting for approximately 3–5% of all female genital tract cancers and predominantly affecting elderly women, although an increasing incidence has been observed among younger patients due to the rising prevalence of human papillomavirus (HPV)-associated disease (1, 2).

Squamous cell carcinoma represents the vast majority of vulvar malignancies and remains the most frequent histological subtype, whereas basal cell carcinoma, adenocarcinoma, melanoma, and other variants are comparatively rare (1, 3). Despite its relatively low incidence, vulvar cancer is associated with significant morbidity, particularly when regional lymph node metastases are present (1, 4).

The status of the inguinofemoral lymph nodes is recognized as the most important prognostic factor in vulvar cancer. The presence, number and extent of nodal metastases strongly influence recurrence risk, disease-free survival and overall survival (1, 3, 4). Consequently, accurate assessment and management of the groin lymph nodes have historically been fundamental components of treatment planning.

For decades, inguinofemoral lymphadenectomy represented the standard approach for staging and treatment of the groin in patients with invasive vulvar cancer. Although effective in achieving regional disease control, this procedure is associated with substantial postoperative morbidity (1, 3). Reported complications include wound infection, wound breakdown, cellulitis, chronic lower-extremity lymphedema, lymphocele formation, lymphatic leakage and prolonged hospitalization (5). These complications may persist long after treatment and significantly impair physical functioning, psychological well-being and overall quality of life (6).

Although advances in surgical techniques have significantly improved patient outcomes, postoperative lymphatic complications remain common. Among these, lymphocele formation is one of the most frequent and clinically relevant complications following groin surgery. A lymphocele is defined as an abnormal collection of lymphatic fluid resulting from disruption of lymphatic channels during surgical dissection. The incidence of lymphocele varies widely across studies, depending on surgical technique, patient characteristics and diagnostic criteria (5). Lymphoceles may remain asymptomatic or present with pain, discomfort, wound complications, infection, lower-extremity edema and delayed recovery. In some cases, invasive interventions such as aspiration, catheter drainage or surgical treatment may be required. Several risk factors have been associated with lymphocele development, including obesity, extensive nodal dissection, increased number of lymph nodes removed and postoperative wound complications (5). Given their potential impact on patient recovery and quality of life, prevention of lymphocele formation remains an important objective in vulvar cancer surgery.

The paradigm of groin management in vulvar cancer changed substantially with the introduction of sentinel lymph node biopsy (SLNB). Based on the principle that lymphatic spread occurs in an orderly fashion through the first draining lymph node, SLNB allows accurate nodal staging while avoiding complete lymphadenectomy in patients with negative sentinel nodes (7). This approach represented a major advance in the management of early-stage vulvar cancer because it significantly reduced treatment-related morbidity without compromising oncological outcomes.

The safety and efficacy of sentinel lymph node dissection in selected patients with early-stage vulvar cancer have been demonstrated in several prospective studies and are currently endorsed by international guidelines (4, 7). According to the most recent European Society of Gynaecological Oncology (ESGO) recommendations, SLNB is considered the standard of care for patients with unifocal tumours smaller than 4 cm and clinically negative groins (4). This strategy has resulted in a substantial reduction in postoperative complications, particularly lymphedema, wound infection and lymphatic morbidity, when compared with complete inguinofemoral lymphadenectomy (4, 7).

Despite the widespread implementation of SLNB, complete inguinofemoral lymphadenectomy remains necessary in selected patients, including those with positive sentinel lymph nodes or more advanced disease (4). Furthermore, management of patients with nodal metastases continues to evolve. The GROningen International Study on Sentinel Nodes in Vulvar Cancer III (GROINSS-V III/NRG-GY024) is currently investigating treatment de-escalation strategies using intensified radiotherapy and chemosensitization in patients with macrometastatic sentinel node disease, aiming to further reduce surgical morbidity while maintaining regional control (8).

Various approaches have been investigated to reduce postoperative lymphatic morbidity, including minimally invasive surgical techniques and biological sealants (9-11). However, current evidence remains inconclusive, and available studies have not demonstrated a consistent reduction in lymphocele formation and lymphedema (10, 11).

Despite significant advances in the surgical management of vulvar cancer, lymphatic complications continue to represent an important source of postoperative morbidity. While sentinel lymph node biopsy has substantially reduced the need for complete inguinofemoral lymphadenectomy, lymphocele formation remains a clinically relevant problem, particularly among patients requiring more extensive nodal surgery. Further investigation is therefore required to better characterize risk factors, evaluate preventive strategies and optimize postoperative outcomes.

The aim of this systematic review is to identify articles that focus on strategies to prevent lymphocele formation and lymphedema following groin surgery in patients with vulvar cancer and to explore the impact of contemporary surgical approaches, particularly sentinel lymph node biopsy, on postoperative lymphatic management.

Materials and methods

This systematic review was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. (12)

This systematic review aimed to identify studies evaluating for the prevention of lymphocele and lymphedema after inguinal lymphadenectomy and/or the role of sentinel lymph node biopsy in preventing these postoperative complications in patients with vulvar cancer. Randomized controlled trials, prospective and retrospective cohort studies, case-control studies and case series were eligible for inclusion. Narrative reviews, systematic reviews, meta-analyses, editorials, and letters to the editor were excluded.

A search on PubMed/MEDLINE was conducted using the following queries: ("Vulvar Neoplasms" OR "vulvar cancer" OR "vulvar carcinoma") AND ("inguinal lymphadenectomy" OR "inguinofemoral lymphadenectomy" OR "sentinel lymph node biopsy") AND ("lymphocele" OR "lymphatic complications" OR "lymphedema" OR "wound complications"). All studies identified were screened by two independent reviewers according to the following inclusion criteria: (1) published in English or Portuguese, (2) between January 1990 and December 2025, (3) with full-text available, (4) articles focusing on strategies to prevent lymphocele and/or lymphedema after inguinal lymphadenectomy and/or assessing the role of sentinel lymph node biopsy in vulvar cancer patients. Two independent reviewers screened titles, abstracts and full-text articles for eligibility. Any disagreements were resolved by discussion until consensus was reached.

The level of evidence of each included study was classified according to the Oxford Centre for Evidence-Based Medicine (OCEBM) Levels of Evidence (13).

Results

The literature search identified a total of 100 articles. Following the assessment of titles and abstracts against the predefined inclusion criteria, 51 articles were excluded. The full texts of the remaining 49 studies were sought and evaluated for eligibility. However, 3 articles were not retrieved because the full-text version was not available.

Of the 46 articles assessed in full, 22 articles were excluded for the following reasons: 2 articles were written in Chinese; 7 were non-comparative studies and were therefore unable to evaluate the effectiveness of the intervention against a comparator; 3 articles were excluded because the results were not reported separately for patients with vulvar cancer; 5 articles did not provide sufficient quantitative data for data extraction and 2 articles did not assess outcomes of interest (lymphocele and/or lymphedema).

Consequently, 27 articles met the eligibility criteria and were included in the final review. The study selection process is illustrated in the PRISMA flow diagram presented in Figure 1. The main characteristics and findings of the 27 selected studies are summarised in Table I.

In order to facilitate the presentation of the results, the included studies were categorized into three groups: (1) Surgical and Reconstructive Techniques with 15 studies; (2) Sentinel Lymph Node Biopsy (SLNB) with 6 studies and (3) Other Interventions with 6 studies.

1. Surgical and Reconstructive Techniques

As previously noted, fifteen studies evaluated surgical and reconstructive strategies aimed at minimizing postoperative lymphatic complications, particularly lower-limb lymphedema and lymphocele formation, following groin dissection in patients with vulvar cancer.

- Modifications to the Lymphadenectomy

Four studies investigated preservation of the great saphenous vein during lymphadenectomy. Zhang X. *et al.* showed that saphenous vein preservation significantly decreased short-term lower-extremity lymphedema compared with vein ligation (43.5% vs. 66.7%; $p < 0.01$), even though there was no significant difference observed in lymphocyst formation (14). Dardarian *et al.* reported a significantly lower incidence of chronic lymphedema with vein preservation (11% vs. 38.7%; $p < 0.05$), while Zhang S.H. *et al.* found reductions in both short-term (32% vs. 70%; $p < 0.001$) and long-term lymphedema (3% vs. 32%; $p = 0.003$), without affecting lymphocyst rates (15, 16). Comparable findings were reported by Rouzier *et al.* with saphenous vein preservation being associated with significantly lower rates of chronic lymphedema (23.1% vs. 45.3%; $p < 0.001$) (17).

Interestingly, the role of sartorius muscle procedures yielded conflicting results. Li *et al.* reported that sartorius tendon transposition significantly reduced chronic lymphedema compared with conventional sartorius transposition (7.1% vs. 33.3%; $p = 0.022$), although lymphocele rates were similar between groups (18). However, the study conducted by Rouzier *et al.* showed that sartorius transposition was associated with significantly higher rates of lymphedema than no

transposition (55.2% vs. 21.6%; $p<0.001$), which suggests that routine sartorius transposition may not provide clinical benefit and could even increase postoperative morbidity (17).

Alternative surgical modifications were evaluated in several studies. Mattson *et al.* demonstrated that superficial inguinal lymph node dissection resulted in significantly lower postoperative lymphedema than deep dissection (15.9% vs. 42.4%; $p<0.01$), with comparable oncologic outcomes (19). Gori *et al.* also reported no cases of lymphedema following ipsilateral superficial inguinal lymphadenectomy in selected patients with early-stage vulvar cancer, compared with 23.8% in patients undergoing conventional bilateral superficial and deep lymphadenectomy ($p<0.02$) (20). In addition, Rouzier *et al.* demonstrated that less extensive dissections (e.g., medial inguinal/medial femoral) resulted in significantly lower lymphedema rates (11.5-32%) compared to full inguinofemoral lymphadenectomy (47%, $p<0.001$) (17). In contrast, Mancini *et al.* found that the position of the skin incision above or below the inguinal ligament did not significantly influence the incidence of lymphocele or chronic lower-limb edema (21).

- Minimally Invasive and Endoscopic Approaches

Several studies evaluated minimally invasive techniques using video endoscopic inguinal lymphadenectomy (VEIL), with potential to reduce postoperative complications. Naldini *et al.*, in a paired comparative study, reported significantly lower lymphedema after VEIL compared to open surgery (OIL) on contralateral sides ($p=0.024$) (22). Le *et al.* also showed significantly fewer lymphatic complications, including lymphatic leakage and lymphocyst formation, in patients undergoing VEIL compared with conventional open surgery ($p=0.034$) (23). Zhang M. *et al.* did not observe statistically significant differences in lymphocele or lymphedema between VEIL and conventional open inguinofemoral lymphadenectomy. However, postoperative complication rates remained numerically lower in the VEIL group while maintaining comparable oncologic safety (24).

- Drainage Management

Postoperative drain management following inguinofemoral lymphadenectomy is a key modifiable factor and was assessed in three different studies. Firstly, Pouwer *et al.* reported that volume-controlled drainage significantly reduced lymphocele formation compared with short fixed-duration drainage (15% vs. 60%; $p<0.001$) (25). On the other hand, Pontre *et al.* did not find any significant differences in lymphocele formation or lower-limb lymphedema between patients managed with routine groin drainage and those without drainage (26). The technique of lymph channel ligation using blue dye was tested by Bharathan *et al.*, which did not significantly affect drainage duration, drainage volume, or lymphocyst formation (27).

- Reconstructive Techniques

Various different reconstructive techniques were also investigated by Caretto *et al.* that evaluated immediate inguinal reconstruction using the superficial circumflex iliac artery perforator (L-SCIP) flap and found significantly smaller increases in lower-limb volume compared to the contralateral non-reconstructed groin ($p=0.022$). Lymphoscintigraphy further confirmed reduced lymphatic impairment in reconstructed groins, suggesting that immediate lymphatic reconstruction may decrease the risk of postoperative lymphedema. (28)

2. Sentinel Lymph Node Biopsy (SLNB)

Across the six included studies, sentinel lymph node biopsy (SLNB) was consistently associated with lower postoperative morbidity than inguinofemoral lymphadenectomy (IFL), while maintaining acceptable oncological outcomes in appropriately selected patients with early-stage vulvar squamous cell carcinoma.

Three studies specifically evaluated lymphocele following groin surgery. Rodríguez-Trujillo *et al.* documented lymphocele rates of 4.8% after SLNB compared with 9.8% after IFL +/- SLNB. However, this difference did not reach statistical significance ($p=0.451$), possibly due to the smaller sample size (29). On the other hand, Gitas *et al.* described a considerable reduction in lymphocele after SLNB, with no cases observed following sentinel node lymph biopsy (0%), whereas they observed development of lymphocele in 22.5% of the patients that underwent IFL ($p<0.001$). In addition, it was observed that patients who developed an early postoperative lymphocele appeared to have a higher likelihood of developing chronic lower-limb lymphedema, which suggests that lymphocele can represent an early marker of long-term lymphatic dysfunction (30).

The pioneering study by Van der Zee *et al.*, a multicenter observational study of 383 patients, showed a substantial reduction in the incidence of lower-limb lymphedema with SLNB (1.9%) compared to IFL (25.2%), a statistically significant difference ($p<0.0001$), without compromising oncological outcomes. These findings provide strong evidence that avoiding complete inguinofemoral lymphadenectomy whenever oncologically feasible markedly reduces long-term lymphatic morbidity (7). Likewise, Rodríguez-Trujillo *et al.* reported no cases of lymphedema after SLNB alone, in contrast with 33.3% in the group that underwent IFL that developed this complication ($p<0.001$). Moreover, this was represented as the most significant long-term morbidity difference identified in the study (29). The results were similar in the Gitas *et al.* study, since it did not report any cases of chronic lymphedema after SLNB, whereas lymphedema occurred in 14% of the patients that underwent IFL, representing a noticeably higher incidence than in the SLNB group ($p<0.001$) (30). The study conducted by Oonk *et al.*, which assessed morbidity via questionnaire, confirmed that lymphedema was significantly more frequent and severe following IFL than after SLNB alone ($p=0.01$) (31). It is important to highlight that one study, Novackova *et al.* found no statistically significant difference in lymphedema rates between groups (25% vs. 37.5%, $p=0.69$). Nevertheless, this was a prospective study with a relatively small sample ($N=29$), which may limit the statistical power to detect differences (32).

Nooij *et al.* compared three approaches to groin management in patients with node-positive vulvar squamous cell carcinoma: SLNB, inguinofemoral lymphadenectomy (IFL), and lymph node debulking. In particular, the results showed that IFL was associated with a higher incidence of lymphocele (26.7% vs. 6.2% after SLNB and 0% after debulking; $p = 0.032$) and lymphedema (43.3% vs. 6.2% and 0%, respectively; $p = 0.002$), when compared to less radical groin procedures (33).

3. Other Interventions

In addition to different surgical techniques and the use of SLNB, various intraoperative and postoperative interventions have been evaluated in order to determine their potential to reduce lymphatic complications, such as lymphedema and lymphocele. These interventions included fibrin sealant patches, compression stockings, and energy-based sealing devices.

Three studies investigated the use of the fibrin sealant patch TachoSil®, with conflicting results. Buda *et al.* reported that the fibrin sealant patch significantly reduced postoperative drainage volume (84 vs. 143 mL; $p=0.004$) and decreased the incidence of lymphocysts requiring drainage (8% vs. 44%) compared with standard management (34). Four years later, in contrast, Saner *et al.* showed that groins treated with TachoSil® developed significantly larger lymphoceles over time (median 20 vs. 5 mL) required more punctures ($p=0.002$) (10). In a double-blind randomized trial, Baggio *et al.* demonstrated that there was no significant difference in lymphocele formation ($p=0.676$) or postoperative lymphedema ($p=0.744$; $p=1$) between TachoSil®-treated and control groins (11).

Carlson *et al.* assessed the addition of VH fibrin sealant to a standard sutured wound closure and the results showed that there was not a significant reduction in lymphedema (67% vs. 60%; $p=0.48$) or lymphocele formation (35).

The role of compression stockings was investigated by Sawan *et al.* with a follow-up of six months after inguinofemoral lymphadenectomy. The findings suggest that, although compression stockings were associated with a significantly smaller increase in mean leg volume (607 vs. 953 mL; $p=0.010$) and improved symptom and clinical scores during follow-up, no significant differences were observed in the incidence of clinically significant lymphedema or lymphocyst formation compared with standard care (36).

Recently, Beamonte *et al.* evaluated the use of an energy-based sealing device during inguinofemoral lymphadenectomy. Although the study reported zero cases of seroma or lymphedema in the device group compared to the rates of 20% and 30%, respectively in controls, these differences did not reach statistical significance ($p=0.505$ for lymphedema), likely due to the very small sample size ($N=15$) (37).

Discussion

These results allow for an integrated analysis of the strategies that were used in order to reduce lymphatic complications following groin surgery in vulvar cancer. The discussion is structured around three main axes: surgical and reconstructive techniques, the role of sentinel lymph node biopsy (SLNB) and the use of adjuvant interventions, such as fibrin-sealant patches or compressing stockings.

Surgical and Reconstructive Techniques

The findings of this review indicate that modifications of conventional groin surgery can largely reduce postoperative lymphatic morbidity without compromising oncological outcomes in appropriately selected patients. Even though the assessed techniques differed considerably in their surgical outcomes, most of the studies had a common objective which was preserving normal lymphatic and vascular anatomy whenever possible.

Among the evaluated surgical modifications, the evidence is robust in favor of great saphenous vein preservation as a simple and effective technical modification to significantly reduce lower-limb lymphedema, both short and long-term. All four comparative studies that were included in this review reported lower rates of postoperative lymphedema following saphenous vein preservation. However, none of these studies demonstrated a corresponding reduction in lymphocele formation (14-17). This apparent discrepancy is biologically plausible, since lymphocele is caused by direct leakage from transected lymphatic vessels, whereas chronic lymphedema reflects a systemic or a regional impairment of lymphatic drainage (5, 38). The preservation of the great saphenous vein can contribute to the maintenance of the venous return and preserve the surrounding lymphatic microcirculation, thus facilitating long-term lymphatic drainage without necessarily preventing the initial accumulation of lymphatic fluid.

The extent of groin dissection also appeared to be a key factor of postoperative morbidity. Numerous studies that assessed superficial or more conservative inguinal lymphadenectomy demonstrated lower percentages of lower-limb lymphedema than conventional inguinofemoral lymphadenectomy, with comparable oncological outcomes in selected patients. By reducing the amount of tissue excised and preserving lymphatic drainage, limiting nodal dissection in carefully selected cases has the potential to be an effective strategy for reducing long-term morbidity (19, 20). However, international guidelines such as those from ESGO, currently only recommend inguinofemoral lymphadenectomy with the excision of both superficial and deep femoral nodes (4). Therefore, less extensive groin surgery should currently be regarded as a promising strategy that requires validation in high quality prospective studies before it can be considered an alternative to the standard of care.

Minimally invasive approaches, such as video endoscopic inguinal lymphadenectomy (VEIL), showed encouraging results. Although only one study demonstrated a statistically significant reduction in postoperative lymphedema (24), the remaining comparative studies consistently reported lower rates of lymphatic complications than conventional open surgery while maintaining similar oncological outcomes (22, 23). The advantages of VEIL are likely multifactorial, with

improved visualisation of anatomical structures, reduced soft tissue trauma and smaller skin incisions. These collectively decrease the probability of injury to the lymphatic vessels and minimise postoperative inflammatory responses. Nevertheless, the current evidence remains limited by relatively small sample sizes and predominantly non-randomised study designs. Therefore, larger prospective comparative studies with long-term follow-up are required before VEIL can be considered the standard approach for eligible patients (22-24).

Another potentially modifiable aspect of postoperative care was drainage management, but the evidence was considerably less consistent. Volume-controlled drain removal was associated with a noticeable reduction in lymphocele formation compared with fixed-duration drainage (25). On the other hand, routine drain placement itself did not influence the incidence of lymphocele or lymphedema, nor did intraoperative blue dye-guided lymphatic channel ligation demonstrate measurable clinical benefit (26, 27).

Caretto *et al.* was the only study to evaluate immediate lymphatic reconstruction using a superficial circumflex iliac artery perforator (L-SCIP) flap. The results presented showed a reduced postoperative limb volume and improved lymphoscintigraphic findings. However, it should be noted that reconstructive procedures remain technically demanding and require specialised surgical expertise, which limits their widespread implementation (28).

Other techniques like the transposition of the sartorius muscle still have uncertain roles within the treatment for groin dissection. While one study reported that sartorius tendon transposition may reduce chronic lymphedema compared with conventional muscle transposition (18), another large retrospective cohort reported significantly higher rates of lymphedema among patients that underwent sartorius transposition than those managed without this procedure (17). These conflicting findings can have multiple explanations, including differences in surgical technique, patient selection, and the extent of lymphadenectomy performed. Consequently, the available evidence does not support its routine use as a strategy for reducing postoperative lymphatic morbidity (17, 18).

Sentinel Lymph Node Biopsy

Among all interventions identified in this review, sentinel lymph node biopsy (SLNB) demonstrated the strongest evidence for reducing postoperative lymphatic complications following groin surgery for vulvar cancer. Across almost all included studies, SLNB had significantly lower rates of both lower-limb lymphedema and lymphocele compared with complete inguinofemoral lymphadenectomy, while maintaining acceptable oncological outcomes in selected patients, particularly early-stage vulvar squamous cell carcinoma (7, 29-31, 33). Nonetheless, there were differences in study design, sample size, and duration of follow-up. Only one study failed to identify statistically significant differences in lymphedema rates between SLNB and inguinofemoral lymphadenectomy. However, this study included a small number of participants, limiting its statistical power (32). When interpreted alongside the larger prospective and multicentre studies included in this review, the overall body of evidence strongly favours SLNB as the preferred groin staging procedure whenever appropriate.

An additional observation is the possible correlation between early lymphocele formation and subsequent development of chronic lower-limb lymphedema. There was only one study that specifically explored this association, which showed that patients who developed postoperative lymphoceles appeared more likely to experience chronic lymphatic dysfunction during follow-up. This result supports the hypothesis that lymphocele formation may not merely represent a transient postoperative event but could also reflect more extensive disruption of the lymphatic system (30). Consequently, prevention and early management of postoperative lymphoceles may have implications extending beyond short-term recovery, potentially influencing long-term functional outcomes.

Other interventions

Overall, these strategies appeared to provide limited additional benefit once lymphatic injury had already occurred during surgery. The greatest inconsistency was observed with fibrin-based sealants, particularly TachoSil®. Although one study reported a substantial reduction in postoperative drainage volume and lymphocyst formation (34), two subsequent studies, including a randomised controlled trial, failed to demonstrate any reduction in lymphatic complications (10, 11). Several factors may explain these conflicting findings, including differences in surgical technique, drain management protocols, methods used to detect lymphoceles, and the relatively small sample sizes of most studies. Furthermore, because lymphatic leakage originates from numerous transected lymphatic vessels rather than a single identifiable defect, the application of fibrin sealants may be insufficient to completely prevent postoperative lymph accumulation (10, 11, 34). Similar to the TachoSil®, the addition of VH fibrin sealant to standard wound closure in the study Carlson *et al.* did not reduce postoperative lymphedema or seroma formation (35). Taken together, the available evidence does not currently support the routine use of fibrin sealants as an effective strategy for preventing lymphatic complications following groin lymphadenectomy (10, 11, 35).

Compression stockings also demonstrated limited effectiveness. There were observed improvements in lower-limb volume and patient-reported symptoms during follow-up, but these benefits did not translate into a significant reduction in clinically relevant lymphedema or lymphocele formation. This finding suggests that compression therapy may have a role in symptom control or postoperative rehabilitation rather than in primary prevention of lymphatic complications (36).

Beamonte *et al.* tested the use of energy-based sealing devices that represents another promising but currently under-investigated approach. The single prospective study included in this review reported lower rates of postoperative seroma and lymphedema, without statistical significance. However, because of the very small sample size, the possibility of a clinically meaningful benefit cannot be excluded. Therefore, larger prospective randomised studies are required before this technique can be recommended routinely (37).

Limitations

Several limitations should be acknowledged. Firstly, considerable heterogeneity existed among the included studies with respect to study design, patient populations including different types of vulvar cancer, surgical techniques, outcome definitions, and duration of follow-up. Second, the overall methodological quality of the available evidence was variable. Most studies were retrospective observational cohorts with relatively small sample sizes, making them susceptible to selection bias, confounding, and incomplete outcome reporting. Some were prospective studies and randomised controlled trials, but many remained pilot or feasibility studies and were therefore underpowered to detect clinically important differences.

Another important limitation relates to the assessment of postoperative lymphatic complications. Across different studies, the definitions of lymphedema and lymphocele varied considerably, with some relying on clinical examination, others using limb volume measurements or imaging techniques, and some used patient-reported outcomes or questionnaire-based assessments. Also, the follow-up duration ranged from the immediate postoperative period to several years, potentially influencing the reported incidence of chronic complications. This methodological heterogeneity makes direct comparison between studies challenging and may partially explain some of the conflicting findings observed for several interventions.

Finally, because vulvar cancer is a relatively uncommon malignancy, many studies were conducted in single centres and included a limited number of patients. This fact restricts statistical power and reduces the generalisability of individual study findings.

Future research

Future research should focus on generating higher quality evidence through adequately powered multicentre randomised controlled trials, comparing preventive strategies for postoperative lymphatic complications. Standardisation of outcome definitions is particularly important, as well as the use of validated and reproducible methods for assessing lymphedema and lymphocele. Further investigation is also warranted for innovative surgical approaches, including minimally invasive groin surgery, immediate lymphatic reconstruction, and reconstructive techniques. The preliminary studies that were presented have encouraging results. However, robust evidence is needed in order to confirm their long-term efficacy and oncological safety.

Conclusion

Overall, the available literature supports that sentinel lymph node biopsy demonstrated the strongest evidence for reducing postoperative lymphatic morbidity. For patients requiring inguinofemoral lymphadenectomy, preservation of the great saphenous vein, less extensive nodal dissection, and selected minimally invasive or reconstructive approaches appear to reduce postoperative lymphedema and should be considered whenever clinically appropriate. Adjunctive interventions such as fibrin sealants, compression therapy, and other postoperative measures have produced inconsistent evidence and currently cannot be recommended as routine preventive strategies.

In conclusion, this systematic review supports a shift towards increasingly conservative, anatomically preserving approaches to groin surgery, with the dual objective of maintaining excellent oncological outcomes while minimising long-term treatment-related morbidity.

Figure 1. Flow-chart of the literature research (PRISMA 2020)

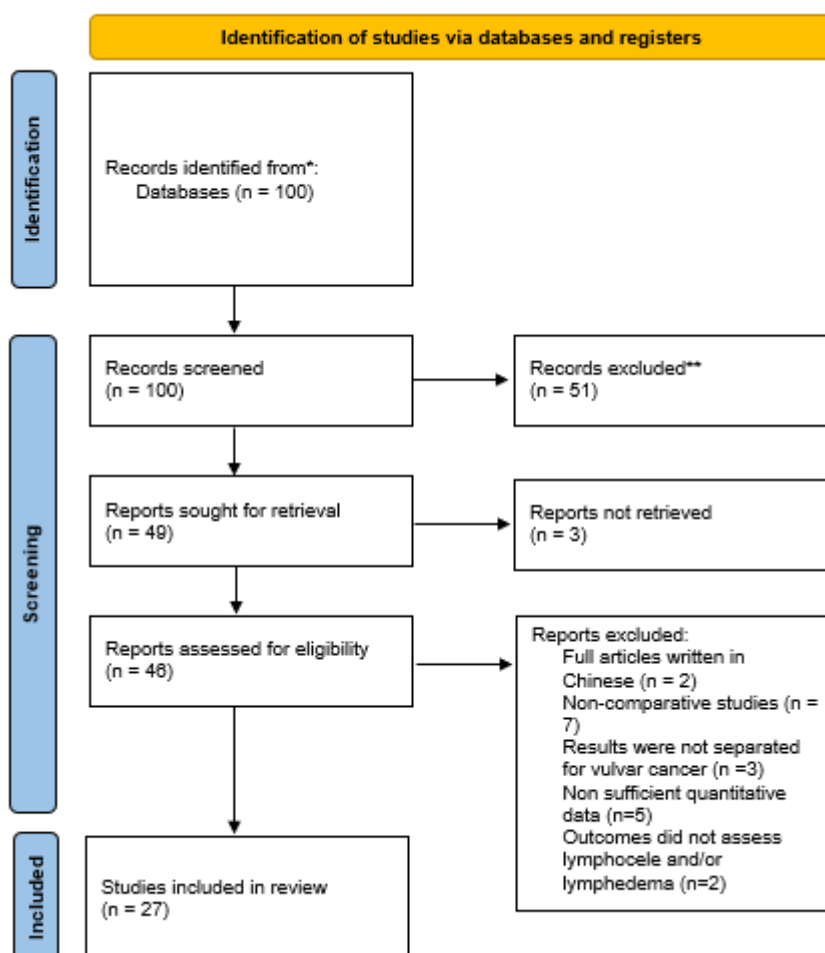


Table I. Summary of evidence

Author	Country; Year of publication	Study Design	Population	Results	Conclusion	Level of evidence
Buda, A. <i>et al.</i>	Italy, 2015	Multicenter observational study	N=49 patients with vulvar cancer that underwent groin dissection (TachoSil®) group=24; control group=25)	Postoperative inguinal drainage volume was significantly lower in the Tachosil group compared to the control group (mean volume of 84 ml vs. 143 ml, $p = .004$). Lymphocyst required drainage occurred in two patients of the TachoSil group (8%) and in 10 patients of control group (44%).	TachoSil® was effective in preventing postoperative lymphocyst formation after groin dissection.	2b
Van der Zee, A. <i>et al.</i>	Netherlands, 2008	Multicenter observational study	N=383 patients with early-stage (T1/T2 ≤ 4 cm), unifocal squamous cell vulvar cancer: 264 underwent SNL biopsy and 119 SLN dissection plus lymphadenectomy	SLN-only patients had a reduced lower-limb lymphedema (1.9% vs. 25.2%, $p<.0001$), compared with inguinofemoral lymphadenectomy patients.	SLN dissection is a safe alternative, reducing lymphedema, without compromising oncological outcomes.	2b
Zhang X. <i>et al.</i>	China, 2007	Prospective comparative clinical study	N= 64 patients with vulvar malignancies underwent inguinal lymphadenectomy with saphenous vein preservation (n=31) or saphenous vein ligation (n=33)	Saphenous vein preservation significantly reduced short-term lower-extremity lymphedema (43.5% vs 66.7%, $p<0.01$). There were no differences in lymphocyst formation (25.8% vs 31.8%, $p>0.05$).	Although there was a reduced short-term lower extremity lymphedema, there was not different in lymphocyst formation with saphenous	2b

			according to clinical stage.		vein preservation.	
Bharathan R. <i>et al.</i>	UK, 2018	Prospective randomized feasibility study	N=6 Patients with vulvar cancer underwent bilateral inguinal lymphadenectomy and blue dye-guided lymph channel ligation was performed on one randomly assigned groin, with the contralateral side serving as control.	No significant differences between intervention and control sides in drainage duration, drainage volume, or lymphocyst formation.	Blue dye-guided lymph channel ligation did not improve postoperative lymphocyst formation.	1b
Naldini A. <i>et al.</i>	Italy, 2017	Prospective pilot paired comparative study	N=15 patients with vulvar cancer underwent bilateral inguino-femoral lymphadenectomy. Each patient underwent Video Endoscopic Inguinal Lymphadenectomy (VEIL) on one side and open inguinal lymphadenectomy (OIL) on the contralateral side.	Lymphedema was significantly lower after VEIL (p=0.024).	VEIL has lower postoperative lymphedema than OIL.	2b

Saner F. <i>et al.</i>	Switzerland, 2019	Retrospective comparative study	N=11 patients with vulvar cancer underwent bilateral inguino-femoral lymphadenectomy. A fibrin sealant patch (TachoSil®) was placed in one groin, with the contralateral groin serving as control.	Groins treated with the fibrin sealant patch developed significantly larger lymphoceles over time (median 20 vs 5 mL; $p=0.002$) and required more punctures for symptomatic lymphoceles.	Fibrin sealant patches after inguinal lymphadenectomy did not reduce lymphocele formation.	3b
Pouwer A.W. <i>et al.</i>	Netherlands, 2017	Prospective multicenter observational comparative study	N=141 patients (251 groins) with vulvar carcinoma underwent inguino-femoral lymphadenectomy. Compared volume-controlled drainage (n=77; 139 groins) vs short fixed-duration drainage (n=64; 112 groins).	Volume-controlled drainage resulted in significantly lower lymphocele formation (15% vs 60%; risk difference 45%, $p<0.001$).	Volume-controlled drainage after inguino-femoral lymphadenectomy reduced lymphocele formation compared with short-duration.	2b
Caretto A.A. <i>et al.</i>	Italy, 2022	Retrospective observational study	N=31 patients with vulvar cancer underwent bilateral inguino-femoral lymphadenectomy, with unilateral immediate inguinal reconstruction using L-SCIP flap. Each patient	The reconstructed groins showed significantly smaller increase in limb volume compared with contralateral sides (479 ± 330 cc vs 683 ± 425 cc; $p=0.022$). Lymphoscintigraphy confirmed reduced lymphatic impairment in reconstructed sides.	Immediate inguinal reconstruction with L-SCIP flap may reduce lower limb lymphedema after groin dissection.	2b

			served as their own control.			
Dardarian T. <i>et al.</i>	USA, 2005	Retrospective cohort study	N=29 patients (49 inguinal lymphadenectomies) with vulvar carcinoma (saphenous vein sparing (n=18 dissections) vs vein ligation (n=31 dissections))	Vein sparing was associated with significantly lower rates of chronic lymphedema (11% vs 38.7%; P<0.05). Short-term edema was similar between groups. No lymphocyst and seroma formation reported.	Saphenous vein preservation during inguinal lymphadenectomy reduced chronic lymphedema.	2b
Sawan S. <i>et al.</i>	UK, 2009	Prospective randomized controlled pilot trial	N=14 patients underwent inguinofemoral lymphadenectomy for vulvar cancer (control (n=7) vs use of compression stockings for 6 months (n=7))	No difference in clinically significant lymphedema incidence and lymphocyst formation between groups. Compression stockings were associated with lower mean leg volume increase (607 vs 953 mL; P=0.010) and improved symptom and clinical scores at several time points.	Compression stockings did not reduce clinically significant lymphedema or lymphocyst formation.	1b
Rodríguez-Trujillo A. <i>et al.</i>	Spain, 2018	Retrospective comparative cohort study	N=93 patients with vulvar carcinoma underwent sentinel lymph node (SLN) biopsy (n=42) or inguinofemoral lymphadenectomy (IFL ± SLN) (n=51).	IFL was associated with higher rates of lymphedema (33.3% vs 0%; P<0.001). The rate of lymphocele was also higher in the group of IFL +/- SLN, although not significantly (9.8% vs. 4.8%; p=0.451).	SLN biopsy alone diminishes lymphedema rates compared to IFL +/- SLN.	2b
Li L. <i>et al.</i>	China, 2015	Case-control study	N=58 patients with vulvar cancer underwent bilateral inguinal lymphadenectomy and received either sartorius	Lymphocele: 20% for sartorius transposition vs 10.7% for sartorius tendon transposition (p=0.473) Chronic lymphedema: 33.3% in sartorius transposition vs 7.1% in	The rates of chronic lower extremity lymphedema, but not lymphocele, were decreased in	3b

			transposition (n=28) or sartorius tendon transposition (n=30)	sartorius tendon transposition (p=0.022).	the sartorius tendon transposition group.	
Carlson J. <i>et al.</i>	USA, 2008	Prospective randomized controlled trial	N=150 patients underwent inguinal lymphadenectomy for vulvar cancer with either sutured closure (SC, n=67 evaluable) or VH fibrin sealant + sutured closure (FS, n=70 evaluable).	No significant difference in grade 2–3 lower limb lymphedema between groups (67% vs 60%; p=0.48). There was no statistically significant difference in seroma formation between the groups.	VH fibrin sealant does not reduce post-lymphadenectomy lymphedema or seroma formation.	1b
Novackova M. <i>et al.</i>	Czech Republic, 2012	Prospective, non-randomized, cohort study	N=29 patients underwent surgery for vulvar cancer: inguinofemoral lymphadenectomy (RAD, n=17) or sentinel lymph node biopsy (CONS, n=12)	Lower-limb lymphedema was: 25% in sentinel lymph node group (3/12) vs 37.5% in inguinofemoral lymphadenectomy group (6/17) (p=0.69).	No difference in lymphedema between the sentinel lymph node and inguinofemoral lymphadenectomy groups.	2b
Le A. <i>et al.</i>	China, 2018	Retrospective comparative observational study	N=46 patients with vulvar cancer (1 malignant melanoma, and 1 adenocarcinoma; others had vulvar squamous cell carcinoma) underwent inguinal lymphadenectomy: video	Lymphatic complications: - Lymph exudate (VEIL-H: 1; VEIL-L: 0; OIL: 4), - Lymph cyst (VEIL-H 1; VEIL-L: 1; OIL 2) p=0.034	VEIL groups had less lymphatic complications compared with OIL.	2b

			endoscopic inguinal lymphadenectomy via hypogastric subcutaneous approach (VEIL-H, n=17), limb subcutaneous approach (VEIL-L, n=8), or open inguinal lymphadenectomy (OIL, n=21).			
Zhang S.H. <i>et al.</i>	USA, 2000	Retrospective comparative study	N=83 patients with vulvar cancer underwent inguinal lymphadenectomy (139 dissections): saphenous vein preservation (n=62) vs saphenous vein ligation (n=77)	Short-term lower-extremity lymphedema (<6 months) occurred in 32% of the saphenous vein preservation group vs 70% of the vein ligation group (p<0.001). Chronic edema (≥2 years) occurred in 3% vs 32%, respectively (p=0.003). Chronic lymphedema occurred in only 1 patient in the vein-preservation group (after postoperative radiotherapy). Lymphocyst incidence was similar between the groups.	Saphenous vein preservation during inguinal lymphadenectomy significantly reduced short- and long-term lower-limb lymphedema, without differences in lymphocyst formation.	3b
Manci N. <i>et al.</i>	Italy, 2009	Prospective randomized clinical trial	N=62 patients with vulvar carcinoma underwent inguinal lymphadenectomy randomized to skin incision 3-4cm above the inguinal ligament (group A) with 31 patients or	Chronic leg edema showed no difference between groups. Lymphocele occurred early in 5.6% (3/54) in group A vs 18.9% (10/53) in group B (p=0.07) and later in 3.77% in group B and 3.70% in group A (p=0.98).	No statistically significant differences were found between lymphadenectomy incision above or below the inguinal ligament in terms of	1b

			below it (group B) with 31 patients.		lymphocele formation or chronic leg edema.	
Baggio S. <i>et al.</i>	Italy, 2019	Double-blind randomized controlled trial	N=19 patients with vulvar cancer underwent bilateral inguinofemoral lymphadenectomy (one groin treated with TachoSil® and the contralateral groin with standard closure).	Lymphocele occurred 21.1% (4/19) in the TachoSil® group and 15.8% (3/19) in the control arm (p=0.676). At 6 months, grade 1 lymphedema occurred in 44.4% of TachoSil®-treated groins vs 50% of controls (p=0.744). Grade 2–3 lymphedema occurred in 33.3% of both groups (p=1).	TachoSil® application did not reduce postoperative lymphedema or lymphatic complications	1b
Gitas G. <i>et al.</i>	Germany, 2021	Retrospective observational cohort study	N=121 patients underwent curative-intent surgery for vulvar carcinoma. 24 patients underwent SLNB alone, a primary IFLND in 41 and both procedures in 30. 14 were excluded from analysis because they died during follow-up. (N=95).	Lymphocele occurred in 0% (0/24) of the patients that underwent SLNB vs 22.5% (16/71) of the patients that underwent IFLND (p<0.001) and lymphedema occurred in 0% (0/24) vs 14% (10/71) (p<0.001), respectively..	SLNB is associated with reduced lymphocele and lymphedema compared to IFLN.	2b
Mattson J. <i>et al.</i>	USA, 2022	Retrospective multicenter cohort study	N=233 patients (400 groin dissections) with vulvar squamous cell carcinoma underwent superficial or deep inguinal	Deep dissection was associated with significantly higher postoperative morbidity, including lymphedema (42.4%), compared to 15.9% of cases in	Superficial inguinal lymph node dissection resulted in less lymphedema with	2b

			lymph nodes dissection.	superficial inguinal lymph nodes dissection (p<0.01)	comparable oncologic outcomes to deep dissection.	
Beamon te I. <i>et al.</i>	Spain, 2025	Prospective, non- randomized study	N=15 patients with vulvar cancer underwent inguinofemoral lymphadenectomy, comparing the use of a sealing device (n=5) vs standard lymphadenectomy (n=10).	Seroma occurred in 0 patients (0%) in the sealing device group and in 2 patients (20%) of the control group. Lymphedema occurred in 30% (3/10) of the patients in the control group and 0% (0/5) in the sealing device group (p=0.505).	The use of a sealing device did not result in a statistically significant reduction in postoperative seroma or lymphedema.	2b
Gori J. <i>et al.</i>	Argentina, 2002	Retrospective comparative cohort study with historical controls	N=24 patients with early-stage vulvar carcinoma treated with simple vulvectomy or wide local excision plus ipsilateral superficial inguinal lymphadenectomy (ISIL) vs 21 controls treated with bilateral superficial/deep inguinal lymphadenectomy	Moderate lymphedema occurred in 5 (23.8%) of the 21 historical comparison patients, while no cases of lymphedema (0/24) was observed in the ISIL group, with p < 0.02. Lymphocele was not a complication considered in this study.	In selected patients with early-stage vulvar cancer, conservative surgery with ISIL appears to achieve comparable oncologic outcomes while substantially reducing postoperative morbidity	2b
Pontre J. <i>et al.</i>	Australia, 2018	Retrospective cohort study	N=71 patients with vulvar cancer underwent unilateral or bilateral inguinofemoral	Lymphocyst occurred in 27.1% of the patients with the drain (13/48) and 43.5% of the patients without the drain (10/23) (p=0.186). Lower-limb lymphedema was reported	Routine groin drainage after inguinofemoral lymphadenectomy did not reduce	2b

			lymphadenectomy, comparing groin drain (n=48) vs no drain (n=23)	in 14.6% (7/48) and in 8.7% (2/23), respectively (p=0.708).	lymphocyst formation and lower-limb lymphedema compared to no drain.	
Nooij L.S. <i>et al.</i>	Netherlands, 2015	Retrospective observational cohort study	N=68 patients with vulvar squamous cell carcinoma and lymph node metastases to the groin who underwent surgery of the groin as their initial treatment: 16 groins treated with sentinel node removal (SLNB), 30 groins with full inguinofemoral lymphadenectomy (IFL), and 38 with lymph node debulking surgery.	Lymphocyst occurred in 6.2% (1/16) of the patients that underwent SLNB, 0% (0/38) in the debulking group and 26.7% (8/30) in the IFL group (p=0.032) and lymphedema occurred in 6.2% (1/16), 0% (0/38) and 43.3% (13/30), respectively (p=0.002).	In patients with vulvar cancer with lymph node metastases, IFL was associated with increased lymphatic complications such as lymphocele and lymphedema, compared with less radical groin approaches, such as SLNB and debulking of pathologic or enlarged nodes (in combination with postoperative radiotherapy), without increasing the risk of recurrence.	2b
Zhang M. <i>et al.</i>	China, 2017	Retrospective cohort study	N= 48 patients with FIGO stage IB-IV invasive squamous cell carcinoma of the vulva underwent	20 patients in the COIL group and 19 patients in the VEIL group returned for follow-up after the operation.	No statistically significant differences were observed	2b

			bilateral inguino-femoral: 21 underwent video endoscopic inguinal lymphadenectomy (VEIL) and 27 conventional open inguino-femoral lymphadenectomy (COIL).	Lymphocele occurred in 5% of the patients in the COIL group (1/20) and in 0% of the patients in the VEIL group (0/19) (p=1.000). Lymphedema was reported in 15% (3/20) and in 31,6% (6/19), respectively (p=0.273).	between the groups in terms of incidence of lymphocele or lymphedema.	
Rouzier R. <i>et al.</i>	France, 2003	Retrospective cohort study	N = 194 patients with vulvar carcinoma who underwent: 1) different techniques of lymphadenectomy, such as inguino-femoral lymphadenectomy (N=206), inguinal lymphadenectomy (N=22), medial inguinal and medial femoral lymphadenectomy (N=52) and inguinal and medial femoral lymphadenectomy (N=75); 2) with sartorius transposition (N=67) or without (N=139); 3) with saphenous vein preservation (N=130) or	Lymphocele was not a complication considered in this study. Lymphedema occurred in 47% of the patients in the inguino-femoral lymphadenectomy group; 22.7% in the inguinal lymphadenectomy group; 11.5% in the medial inguinal and medial femoral lymphadenectomy group; and 32% in the inguinal and medial femoral lymphadenectomy group (p<0.001). In the second category, lymphedema occurred in 55.2% of the patients in the sartorius transposition group and 21.6% in the group without (p<0.001). In the third category, lymphedema was a complication in 23.1% of the patients with saphenous vein preservation and 45.3% of the patients in the group without (p<0.001).	Conservative modifications of groin dissection, including preservation of the fascia lata and saphenous vein, were associated with lower postoperative morbidity and lower rates of chronic lymphedema while maintaining comparable oncologic outcomes. Sartorius transposition did not reduce morbidity and was associated with increased lymphedema.	3b

			without (N=225).			
Oonk M.H.M. <i>et al.</i>	Netherla nds, 2009	Cross- sectional questionnaire study	N=62 patients with early-stage vulvar cancer enrolled in the GROINSS-V study. 35 patients had a negative sentinel lymph node (SLN) and underwent SLN biopsy alone, while 27 patients had a positive SLN and subsequently underwent unilateral or bilateral inguinofemoral lymphadenecto my.	Self-reported lymphedema was significantly more frequent following inguinofemoral lymphadenectomy, than after sentinel lymph node biopsy alone (35 ± 32 vs. 12 ± 22 ; $p = 0.001$).	Patients treated with sentinel lymph node biopsy alone experienced less lymphedema complaints than those undergoing inguinofemor al lymphadenect omy.	2b

References

1. Hacker NF, Eifel PJ, van der Velden J. Cancer of the vulva. *Int J Gynaecol Obstet*. 2012;119 Suppl 2:S90–6.
2. Alkatout I, Schubert M, Garbrecht N, Weigel MT, Jonat W, Mundhenke C, et al. Vulvar cancer: epidemiology, clinical presentation, and management options. *Int J Womens Health*. 2015;7:305–13.
3. Nogueira-Rodrigues A, Oonk MHM, Lorusso D, Slomovitz B, Leitão MM, Jr., Baiocchi G. Comprehensive management of vulvovaginal cancers. *CA Cancer J Clin*. 2025;75(5):410–35.
4. Oonk MHM, Planchamp F, Baldwin P, Mahner S, Mirza MR, Fischerová D, et al. European Society of Gynaecological Oncology Guidelines for the Management of Patients with Vulvar Cancer - Update 2023. *Int J Gynecol Cancer*. 2023;33(7):1023–43.
5. Gould N, Kamelle S, Tillmanns T, Scribner D, Gold M, Walker J, et al. Predictors of complications after inguinal lymphadenectomy. *Gynecol Oncol*. 2001;82(2):329–32.
6. de Melo Ferreira AP, de Figueiredo EM, Lima RA, Cândido EB, de Castro Monteiro MV, de Figueiredo Franco TM, et al. Quality of life in women with vulvar cancer submitted to surgical treatment: a comparative study. *Eur J Obstet Gynecol Reprod Biol*. 2012;165(1):91–5.
7. Van der Zee AG, Oonk MH, De Hullu JA, Ansink AC, Vergote I, Verheijen RH, et al. Sentinel node dissection is safe in the treatment of early-stage vulvar cancer. *J Clin Oncol*. 2008;26(6):884–9.
8. Gien LT, Slomovitz B, Van der Zee A, Oonk M. Phase II activity trial of high-dose radiation and chemosensitization in patients with macrometastatic lymph node spread after sentinel node biopsy in vulvar cancer: GROningen INternational Study on Sentinel nodes in Vulvar cancer III (GROINSS-V III/NRG-GY024). *Int J Gynecol Cancer*. 2023;33(4):619–22.
9. Elbalka SS, Taha A, Srinivas C, Hegazy MAF, Kotb SZ, Elnahas W, et al. Short-Term Surgical Outcomes of Standard and Lateral Video Endoscopic Inguinal Lymphadenectomy: A Multinational Retrospective Study. *J Laparoendosc Adv Surg Tech A*. 2020;30(4):373–7.
10. Saner FA, Schötzau A, Mackay G, Heinzelmann-Schwarz V, Montavon Sartorius C. Fibrin-thrombin sealant does not reduce lymphocele formation in patients with inguinofemoral lymphadenectomy for vulvar cancer. *Cancer Manag Res*. 2019;11:3575–82.
11. Baggio S, Laganà AS, Garzon S, Scollo M, Raffaelli R, Tateo S, et al. Efficacy of a collagen-fibrin sealant patch (TachoSil®) as adjuvant treatment in the inguinofemoral lymphadenectomy for vulvar cancer: a double-blind randomized-controlled trial. *Arch Gynecol Obstet*. 2019;299(5):1467–74.
12. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Bmj*. 2021;372:n71.
13. Group OLoEW. The Oxford Levels of Evidence 2: Oxford Centre for Evidence-Based Medicine; [Available from: <https://www.cebm.ox.ac.uk/resources/levels-of-evidence/ocebml-levels-of-evidence>
14. Zhang X, Sheng X, Niu J, Li H, Li D, Tang L, et al. Sparing of saphenous vein during inguinal lymphadenectomy for vulval malignancies. *Gynecol Oncol*. 2007;105(3):722–6.
15. Dardarian TS, Gray HJ, Morgan MA, Rubin SC, Randall TC. Saphenous vein sparing during inguinal lymphadenectomy to reduce morbidity in patients with vulvar carcinoma. *Gynecol Oncol*. 2006;101(1):140–2.

16. Zhang SH, Sood AK, Sorosky JL, Anderson B, Buller RE. Preservation of the saphenous vein during inguinal lymphadenectomy decreases morbidity in patients with carcinoma of the vulva. *Cancer*. 2000;89(7):1520–5.
17. Rouzier R, Haddad B, Dubernard G, Dubois P, Paniel BJ. Inguinofemoral dissection for carcinoma of the vulva: effect of modifications of extent and technique on morbidity and survival. *J Am Coll Surg*. 2003;196(3):442–50.
18. Li L, Kou X, Feng X, Liu F, Chao H, Wang L. Clinical application of sartorius tendon transposition during radical vulvectomy: a case control study of 58 cases at a single institution. *J Gynecol Oncol*. 2015;26(4):320–6.
19. Mattson J, Emerson J, Underwood A, Sun G, Mott SL, Kulkarni A, et al. Superficial versus deep inguinal nodal dissection for vulvar cancer staging. *Gynecol Oncol*. 2022;166(3):465–70.
20. Gori JR, Fritsches HW, Castaño R, Toziano M, Habich D. Ipsilateral superficial inguinal lymphadenectomy for the treatment of early cancer of the vulva. *J Low Genit Tract Dis*. 2002;6(3):150–4.
21. Mancini N, Marchetti C, Esposito F, De Falco C, Bellati F, Giorgini M, et al. Inguinofemoral lymphadenectomy: randomized trial comparing inguinal skin access above or below the inguinal ligament. *Ann Surg Oncol*. 2009;16(3):721–8.
22. Naldini A, Rossitto C, Pacelli F, Vizzielli G, Campagna G, Moruzzi MC, et al. The video endoscopy inguinal lymphadenectomy for vulvar cancer: A pilot study. *Taiwan J Obstet Gynecol*. 2017;56(3):281–5.
23. Le A, Xiong J, Wang Z, Dai XY, Xiao TH, Zhuo R, et al. Endoscopy-assisted inguinal lymphadenectomy in vulvar cancer. *Arch Gynecol Obstet*. 2018;297(5):1277–83.
24. Zhang M, Chen L, Zhang X, Ding J, Hua K. A Comparative Study of Video Endoscopic Inguinal Lymphadenectomy and Conventional Open Inguinal Lymphadenectomy for Treating Vulvar Cancer. *Int J Gynecol Cancer*. 2017;27(9):1983–9.
25. Pouwer AW, Hinten F, van der Velden J, Smolders RGV, Slangen BFM, Zijlmans H, et al. Volume-controlled versus short drainage after inguinofemoral lymphadenectomy in vulvar cancer patients: A Dutch nationwide prospective study. *Gynecol Oncol*. 2017;146(3):580–7.
26. Pontre J, Harding J, Chivers P, Loughlin L, Leung Y, Salfinger SG, et al. Do Groin Drains Reduce Postoperative Morbidity in Women Undergoing Inguinofemoral Lymphadenectomy for Vulvar Cancer? *Int J Gynecol Cancer*. 2018;28(1):183–7.
27. Bharathan R, Madhuri K, Fish A, Larsen-Disney P, Chatterjee J, Butler-Manuel S, et al. Effect of blue dye guided lymph channel ligation on the surgical morbidity of groin lymphadenectomy for vulvar cancer: a feasibility study. *J Obstet Gynaecol*. 2018;38(5):674–7.
28. Caretto AA, Stefanizzi G, Fragomeni SM, Federico A, Tagliaferri L, Lancellotta V, et al. Lymphatic Function of the Lower Limb after Groin Dissection for Vulvar Cancer and Reconstruction with Lymphatic SCIP Flap. *Cancers (Basel)*. 2022;14(4).
29. Rodríguez-Trujillo A, Fusté P, Paredes P, Mensión E, Agustí N, Gil-Ibáñez B, et al. Long-term oncological outcomes of patients with negative sentinel lymph node in vulvar cancer. Comparative study with conventional lymphadenectomy. *Acta Obstet Gynecol Scand*. 2018;97(12):1427–37.
30. Gitas G, Proppe L, Baum S, Kruggel M, Rody A, Tsolakidis D, et al. A risk factor analysis of complications after surgery for vulvar cancer. *Arch Gynecol Obstet*. 2021;304(2):511–9.
31. Oonk MH, van Os MA, de Bock GH, de Hullu JA, Ansink AC, van der Zee AG. A comparison of quality of life between vulvar cancer patients after sentinel lymph node procedure only and inguinofemoral lymphadenectomy. *Gynecol Oncol*. 2009;113(3):301–5.

32. Novackova M, Halaska MJ, Robova H, Mala I, Pluta M, Chmel R, et al. A prospective study in detection of lower-limb lymphedema and evaluation of quality of life after vulvar cancer surgery. *Int J Gynecol Cancer*. 2012;22(6):1081–8.
33. Nooij LS, Ongkiehong PJ, van Zwet EW, Bosse T, Creutzberg CL, Gaarenstroom KN, et al. Groin surgery and risk of recurrence in lymph node positive patients with vulvar squamous cell carcinoma. *Gynecol Oncol*. 2015;139(3):458–64.
34. Buda A, Ghelardi A, Fruscio R, Guelfi F, La Manna M, Dell'Orto F, et al. The contribution of a collagen-fibrin patch (Tachosil) to prevent the postoperative lymphatic complications after groin lymphadenectomy: a double institution observational study. *Eur J Obstet Gynecol Reprod Biol*. 2016;197:156–8.
35. Carlson JW, Kauderer J, Walker JL, Gold MA, O'Malley D, Tuller E, et al. A randomized phase III trial of VH fibrin sealant to reduce lymphedema after inguinal lymph node dissection: a Gynecologic Oncology Group study. *Gynecol Oncol*. 2008;110(1):76–82.
36. Sawan S, Mugnai R, Lopes Ade B, Hughes A, Edmondson RJ. Lower-limb lymphedema and vulval cancer: feasibility of prophylactic compression garments and validation of leg volume measurement. *Int J Gynecol Cancer*. 2009;19(9):1649–54.
37. Beamonte I, Gracia M, Siegrist J, Perez Y, Hernandez A, Zapardiel I. Pilot study on inguinofemoral lymphadenectomy by sealing device - Ilsede study. *Indian J Cancer*. 2024;61(4):736–40.
38. Rockson SG. Lymphedema. *Am J Med*. 2001;110(4):288–95.

INSTITUTO DE CIÊNCIAS BIOMÉDICAS ABEL SALAZAR

