Thieme

Sentinel Lymphonodectomy in Early Vulvar Cancer in Daily Practice: a Multicenter Experience from Germany

Sentinel-Lymphonodektomie bei Vulvakrebs im Frühstadium in der täglichen Praxis: eine multizentrische Erfahrung aus Deutschland

Authors

Philipp Soergel[1], Matthias Hempel[2], Julia Gallwas[3,4], Christian Dannecker[5], Linn Woelber[6], Ruediger Klapdor[2], Peer Hantschmann[7], Dirk M. Forner[8], Paul Gass[9], Monika Hampl[10], for the AGO Komission Vulva/Vagina

Affiliations

1 University Women's Hospital, Johannes Wesling Klinikum Minden, Ruhr University Clinic, Minden, Germany
2 University Women's Hospital, Hannover Medical School, Hannover, Germany
3 Department of Gynecology and Obstetrics, University of Munich, Munich, Germany
4 Department of Gynecology and Obstetrics, University Hospital Göttingen, Göttingen, Germany
5 Department of Obstetrics and Gynecology, University Hospital Augsburg, Augsburg, Germany
6 University Medical Center Hamburg-Eppendorf and Colposcopy Center at the Jerusalem Hospital, Hamburg, Germany
7 Department of Obstetrics and Gynecology, Altötting Hospital, Altötting, Germany
8 Department of Obstetrics and Gynecology, Cologne-Kalk Hospital, Cologne, Germany
9 Department of Gynecology and Obstetrics, Erlangen University Hospital, Comprehensive Cancer Center Erlangen-EMN, Friedrich Alexander University of Erlangen–Nuremberg, Erlangen, Germany
10 University Women's Hospital, University Hospital of Düsseldorf, Düsseldorf, Germany

Keywords

vulvar cancer, sentinel, groin, vulva

Schlüsselwörter

Vulvakrebs, Sentinel, Leiste, Vulva

received 24.10.2024
accepted after revision 16.2.2025
published online 25.3.2025

Bibliography

Geburtsh Frauenheilk 2025; 85: 533–540
DOI 10.1055/a-2541-2191
ISSN 0016-5751

Georg Thieme Verlag KG, Oswald-Hesse-Straße 50, 70469 Stuttgart, Germany

Correspondence

Philipp Soergel, MD
University Women's Hospital
Johannes Wesling Klinikum Minden, Ruhr University Clinic
Hans-Nolte-Straße 1
32429 Minden, Germany
Philipp.Soergel@muehlenkreiskliniken.de

ABSTRACT

Objective

Inguinal sentinel lymph node dissection has been shown to be safe in early vulvar cancer in several studies and is considered or even recommended in many guidelines. The prognosis of inguinal recurrence is often poor and associated with significant mortality. To ensure an acceptably low false-negative rate and recurrence, vulvar sentinel lymph node dissection should only be performed using high-quality standards. This retrospective study aims to investigate the incidence of isolated groin recurrence in daily practice in six large cancer centers in Germany.

Methods
We identified all patients with early vulvar cancer in 2009–2015 who underwent inguinal sentinel lymphonodectomy and presented with node-negative final histologic results. Patient details regarding disease stage, sentinel procedure, and follow-up were examined using local cancer databases and patient registries.

Results
A total of 414 patients with available follow-up data were found, with a mean follow-up time of 38.4 months. The mean tumor size, measured in the dermal plane before surgery, was 40.0 mm, with a median tumor size of 36 mm. Isolated groin recurrence was found in 13 of 414 cases, leading to an isolated groin recurrence rate of 3.1 %. The mean time to isolated groin recurrence was 17.7 months. There was no statistically significant association of any of the different quality requirements (tumor size < 4 cm, unifocal tumor, histologic ultra-staging, and preoperative exclusion of suspicious groins) with isolated groin recurrence.

Conclusion
Sentinel lymphadenectomy in vulvar cancer is a safe procedure in daily practice. The requirements of the cancer guidelines (unifocal tumor, ≤ 4 cm, histologic ultrastaging, and exclusion of suspicious groins preoperatively) should be followed to ensure a low isolated groin recurrence rate. However, in this study, we could not find any difference between the patients who fulfilled the guideline requirements and those who did not.

ZUSAMMENFASSUNG

Ziel
Mehrere Studien haben bestätigt, dass die Entfernung von Sentinel-Lymphknoten in der Leiste ein sicherer Eingriff bei Vulvakrebs im Frühstadium ist, und der Eingriff wird in vielen Leitlinien erwogen oder gar empfohlen. Die Prognose bei einem Rezidiv in der Leistengegend ist meist schlecht und geht mit einer signifikanten Mortalität einher. Um eine akzeptabel niedrige falsch negative Rate sicherzustellen und Rezidive zu vermeiden, sollte die Entfernung von Sentinel-Lymphknoten in der Leistengegend nur unter Einsatz hoher Qualitätsstandards durchgeführt werden. Ziel dieser retrospektiven Studie war es, das Auftreten von isolierten Leistenrezidiven in der täglichen Praxis in 6 großen Krebszentren in Deutschland zu untersuchen.

Methoden
Wir haben alle Patientinnen mit Vulvakrebs im Frühstadium ermittelt, die sich zwischen 2009 und 2015 einer Sentinel-Lymphonodektomie der Leiste unterzogen haben und deren endgültige histologische Ergebnisse nodal negativ waren. Die Patientenangaben zum Krankheitsstadium, Sentinel-Lymphonodektomie-Verfahren und Follow-up wurden mithilfe der örtlichen Krebsregister und Patientenregister geprüft.

Ergebnisse
Es fanden sich insgesamt 414 Patientinnen, bei denen Follow-up-Daten erhältlich waren. Die durchschnittliche Nachbeobachtungszeit betrug 38,4 Monate. Die vor der Operation kutan gemessene durchschnittliche Tumorgröße betrug 40,0 mm, die mittlere Tumorgröße war 36 mm. Isolierte Leistenrezidive traten bei 13 von 414 Fällen auf, was einer isolierten Leistenrezidivrate von 3,1 % entspricht. Die durchschnittliche Zeit bis zum Auftreten eines isolierten Leistenrezidivs betrug 17,7 Monate. Es gab keinen statistisch signifikanten Zusammenhang zwischen den Qualitätsanforderungen (Tumorgröße < 4 cm, unifokaler Tumor, histologisches Ultrastaging, präoperativer Ausschluss bei Verdacht auf Leistenmetastasen) und einem isolierten Rezidiv in der Leiste.

Schlussfolgerung
Die Sentinel-Lymphonodektomie zur Behandlung von Vulvakrebs ist ein sicherer Eingriff in der täglichen Praxis. Es sollten die in den Krebsleitlinien geforderten Anforderungen (unifokaler Tumor, ≤ 4 cm, histologisches Ultrastaging sowie der präoperative Ausschluss bei Verdacht auf Leistenmetastasen) befolgt werden, um eine niedrige isolierte Rezidivrate in der Leiste zu gewährleisten. Wir konnten aber in dieser Studie keinen Unterschied zwischen Patientinnen, welche den Leitlinienanforderungen entsprachen, feststellen und denjenigen, die das nicht taten.

INFO

What is already known on this topic

Inguinal sentinel lymph node dissection has been shown to be safe in early unifocal vulvar cancer in several studies and is considered or even recommended in many guidelines.

What this study adds

Sentinel lymphadenectomy in vulvar cancer patients is a safe procedure in daily practice in a real-world setting.

How this study might affect research, practice or policy

Sentinel lymphadenectomy in vulvar cancer can be routinely used in daily practice.

Introduction

Vulvar cancer is a rare gynecologic malignancy, but its incidence has been shown to increase in recent decades [1, 2]. Inguinal lymph node involvement is the most important prognostic factor for disease-free and overall survival, with a reduction in three-year disease-free survival and overall survival rates from 75 % to 35 % and from 90 % to 56 %, respectively, in patients with node-positive disease [3].

The standard therapy for early vulvar cancer is surgery, with a local excision of the tumor up to complete vulvectomy. Inguinofemoral nodal staging is mandatory for all vulvar cancers, with an infiltration depth > 1 mm (> pT1a). The risk of inguinal metastasis correlates with the depth of infiltration and increases rapidly from infiltration over 1 mm. Complete groin dissection (inguinofemoral lymphadenectomy) is associated with considerable short-term and long-term morbidity, with wound breakdown/infections in up to 30 % of patients and lymphoceles and lymph edema in up to 40 % [4].

Inguinal sentinel lymph node dissection has been shown to be safe in early unifocal vulvar cancer in several studies and is considered or even recommended in many guidelines [5, 6, 7, 8]. In the GROINSS-V study, the isolated groin recurrence rate was 2.5 % at 5 years [7]. The prognosis of inguinal recurrence is often poor and associated with significant mortality [7, 9]. To ensure an acceptably low false-negative rate, vulvar sentinel lymph node dissection should only be performed in patients with a unifocal tumor up to a tumor size of 4 cm and clinically unsuspicious lymph nodes through a clinical and/or sonographic examination, with the availability of histologic ultrastaging of the sentinel lymph nodes and a team trained for this procedure [8]. The gold standard of sentinel mapping in vulvar cancer is the use of radioactive technetium-99 m (Tc-99 m)-labelled nanocolloid. In addition, mapping with patent blue or indocyanine green (ICG) may be performed [8, 10].

This retrospective study aimed to investigate the incidence of isolated groin recurrence in daily practice in six large cancer centers in Germany. Ensuring a low rate in this setting further emphasized the safety of the procedure.

Methods

Ethical review

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board and Ethics Committee of Hannover Medical School, with reference number 7898.

Patients

The study was performed in six large gynecologic centers, all members of the AGO-Kommission Vulva/Vagina group (Dusseldorf, Hamburg, Munich, Hanover, Altötting, and Cologne-Kalk). In a retrospective setting, we identified all patients with early vulvar cancer treated between 2009 and 2015 who underwent inguinal sentinel lymphonodectomy and presented with final node-negative histologic results. The patient details regarding disease stage, sentinel procedure, and follow-up were examined using local cancer databases and patient registries. Patients with no available follow-up were excluded from further analysis.

Statistical analysis

Statistical analysis was performed using Microsoft Excel 2019 (Microsoft Corp., Redmond, USA) and XLSTAT 2020 (Addinsoft, Paris, France). The Kaplan–Meier curves were calculated for isolated groin recurrence. Special attention has been given to the analysis of the quality parameters derived from previous studies and the German guidelines on vulvar cancer (unifocal tumor, tumor size ≤ 4 cm, unsuspicious clinical groin examination, and histologic ultrastaging) [6, 8].

Results

Study population

Between 2009 and 2015, we identified 743 patients with vulvar cancer who underwent a sentinel procedure. After excluding patients with nodal involvement and subsequent further therapy, we found 414 patients with available follow-up data (Dusseldorf, n = 163; Munich, n = 94; Hamburg, n = 80; Hanover, n = 49, Altötting, n = 20; Cologne-Kalk, n = 8) (▶ **Fig. 1**). The mean age at diagnosis was 60.5 years (range 23–94).

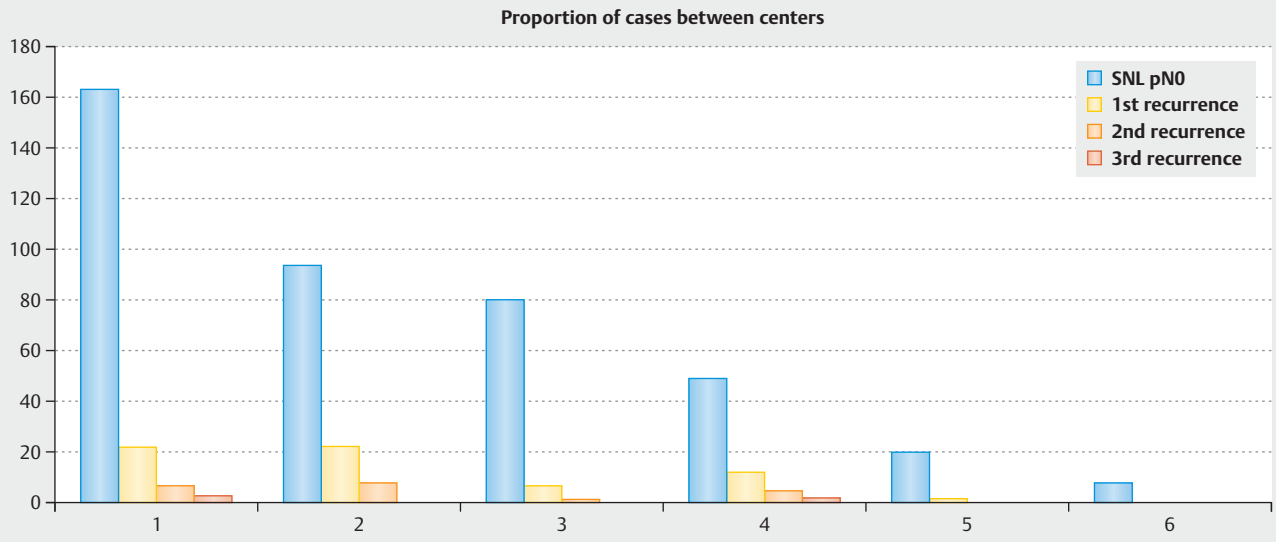
The mean follow-up time was 38.4 months (range 1–115).

Primary tumor

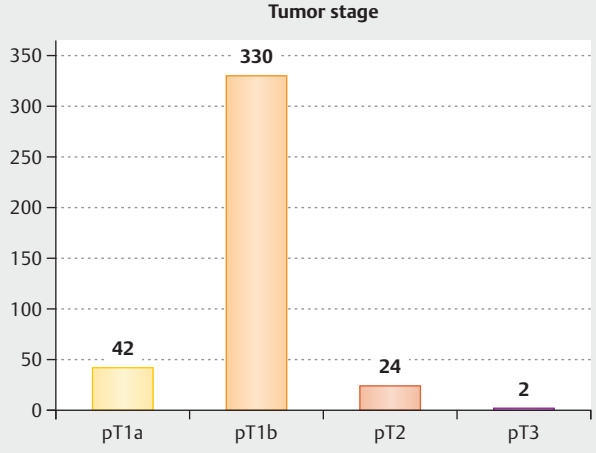
The final tumor stage of the primary tumor was available in 398 patients. pT1 b was the most frequent stage (n = 330; 82.9 %), while pT1a (n = 42; 10.6 %), pT2 (n = 24; 6.0 %) and pT3 (n = 2; 0.5 %) were less common (▶ **Fig. 2**).

Among the patients, 95.9 % showed unifocal tumors, while 3.1 % had multifocal invasive diseases (no information on 1 % of the cases).

In 115 patients, a local excision was performed (29.7 %), while 241 patients received a partial vulvectomy (62.3 %) and 31 patients (8.0 %) received a complete vulvectomy.



▶ **Fig. 1** Proportion of patient cases among the different recruiting centers.



▶ **Fig. 2** Distribution of the primary tumor stages.

The mean tumor size, measured in the dermal plane before surgery, was 40.0 mm (range 2–150 mm, data from 333 patients), with a median tumor size of 36 mm (▶ **Fig. 3**). The postoperative histologically measured mean tumor size was significantly smaller at 18.3 mm (range 1– 220 mm).

Preoperative groin assessment

All 414 patients had either a preoperative clinical examination of the groin, sonography, or both. Clinical examination was carried out in 254 patients (61.4%). Among them, 252 showed a normal result (99.2%), and the remaining two patients had suspicion of nodal involvement (0.8%). Sonography of the groins was conducted in 307 patients (76.0%). Among these patients, 295 (96.1%) had unsuspicious groin sonography before surgery, while 12 patients (3.9%) had suspicious findings in groin sonography.

Sentinel procedure and workup

Sentinel lymphonodectomy was performed unilaterally in 48 cases (11.6%) and bilaterally in 363 cases (87.7%). In 405 of the 414 cases, information on the substance used for the sentinel mapping was available. Tc-99 m-labeled nanocolloid was used in all 405 cases, with additional marking with patent blue in 42 cases (10.4%) and ICG in two cases (0.5%).

The mean number of removed sentinel nodes was 2.2 per side (range 0–9; right groin 2.16; left groin 2.26, n.s.). In 181 of 414 patients (43.7%), additional non-sentinel lymph nodes were removed (mean 3.7 per patient; median 2.0; range 1–18), leading to a mean of 1.6 non-sentinel lymph nodes in all patients.

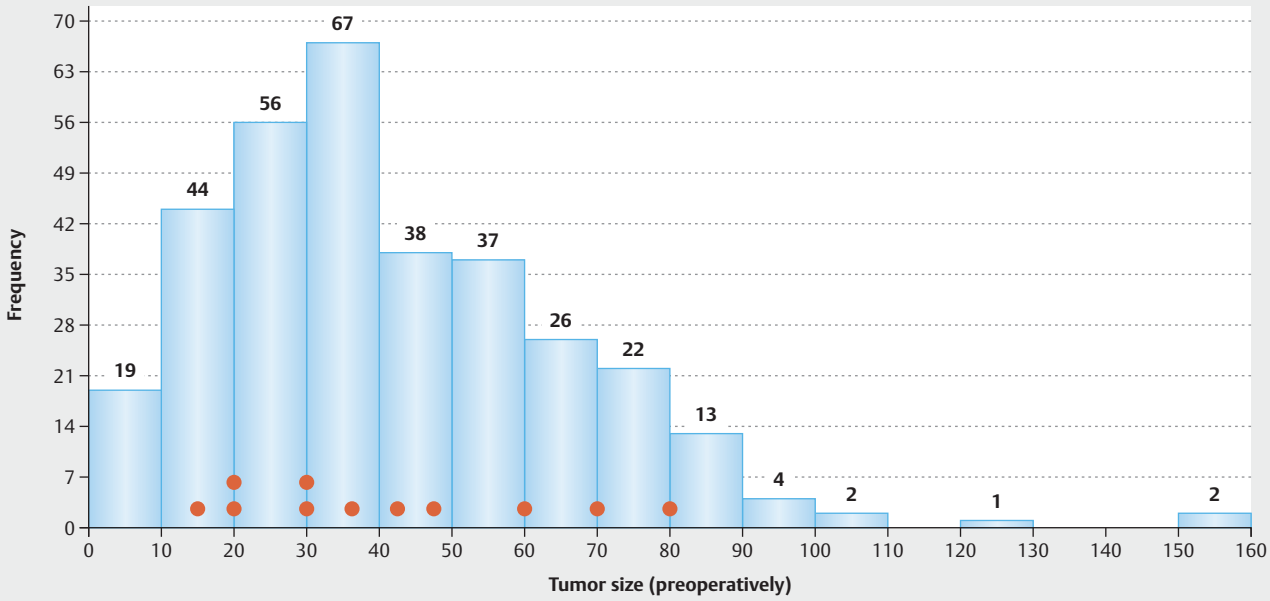
In 408 of 414 cases, we gathered information about histologic ultrastaging, which was performed in 404 cases (97.6%), with four cases without histologic ultrastaging and six cases with no information available. Frozen section analysis was performed in 82.4% of all cases.

Recurrence

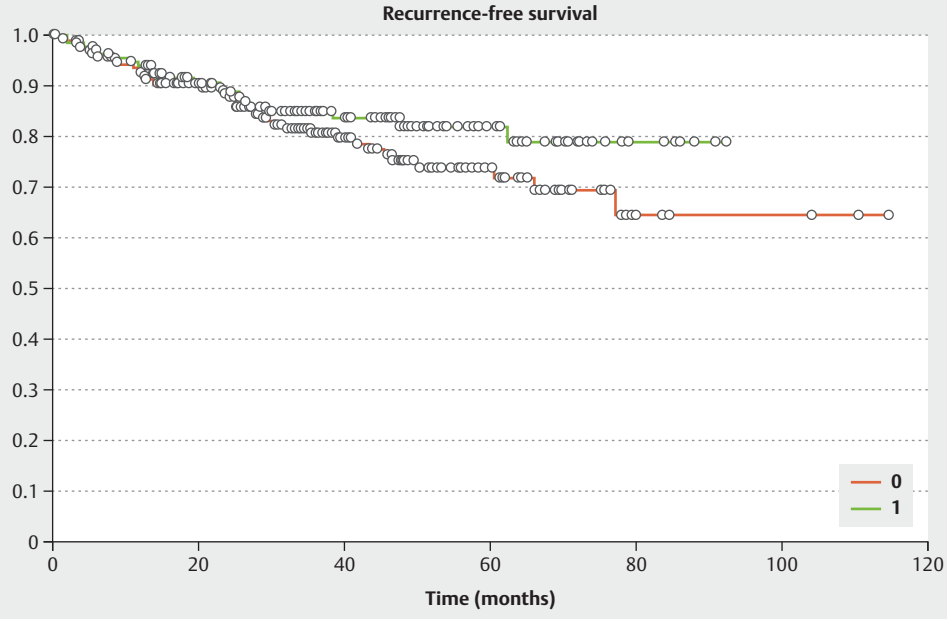
Among the 414 patients, 65 experienced recurrent disease (15.7%). The mean time to recurrence was 22.7 months (range 2–77). Moreover, 21 and 5 patients developed a second (21/65 = 32.3%) and third recurrence (5/21 = 23.8%), respectively. No significant differences in the overall recurrence rate between patients who fulfilled the guideline quality requirements and those who did not were observed (▶ **Fig. 4**).

Isolated groin recurrence (IGR)

Isolated groin recurrence was seen in 13 of 414 cases, leading to an isolated groin recurrence rate of 3.1%. The mean time to iso-



▶ **Fig. 3** Distribution of the preoperatively measured tumor size. Red dots indicate cases of isolated groin recurrence.



▶ **Fig. 4** Recurrence-free survival, depending on whether the quality criteria of the German guidelines for the treatment of vulvar cancer [8] are fulfilled (group 1) or not (group 0); p = 0.20.

lated groin recurrence was 17.7 months (range 5–39). With a mean age of 67 years (range 46–80), the difference in the whole study population (60 years) did not reach statistical significance (p = 0.1). The mean preoperative tumor size was 41 mm, and the mean histologic tumor size was 21.4 mm, both not statistically different from the group of all patients (40 mm and 18.3 mm, respectively). The tumor stage also did not statistically differ (pT1a, n = 1; pT1 b, n = 11; pT2, n = 1). All of these patients were marked with TC-99 m-nanocolloid, with additional blue dye marking in two cases. In 12 of the 13 patients in this group, an intraoperative frozen section was obtained, which was not significantly higher than in the whole study population (92 % vs. 82 %, p = 0.3).

▶**Table 1** Fulfilment of quality requirements for vulvar sentinel lymphadenectomy according to the German guideline in all patients, as in patients with and without isolated groin recurrence.

	All patients					Patients without isolated groin recurrence					Patients with isolated groin recurrence				
	Den.	yes	%	no	%	Den.	yes	%	no	%	Den.	yes	%	no	%
Unifocal tumor	403	389	96.5	14	3.5	390	377	96.7	13	3.3	13	12	92.3	1	7.7
Tumor size ≤ 4 cm, preoperative	333	187	56.2	146	43.8	322	181	56.2	141	43.8	11	6	54.5	5	45.5
Tumor size ≤ 4 cm, postoperative	352	333	94.6	19	5.4	339	320	94.4	19	5.6	13	13	100	0	0
Ultrastaging	414	403	97.3	10	2.4	400	390	97.5	10	2.5	13	13	100	0	0
Unsuspicious groin in palpation/ sonography	414	397	95.9	17	4.1	401	384	95.8	17	4.2	13	13	100	0	0
Combined*	333	184	55.3	149	44.7	322	178	55.3	144	44.7	11	6	54.5	5	45.5
Combined* without pT1a cases	291	143	49.1	148	50.9	281	138	49.1	143	50.9	10	5	50.0	5	50.0

Den. = Denominator; * without tumor size postoperatively

All patients in the IGR group underwent histologic ultrastaging. The mean number of sentinels removed per groin did not statistically differ from that of the whole study group (1.95 vs. 2.25; p = 0.37). Furthermore, the mean number of removed non-sentinel lymph nodes per patient did not statistically differ from that of the other study population (2.2 vs. 1.6; p = 0.56).

Fulfillment of the requirements of the German guidelines

▶ **Table 1** shows the proportion of fulfillment of the requirements of the German guidelines for the treatment of vulvar cancer [8]. Information for all different parameters was available in 333 of the 414 patients (80.4 %). Among these patients, all the requirements of the German guidelines were followed by 55.3 %.

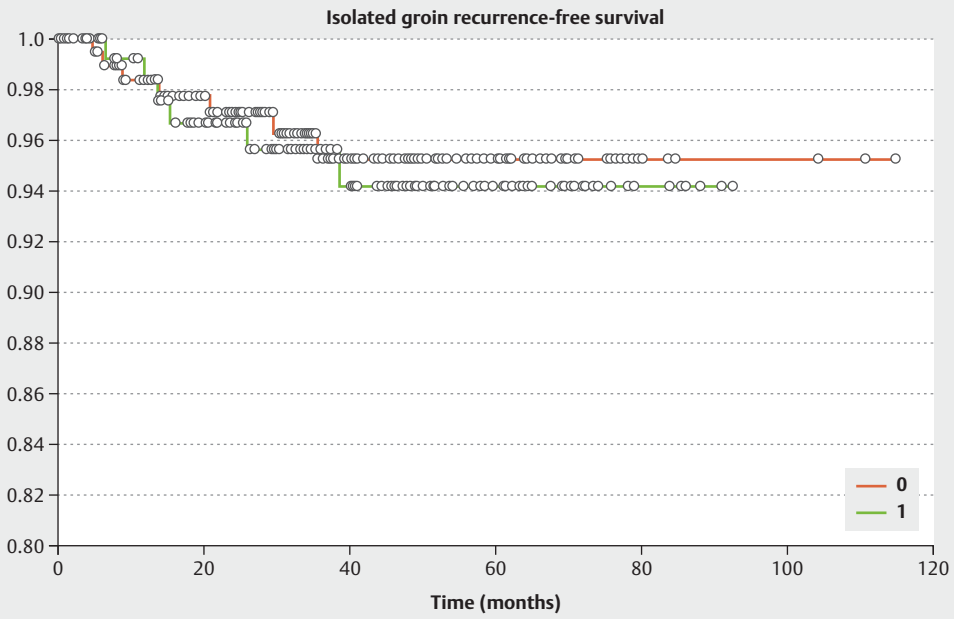
In this subgroup of 184 patients, there were six isolated recurrences, leading to an isolated recurrence rate of 3.3 %, with a mean follow-up time of 43 months. There were no statistically significant differences in the different quality requirements in any of the patient groups, with or without an isolated groin recurrence (▶ **Fig. 5**). After removing the pT1a cases who had been treated with the sentinel procedure, no statistically significant difference was found.

Discussion

The feasibility and the oncological safety of the sentinel node procedure in vulvar cancer have been shown in several prospective trials [5, 6, 7]. This procedure has been considered the most effective method to reduce treatment-related morbidity for patients with early-stage vulvar cancer in recent decades. However, data from real-life settings outside the framework of prospective studies are limited. This study confirms that vulvar sentinel dissection is also safe in this context.

In the GROINSS-V study, the isolated groin recurrence rate was 2.5 % at five years for sentinel-negative patients [7]. In our data, the isolated groin recurrence rate was slightly higher at 3.1 % at a mean follow-up time of 38.4 months. The risk of recurrence was higher in our study due to different factors often associated with real-life data.

The main factor was the significantly higher mean tumor size. The median diameter in the GROINSS-V study was 17.5 mm in sentinel-negative patients [6, 7]. Following the study protocol, this diameter was measured preoperatively. The primary tumor was measured by tape or estimated preoperatively, although we have no data on the specific measurement methods in a single patient. Postoperative measurements were done by rulers or measuring tapes in pathology departments. GROINSS-V excluded patients with a tumor size of > 4 cm, but these patients were included in our study population. In our data, the median tumor size, measured in the dermal plane before surgery, was 36.0 mm (range 2–150 mm, data from 333 patients), with a mean tumor size of 40 mm. The histologic measurement showed a mean tumor size of 18.3 mm. Among the patients, 43.8 % and 5.4 % had a preoperative and postoperative tumor size > 4 cm, respectively. As shown in ▶ **Fig. 3**, most of the cases had tumor sizes of 30–40 mm. In the 11 isolated groin recurrences, five occurred in this group, leading to an isolated groin recurrence rate of 3.4 % in patients with tumor sizes > 4 cm, without a significant difference compared with the whole population. Tumor size is the main predictive factor for lymphatic involvement [11, 12, 13]. Therefore, the significantly higher tumor size is a convincing explanation for the slightly higher isolated groin recurrence rate in our data compared with GROINSS-V [6, 7]. The reasons for performing sentinel



▶ **Fig. 5** Isolated groin recurrence-free survival, depending on whether the quality criteria of the German guidelines for the treatment of vulvar cancer [8] are fulfilled (group 1) or not (group 0); p = 0.75.

procedures in patients with tumor sizes > 4 cm were mainly higher age and co-morbidities.

In GROINSS-V, patients with multifocal tumors were excluded after amending the study protocol [5, 6, 7]. Among the patients in our data, 3.5 % had multifocal tumors who underwent sentinel lymphonodectomy, mainly due to higher age and co-morbidities. One patient in this group who had a tumor size of 15 mm and negative sentinel lymph nodes in both groins had an isolated groin recurrence after 14 months.

As reported, all patients in GROINSS-V had unsuspicious groin during palpation/sonography and histologic ultrastaging [7]. In our data, we found a small number of patients with suspicious groins preoperatively (14/414 = 3.4 %), or without ultrastaging (2.4 %, no information on ultrastaging/no ultrastaging). However, none of the 11 isolated groin recurrences occurred in these patients.

An infiltration depth below 1 mm is associated with a low rate of inguinal lymph node involvement [11]. In GROINSS-V, patients with an invasion depth ≤ 1 mm were excluded [6, 7]. However, in our real-life setting, 42 patients had pT1a stage (10.6 %). Interestingly, one patient in this group experienced an isolated groin recurrence. This patient had a unifocal vulvar cancer of 14 mm, which had a left-sided negative inguinal sentinel (0/3). Twenty-six months after surgery, a unilateral, left-sided isolated groin and pelvic recurrence was found, which was treated through surgery and radiotherapy.

To compare our dataset with the results of the GROINSS-V trial, we evaluated a subset of patients who fulfilled all the requirements for vulvar sentinel lymphadenectomy (▶ **Table 1**). No statistically significant difference was found between this group and the group of patients in which one or more requirements were not met. However, the low number of isolated groin recurrences is a restricting factor in analyzing the assumed difference.

Conclusions

Sentinel lymphadenectomy in vulvar cancer patients is a safe procedure in daily practice. The requirements of the cancer guidelines (unifocal tumor, ≤ 4 cm, histologic ultrastaging, and exclusion of suspicious groins preoperatively) should be followed to ensure a low isolated groin recurrence rate. However, in this study, we could not find any difference between the patients who fulfilled the guideline requirements and those who did not.

Acknowledgement

We would like to thank all members of the AGO-Kommission Vulva/Vagina for their support and critical discussion of this study.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

[1] Hampl M, Deckers-Figiel S, Hampl JA et al. New aspects of vulvar cancer: Changes in localization and age of onset. Gynecol Oncol 2008; 109: 340–345. DOI: 10.1016/j.ygyno.2008.01.041

[2] Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. CA Cancer J Clin 2020; 70: 7–30. DOI: 10.3322/caac.21590

[3] Mahner S, Jueckstock J, Hilpert F et al. Adjuvant therapy in lymph node-positive vulvar cancer: The AGO-CaRE-1 study. J Natl Cancer Inst 2015; 107. DOI: 10.1093/jnci/dju426

[4] Hinten F, van den Einden LC, Hendriks JC et al. Risk factors for short- and long-term complications after groin surgery in vulvar cancer. Br J Cancer 2011; 105: 1279–1287. DOI: 10.1038/bjc.2011.407

[5] Hampl M, Hantschmann P, Michels W et al. German Multicenter Study Group. Validation of the accuracy of the sentinel lymph node procedure in patients with vulvar cancer: Results of a multicenter study in Germany. Gynecol Oncol 2008; 111: 282–288. DOI: 10.1016/j.ygyno.2008.08.007

[6] Van der Zee AG, Oonk MH, de Hullu JA et al. Sentinel node dissection is safe in the treatment of early-stage vulvar cancer. J Clin Oncol 2008; 26: 884–889. DOI: 10.1200/JCO.2007.14.0566

[7] Te Grootenhuis NC, van der Zee AG, van Doorn HC et al. Sentinel nodes in vulvar cancer: Long-term follow-up of the GROningen INternational Study on Sentinel nodes in Vulvar cancer (GROINSS-V) I. Gynecol Oncol 2016; 140: 8–14. DOI: 10.1016/j.ygyno.2015.09.077

[8] Schnürch HG, Ackermann S, Alt CD et al. Diagnosis, therapy, and follow-up care of vulvar cancer and its precursors. Guideline of the DGGG and DKG (S2k-Level, AWMF Registry Number 015/059, November 2015. Geburtshilfe Frauenheilkd 2016; 76: 1035–1049. DOI: 10.1055/s-0042-103728

[9] Klapdor R, Hertel H, Soergel P et al. Groin recurrences in node-negative vulvar cancer patients after sole sentinel lymph node dissection. Int J Gynecol Cancer 2017; 27: 166–170. DOI: 10.1097/IGC.0000000000000860

[10] Soergel P, Hertel H, Nacke AK et al. Sentinel lymphadenectomy in vulvar cancer using near-infrared fluorescence from indocyanine green compared with technetium-99m-nanocolloid. Int J Gynecol Cancer 2017; 27: 805–812. DOI: 10.1097/IGC.0000000000000996

[11] Oonk MHM, Hollema H, de Hullu JA et al. Prediction of lymph node metastases in vulvar cancer: A review. Int J Gynecol Cancer 2006; 16: 963–971. DOI: 10.1111/j.1525-1438.2006.00387.x

[12] Woelber L, Eulenburg C, Choschzick M et al. Prognostic role of lymph node metastases in vulvar cancer and implications for adjuvant treatment. Int J Gynecol Cancer 2012; 22: 503–508. DOI: 10.1097/IGC.0b013e31823eed4c

[13] Klapdor R, Wölber L, Hanker L et al. Predictive factors for lymph node metastases in vulvar cancer. An analysis of the AGO-CaRE-1 multicenter study. Gynecol Oncol 2019; 154: 565–570. DOI: 10.1016/j.ygyno.2019.06.013