Thieme

Loop Excision for Precancers of the Uterine Cervix: Local or General Anaesthetic?

Schlingenexzision für Präkanzerosen der Cervix uteri: Lokalanästhesie oder Narkose?

Authors

Moritz Freisleben[1], Anja Petzel[2], Anne Jülicher[2], Anna Jonas[2], Janina Betzler[2], Natalia Choly[2], Esmira Pashayeva[3], Jan Porthun[4], Thomas Welcker[2], Viola Schneider[2], Andreas M. Kaufmann[5], Achim Schneider[2]

Affiliations

1 Praxis Dr. Katrin Schäfer, Hennigsdorf, Germany
2 Institut für Zytologie und Dysplasie, Berlin, Germany
3 Sankt Gertrauden Krankenhaus, Berlin, Germany
4 NTNU – Technisch-Naturwissenschaftliche Universität Norwegens, Campus Gjøvik, Gjøvik, Norway
5 Klinik für Gynäkologie, Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, CVK, Berlin, Germany

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Georg Thieme Verlag KG, Rüdigerstraße 14,
70469 Stuttgart, Germany

Correspondence
Prof. Dr. Achim Schneider, M.P.H.
Institut für Zytologie und Dysplasie
Hohenzollerndamm 123
14199 Berlin, Germany
mvz.schneider@icloud.com
a.schneider@mvz-fuerstenberg-karree.de

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ABSTRACT

Aim

In Germany, treatment of HSIL or AIS of the uterine cervix by loop excision is performed almost exclusively under general anaesthesia (GA). International studies and guidelines show high acceptance of local anaesthesia (LA) due to hermeneutic, medical, and economic factors. We performed an observational comparative study aiming to prove advantages of local anaesthesia within the German health system.

Patients and Methods

In a prospective observational study, patients diagnosed with HSIL or AIS of the uterine cervix were treated at the Institute for Cytology and Dysplasia, Berlin, by loop excision in 2021. We started with a feasibility study: 303 patients diagnosed with HSIL/AIS of the uterine cervix and her colposcopist answered an electronic questionnaire with respect to loop excision under LA.

Since we found a high acceptance for LA in patients and colposcopists, we initiated a comparative study LA vs. GA: 322 patients underwent loop excision and selected their mode of anaesthesia: n = 206 LA vs. n = 116 GA. 114 patients of the feasibility study had to undergo loop excision and became part of the comparative study (n = 79 for the LA group, n = 35 for the GA group). All patients received a standardised questionnaire to document their pain score within 24 h after treatment on a visual analogue scale, i.e. VAS, between 0 and 100. 178 patients of the LA group and 80 patients of the GA group completed and returned the questionnaire and form the cohort for our comparison of LA vs. GA. With 191 of these 258 patients, i.e. 74%, a telephone survey was performed to ask for patient satisfaction and the rates of recurrence after a mean interval of 1 year

post surgery. We postulate that there will be no clinically relevant significant difference in satisfaction and postoperative pain between patients in the LA group and the GA group.

Results

In the feasibility study, 90 % (272 of 303) of patients diagnosed with HSIL or AIS were considered eligible for LA by their colposcopists. 75 % (227 of 303) of patients were open to loop excision under LA.

In the comparative study, 63 of 206 women of the LA group were interviewed preoperatively: 89 % would accept a pain score above 20 during the procedure, 33 % a pain score above 50 and 11 % of max. 20. Postoperatively, the median VAS pain score for loop excision under local anaesthesia was 13.1 in 178 patients, and pain during injection of local anaesthesia was 20.9 ($p < 0.001$). The VAS pain score 20 minutes post surgery did not differ significantly between 178 patients after local anaesthesia versus 80 patients after general anaesthesia ($p = 0.09$). The surgeons estimated the patient's pain significantly less than the patients themselves with an underestimate of −14.63 points on the VAS ($p < 0.001$).

Within 7 days following loop excision under LA, 95.5 % of 178 patients would choose local anaesthesia as their preferred method for a potential repeat loop excision, 8.8 % of which would like additional painkillers, and 4.5 % would choose general anaesthesia.

In a telephone follow-up survey of 133 women from the LA group after a mean of 12 months post surgery, 97 % were "satisfied" or "very satisfied" with the treatment carried out. For patient satisfaction and postoperative pain, no clinically relevant significant difference was seen between the LA and the GA group.

The rate of secondary bleeding (6.7 % vs. 8.1 %, $p = 0.72$), recurrence of HSIL/AIS (3.6 % vs. 5.2 %, $p = 0.62$), and the distribution of the histopathological R status (R0 89.5 % vs. 81.1 %, $p = 0.73$; R1 5.3 % vs.12.2 %, $p = 0.57$, Rx 4.1 % vs. 5.4 %, $p = 0.65$) showed no significant difference when comparing the LA group versus the GA group.

Conclusion

Following loop excision under local anaesthesia, more than 95 % of patients would choose this method again for repeat surgery. One year post surgery, 97 % of the patients were "satisfied" or "very satisfied" with the treatment under local anaesthesia. Offering local anaesthesia for loop excision to patients should be mandatory and included in current guidelines.

ZUSAMMENFASSUNG

Ziel

Schlingenexzisionen zur Therapie von HSIL oder AIS der Cervix uteri werden in Deutschland fast ausschließlich in Allgemeinnarkose (AA) durchgeführt. Internationale Studien und Leitlinien zeigen eine Präferenz für Lokalanästhesie (LA) aus hermeneutischen, medizinischen und ökonomischen Gründen. Mit dem Ziel, die Alternative der örtlichen Betäubung auch den Frauen im deutschen Gesundheitssystem zukommen zu lassen, führten wir eine vergleichende Beobachtungsstudie durch.

Patientinnen und Methodik

In einer prospektiven Beobachtungsstudie wurden Patientinnen mit der Diagnose HSIL oder AIS der Cervix uteri im Institut für Zytologie und Dysplasie, Berlin, mittels Schlingenexzision im Jahre 2021 behandelt. Zunächst wurden in einer Machbarkeitsstudie 303 Patientinnen mit der Diagnose einer HSIL/AIS der Cervix uteri und ihr/ihre Kolposkopiker*in mittels eines elektronischen Fragebogens zur Option Schlingenexzision in LA befragt.

Da diese Befragung eine hohe Akzeptanz für LA bei Patientinnen und Kolposkopiker*innen ergab, initiierten wir eine Vergleichsstudie von LA vs. AA: 322 Patientinnen wurden mittels Schlingenexzision behandelt und wählten selbst das Anästhesieverfahren: $n = 206$ in LA vs. $n = 116$ in AA. Aus der Machbarkeitsstudie hatten 114 Patientinnen die Indikation zur Schlingenexzision und wurden Teil der Vergleichsstudie ($n = 79$ für die LA-Gruppe, $n = 35$ für die AA-Gruppe). Allen Patientinnen wurde ein standardisierter Fragebogen mitgegeben, mit dem der Schmerzscore bei einer visuellen Analogskala (VAS) zwischen 0 und 100 innerhalb von 24 Stunden postoperativ erfasst wurde. 178 Frauen der LA-Gruppe und 80 Frauen der AA-Gruppe beantworteten den postoperativ mitgegebenen Fragebogen und bilden somit die Kohorte für unsere vergleichende Untersuchung. 191 dieser 258 Patientinnen, i.e. 74 %, konnten nach einer mittleren Dauer von 1 Jahr postoperativ erneut telefonisch befragt werden. Hierbei wurde die Zufriedenheit und der Rezidivstatus der Patientinnen erfragt und dokumentiert. Wir postulierten, dass sich bezüglich Zufriedenheit und postoperativem Schmerzempfinden zwischen Patientinnen der LA-Gruppe und der AA-Gruppe keine klinisch relevanten signifikanten Unterschiede zeigen würden.

Ergebnisse

In der Machbarkeitsstudie wurden 90 % (272 von 303) der Patientinnen mit der Diagnose HSIL oder AIS von Kolposkopiker*innen als geeignet für eine Schlingenexzision in LA angesehen. 75 % (227 von 303) der in diesem Rahmen befragten Patientinnen waren offen für eine Operation in LA.

In der Vergleichsstudie wurden 63 von 206 Frauen der LA-Gruppe präoperativ befragt: 89 % würden bei der Operation einen Schmerzscore über 20 akzeptieren, 33 % einen Schmerzscore über 50 und 11 % von maximal 20. Postoperativ wurde von 178 Patientinnen für die Schlingenexzision in LA ein mittlerer Schmerzscore von 13,1, für den Injektionsschmerz der LA ein mittlerer Schmerzscore von 20,9 angegeben ($p < 0,001$). Schmerzen 20 Minuten nach dem Eingriff in LA ($n = 178$) versus Narkose ($n = 80$) unterschieden sich nicht signifikant ($p = 0,09$). Die Operateur*innen beurteilten

die Schmerzempfindung der Patientinnen während der Schlingenexzision in LA signifikant geringer als den Schmerz, der von der Patientin empfunden wurde mit einer Unterschätzung von − 14,63 Schmerzpunkten auf der VAS ($p < 0{,}001$).

Die Befragung innerhalb von 7 Tagen nach Schlingenexzision bei 178 Frauen der LA-Gruppe erbrachte, dass 95,5 % den Eingriff wieder in LA durchführen ließen (8,8 % davon mit zusätzlichen Schmerzmitteln) und 4,5 % die Vollnarkose wählen würden. Die telefonische Befragung nach einem mittleren Abstand zur OP von 12 Monaten ergab bei 133 Patientinnen der LA-Gruppe, dass 97 % der Patientinnen „zufrieden" oder „sehr zufrieden" mit der durchgeführten Behandlung waren. Für Patientinnenzufriedenheit und postoperatives Schmerzempfinden zeigte sich zwischen LA-Gruppe und AA-Gruppe kein signifikanter Unterschied.

Für die Rate an Nachblutungen (6,7 % vs. 8,1 %, $p = 0{,}72$), HSIL/AIS Rezidiven (3,6 % vs. 5,2 %, $p = 0{,}62$) sowie der Verteilung des histopathologischen R-Status (R0 89,5 % vs. 81,1 %, $p = 0{,}73$; R1 5,3 % vs. 12,2 %, $p = 0{,}57$, Rx 4,1 % vs. 5,4 %, $p = 0{,}65$) zeigte sich zwischen der LA-Gruppe versus AA-Gruppe kein signifikanter Unterschied.

Schlussfolgerung

Mehr als 95 % der Patientinnen würden wieder die örtliche Betäubung als Anästhesieverfahren wählen, und 97 % der Patientinnen zeigten sich auch noch 1 Jahr später zufrieden oder sehr zufrieden mit der Operation in Lokalanästhesie. Das Angebot einer Lokalanästhesie sollte obligat werden und in die entsprechende Leitlinie Aufnahme finden.

Introduction

Approximately 100 000 women in Germany undergo surgery every year for precancerous lesions of the uterine cervix. One treatment option is loop excision, also called the Loop Electrical Excision Procedure (LEEP), which is gentle to the tissue and can be performed both under local or general anaesthetic. The German guidelines for the prevention of cervical carcinoma do not provide a recommendation on the anaesthetic techniques to be used (https://register.awmf.org/assets/guidelines/015–027OLl_Praevention_Zervixkarzinom).

The UK NHS Guidance chapter "Colposcopic diagnosis, treatment and follow up" version dated 5 January 2023 provides the following guidelines on anaesthesia for loop excision:

"Treatment should be performed with adequate pain control and should include pre-treatment counselling. Treatment should be offered with local analgesia. Where this is inappropriate, general anaesthesia should be offered. Reasons for treating under general anaesthesia should be recorded in the colposcopy record. The proportion of individuals managed as out-patients with local anaesthesia should be at least 85 %, with an achievable target of 90 %."

(https://www.gov.uk/government/publications/cervical-screening-programme-and-colposcopy-management/3-colposcopic-diagnosis-treatment-and-follow-up).

160 responses to a questionnaire consisting of 38 questions to German colposcopy gynaecologists* about clinical practice in 2018 were analysed. 91.2 % perform the removal of HSIL of the uterine cervix by loop excision. 61.2 % perform the loop excision with a colposcope and 92.5 % under general anaesthetic. The authors call for a "uniform approach to be set out in detail in directives or guidelines" [1]. This questionnaire does not provide information on the ratio of LA to anaesthesia as the anaesthetic technique in German patients, but makes it very likely that LA is rather an exception, despite the fact that there are numerous international studies showing the advantages of LA and recommending it as the better form of anaesthesia for the majority of patients (see discussion).

A systematic analysis of 33 studies of diagnostic and therapeutic interventions involving 5935 women concluded that LEEP/LLETZ should be performed under LA and with colposcopic magnification [2].

In Germany, one comparative evaluation of the satisfaction between the two forms of anaesthesia for loop excision has been conducted to date, which shows no significant difference [3] (see also in discussion).

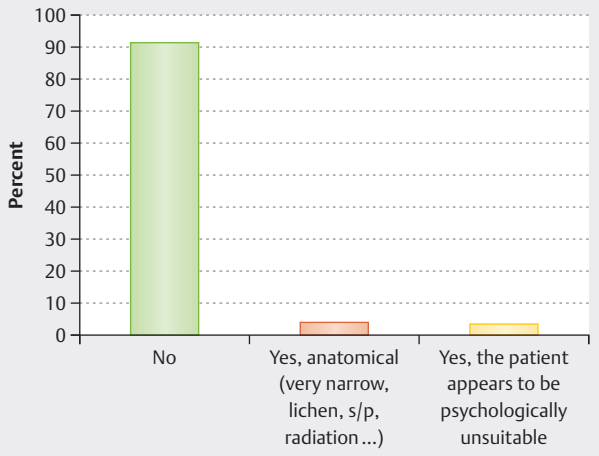
In our study, in addition to evaluating acceptance and treatment satisfaction, we also performed a differentiated measurement of the pain intensity of the loop excision with general anaesthetic vs. local anaesthesia.

We show that the operation under local anaesthesia is perceived by patients as low-pain and low-stress and is readily accepted.

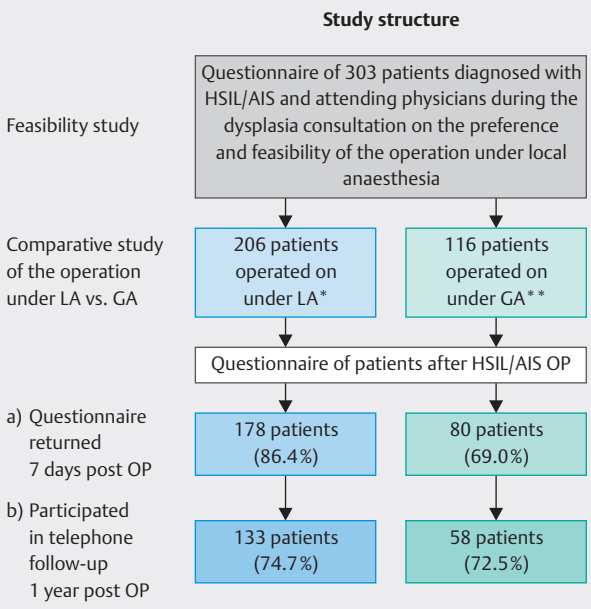
Patients and Methods

In the feasibility study, 303 patients diagnosed with HSIL of the uterine cervix in 2021 were interviewed by an electronic questionnaire immediately after the colposcopic examination, including biopsy of the vaginal portion of the cervix (▶ **Fig. 1**). They were told that if they needed an operation for their dysplasia, there were two different anaesthetic techniques available, GA or LA, and both procedures were explained to the patients. In addition, the colposcopists evaluated the question of how many of these patients could be operated on under local anaesthesia based on the patient's personality, the anatomy of the lower genital tract, the extent of the precancerous lesion, and the possible presence of concomitant diseases.

In the subsequent comparative study LA versus GA, 322 patients who were treated by loop excision at the Institute for Cytology and Dysplasia Berlin (IZD) in 2021 were included in this prospective observational study (▶ **Fig. 2**).



▶ **Fig. 1** Individual assessment of contraindications for local anaesthesia by the treating colposcopists. Survey of treating colposcopists on clinical and psychological contraindications in their patients (n = 303) to surgical therapy of HSIL under local anaesthesia by electronic questionnaire.



GA: General anaesthesia; LA: Local anaesthesia

* 79 of the patients from the feasibility study had the indication for surgery and are therefore part of the comparative study.

** 35 of the patients in the feasibility study were indicated for surgery and are part of the comparative study.

▶ **Fig. 2** Composition of the cohorts for the feasibility study and the comparative study.

All enrolled patients were open to both anaesthetic techniques. The patients were therefore not randomly assigned to one of the two groups, but based on the patient's time, spatial or personal preference. The operation was performed on 206 patients under local anaesthesia and on 116 patients under anaesthesia. The operations were performed by A. P., A. Jo., A. Jü., J. B., N. C., or A. S. As performing the operation under LA is potentially difficult (tense patient, limited field of vision), the experience of at least 100 loop excisions was a prerequisite for participating in the study.

114 of 303 patients in the feasibility study who had the indication for surgical therapy were included in the comparative study. Of these, 79 went to the LA group, 35 to the GA group (▶ **Fig. 2**).

258 of the 322 patients in the comparative study (86 % in the LA group i.e. n = 178 vs. 68 % i.e. n = 80 in the GA group) answered the postoperative questionnaire, returned it by post and were followed up (▶ **Fig. 2**). Of these 258 patients, 191 (74%) were able to be interviewed again by telephone after an average of 12 months after the operation regarding their treatment satisfaction and recurrence status (▶ **Fig. 2**). The pain scale in the questionnaire for the patients in the comparative study had already been validated in the feasibility study and was considered appropriate. The Ethics Committee had evaluated and accepted the questionnaire.

Methods of anaesthesia

In the patients with local anaesthesia, 20 ml of 1 % mepivacaine solution was injected subepithelially into the uterine cervix. This was done as standard either at the 3 and 9 o'clock positions or 3, 6, 9, and 12 o'clock positions in the lithotomy position and was documented in each case.

General anaesthetic was administered to all patients with propofol and an ultra-short-acting opioid i. v. and with a laryngeal mask.

All patients received 600 mg of ibuprofen orally one hour before surgery.

Data collection methods

All women were given a postoperative questionnaire to assess pain perception at regular intervals using a 10-cm visual 101-point analogue scale. The VAS is used as an alternative to the NRS scale with comparable values [4, 5].

In addition, the question of the preferred form of anaesthesia in the event of a repeat loop excision was recorded in writing.

Patient satisfaction with the treatment was not evaluated immediately after the procedure, as the patients in the GA group were still under the influence of the anaesthesia. Furthermore, in addition to the direct occurrence of pain, treatment success (secondary bleeding, recurrence, postoperative complications) should also be included in the evaluation of satisfaction. A corresponding time interval is necessary for this and we therefore asked for satisfaction with the treatment performed after an interval of 12 months using a 4-point Likert scale. Since the overall satisfaction survey was conducted by telephone after 12 months, it was more practical to use a Likert scale rather than a more differentiated 10 cm VAS. The 4-point Likert scale allows the patient to be categorised into "satisfied" (very satisfied, satisfied) or "dissatisfied" (less satisfied or not satisfied at all).

In order to determine the reasons for satisfaction or dissatisfaction, the questionnaire included the open question as to whether the patients had suggestions for improvement and, if so, which. The results are comprehensive and very diverse and are therefore not listed in this publication.

All surgeons and anaesthetists documented the operation and complications in the perioperative period and immediately after the operation.

(see Online Appendix).

Surgical technique

The same information sheets were always used in both groups to inform the patients about the operation. All practitioners explained the procedure to both groups. The physician who carried out the primary colposcopic examination on the patient then also operated on the respective patient. This ensured a trustful patient-physician relationship. In the preoperative phase, all patients had the opportunity to clarify any questions with the surgeon. During the procedure, the patients in the LA group had the option, if desired, of following the operation on a monitor or distracting themselves with a video (flora and fauna from different regions of the world) on a ceiling monitor and/or playing audios on headphones. The surgical instruments available (duckbill speculum/CO_2 laser/loops/spray coagulation) were identical for both groups. The vaginal portion of the cervix was adjusted and fixed by means of a duckbill speculum, so that the vaginal portion of the cervix was never held with bullet forceps. In the postoperative period, the patients were monitored by the nursing staff and the surgeon and told by the surgeon about how the operation went and how to proceed before they were discharged. The operative report and a leaflet on future conduct were given to the patient. Further postoperative treatment of the patients was carried out by the referring physicians approx. 14 days after the procedure. All patients received a 24 h emergency telephone number for postoperative complications. The operations under LA were always carried out without an anaesthesiologist present and patients haven't had the option of switching to a GA.

All women were told about the study and documented their participation in an information document by signing it. The study was approved by the Ethics Committee of Charité Universitätsmedizin Berlin (application number EA2/018/21).

Inclusion criteria

Any patient who was operated on at MVZ Fürstenbergkarree or GVZ Kreuzberg for precancerous lesions on the uterus and who consented to data collection.

Exclusion criteria

Patients who did not want to respond to the questionnaire sent to them.

Patients who were only eligible for only one of the two comparison groups for anatomical or disease-related reasons. These included: S/p. brachytherapy, severe vaginal stenosis and thus cervix not adjustable, allergy to local anaesthetics, patients with an anxiety disorder or experience of violence, or contraindication to GA.

The criteria described are based on experience and not on evidence.

The patients' mean age was evaluated.

Education, ethnicity, and BMI were not documented. Comorbidities are recorded in the digital tab, but were not documented separately for this study.

The volume of the excised tissue was measured according to Archimedes or estimated on the basis of the loop size used. The operation time was estimated by the surgeon minus the time required for an endocervicoscopy/hysteroscopy. Both the time for the application of the LA as well as inducing and emerging from GA were included. Intraoperative blood loss was estimated. There was no pre- and/or postoperative Hb check.

Statistical analysis

The hypothesis was that patient satisfaction would be roughly equally distributed in both groups and that postoperative pain perception would not differ significantly. In order to show a possible difference that significantly more patients in the LA group report treatment satisfaction as "less or not at all satisfied" than in the general anaesthetic group, the SAS function proc power, with an alpha of 0.05, results in a total of 117 patients in order to guarantee a power of 85 %. Since there were no preliminary studies, we calculated a drop-out rate of 40 %.

Pain sensations were measured using a visual analogue scale of 0–100. To compare pain sensation at different times between the local anaesthesia and general anaesthesia groups, t-tests for independent samples were used. Patient satisfaction was measured using a 4-point Likert scale.

The nonparametric Mann–Whitney U test was used to compare treatment satisfaction as well as the histopathological criterion of the resection edge status and clinical recurrence frequencies of both groups. The significance level was assumed to be $p = 0.05$. For statistical analysis, the software SPSS was used (IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp.).

Results

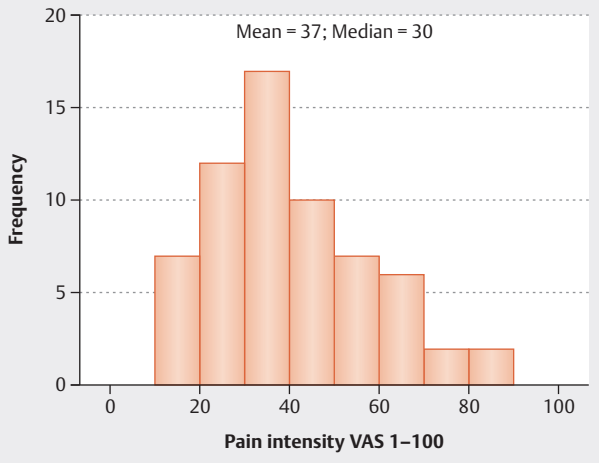
Feasibility study results

In the feasibility study, the medical assessment of 303 patients with a potential indication for loop excision showed that local anaesthesia was an option for 92 % of the patients. For 4 % of the patients, the anatomical conditions made general anaesthesia appear advantageous, and in a further 4 % of the women, the psychological constellation prevented intervention while they were conscious (▶ **Fig. 1**).

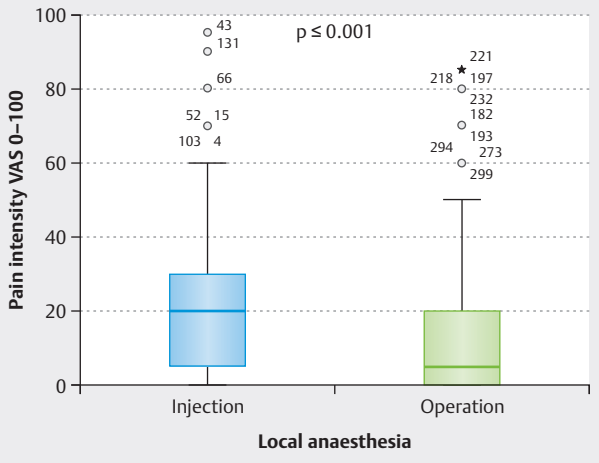
The questionnaire of patients revealed that 25 % (76 out of 300) of patients would only undergo surgery under general anaesthetic. 15 % (45 out of 300) of the patients reported that they would only undergo surgery under local anaesthesia and 60 % (182 out of 300) reported not having a preference for either anaesthetic technique. Overall, approximately 75 % (227 out of 303) of the patients surveyed were open to an operation under local anaesthesia.

Results of the prospective therapeutic comparison study

In the LA versus GA comparison study, patients were asked before the procedure what pain intensity on the VAS scale of 0–100 would still be acceptable for them for a loop excision under LA. 63 of 178 women answered this question and a mean of 37 was



▶ **Fig. 3** Maximum tolerable pain during surgery with local anaesthesia stated prior to the procedure. Frequency distribution of each preoperative statement on the maximum tolerable pain for the patient during the operation under local anaesthesia of patients operated on under local anaesthesia (n = 63) on a scale of 1–100. Questionnaire by the practitioners.



▶ **Fig. 4** Injection pain and surgery pain stated after the procedure. Comparison of subjectively perceived pain during injection of local anaesthesia versus subjectively perceived pain during loop excision, laser treatment, and haemostasis of patients operated on under local anaesthesia (n = 178) using t-test for independent samples. Survey by postoperative questionnaire.

calculated with a median of 30 (▶ **Fig. 3**). 20% of women would accept a pain intensity above 50 and all women considered a pain score up to 10 to be normal.

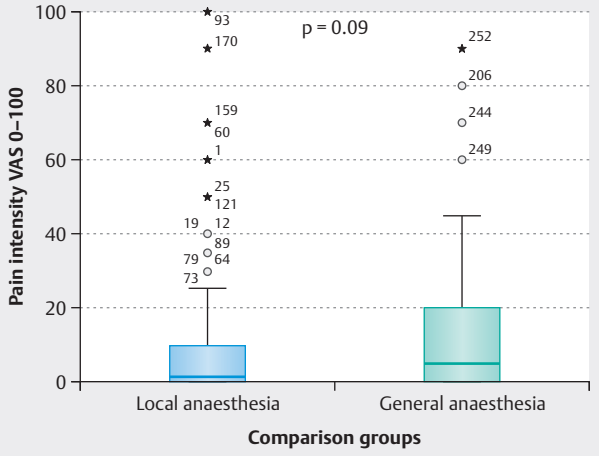
178 patients of the patients operated on under local anaesthesia documented both the injection pain of the LA and the pain during the loop excision in the postoperative questionnaire. It was shown that the injection was felt to be twice as painful compared to the loop: 20.9 versus 13.1 (mean difference 7.8 [95% CI [3.9;11.7]) in the mean pain score (p < 0.001) (▶ **Fig. 4**).

Primary endpoints

The questionnaire comparing LA (n = 178) versus GA (n = 80) was conducted at different points in time after the procedure. For 20 minutes post operation, the mean pain intensity was 10 (mean LA 9.3 versus mean GA 13.2 95% (mean difference − 3.9 [95% CI [− 8.3;0.6]; p = 0.09) in the pain score and therefore no significant difference between the two procedures (▶ **Fig. 5**). Even after 2, 4, 6, 12 and 24 hours, there were no significant differences in the respective mean pain intensities of the two groups: 10 vs. 14 (mean difference −3.7 [95% CI [−8.4;0.99] p) = 0.12), 8.0 vs. 10.6 (mean difference −2.5 [95% CI [−6.2;1.1] (p = 0.17), 8.0 vs. 9.4 (mean difference −1.3 [95% CI [−4.9; 2.2] p) = 0.45), 6.7 vs. 6.9 (mean difference −0.3 [95% CI [−3.6;3.1] p = 0.87) and 4.8 vs. 4.7 (mean difference 0.01 [95% CI [−2.5; 2.7] p = 0.94) on the VAS.

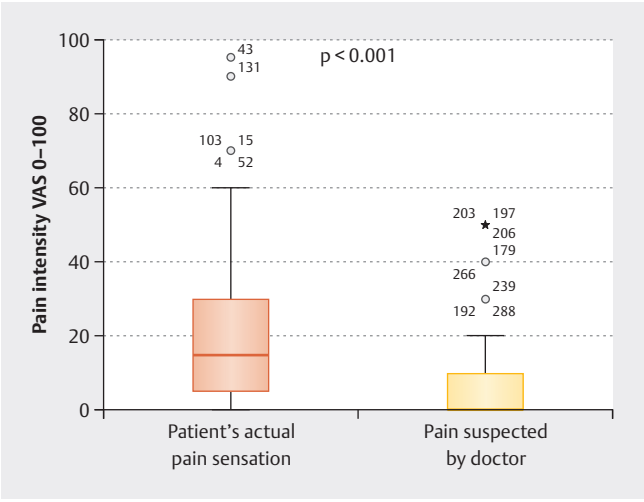
In the local anaesthesia group, 26.4% (47/178) of patients reported taking additional WHO level 1 analgesics in the first 24 h postoperatively. In the general anaesthetic group, this was reported by 23.8% (19/80) (p = 0.83). In the GA group, 8.8% (7/80) also received postoperative analgesics in the recovery room.

The sensation of pain during the entire procedure was assessed and documented by both the patient and the surgeon. For the patient, the mean pain score was 20, while the surgeon rated the pain as only half as severe, with a mean pain score of 6 (▶ **Fig. 6**). This difference is significant with a mean value of pain underestimation by the surgeon of −14.63 [95% CI [11.5;17.8] pain points on the VAS (p < 0.001).



▶ **Fig. 5** Comparison of indicated pain intensities 20 minutes postoperatively LA group versus GA group. Pain intensity represented 20 minutes postoperatively in patients operated under local anaesthesia (n = 178) versus patients operated under general anaesthetic (n = 80) with HSIL using a t-test for independent samples. Postoperative interview by questionnaire.

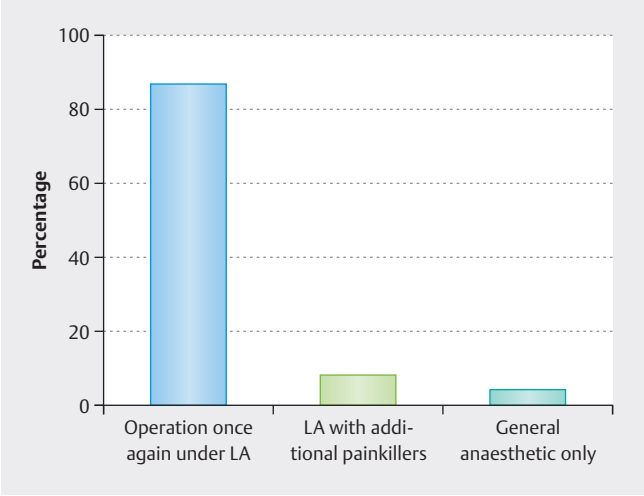
The questionnaire of the LA group within one week after the operation revealed that 95.5% of women would wish to have a re-



▶ **Fig. 6** Presumed vs. actually perceived pain during the operation. Discrepancy between pain intensity of patients operated on under local anaesthesia as presumed by the practitioners and actually perceived by the patient (n = 178). Postoperative questionnaire of patients and practitioners by questionnaire. Comparison by a t-test for independent samples.

peat loop excision under LA, of which 8.8% would choose additional painkillers, and 4.5% would choose general anaesthetic (▶ **Fig. 7**).

The telephone questionnaire of 191 patients about 12 months after the procedure on treatment satisfaction showed that 97% (96.9% vs. 96.5%) of patients in the LA group and the GA group were "very satisfied or satisfied" with the treatment (p = 0.44) (▶ **Fig. 8**).



▶ **Fig. 7** Desired type of anaesthesia in case of required repeat operation in the LA group. Frequency distribution of responses to the question which anaesthetic technique the patient would choose in case of need for a repeat operation of HSIL. Postoperative questionnaire of patients operated under local anaesthesia within 7 days postoperatively (n = 178).

Further results

The comparison of the histopathological R status of the HSIL or AIS excised tissue (R0 89.5% vs. 81.1%, p = 0.73; R1 5.3% vs. 12.2%, p = 0.06, Rx 4.1% vs. 5.4%, p = 0.65) and the comparison of recurrence rates at 12 months (3.6% vs. 5.2%, p = 0.62) showed no significant difference for either anaesthetic technique (LA vs. GA) (▶ **Fig. 9** and ▶ **Fig. 10**).

The rate of secondary bleeding was also equally distributed in both groups (LA group: 6.7%, GA group: 8.1%; p = 0.72).

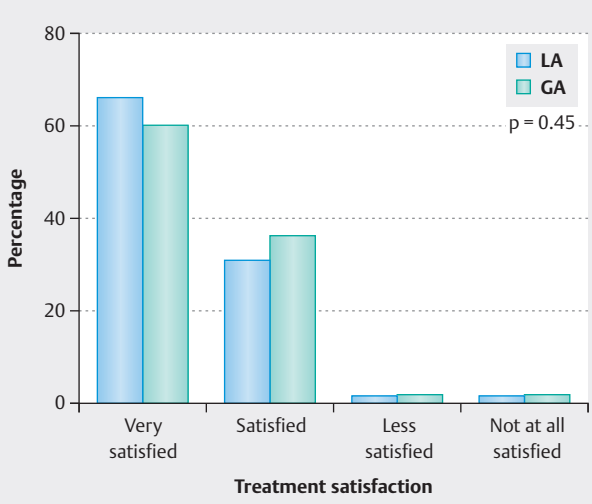
There was no significant difference between the two groups for the mean volume of the excised tissue for LA 1.02 (0.2–1.8) cm^3 versus GA 1.125 (0.9–1.5) cm^3, surgery time including LA application and GA induction and emergence 23.5 (17–30) versus 20 (15–33) minutes, and intraoperative blood loss for LA 2.4 (0–20) versus GA 2.2 (0–15) ml.

Pain sensation during surgery after either 2 or 4 injections into the uterine cervix did not differ significantly (mean pain score after 2 injections 15.2 vs. after 4 injections 12.4 (mean difference 2.83 [95% CI [− 0.14; 0.45] p = 0.3]).

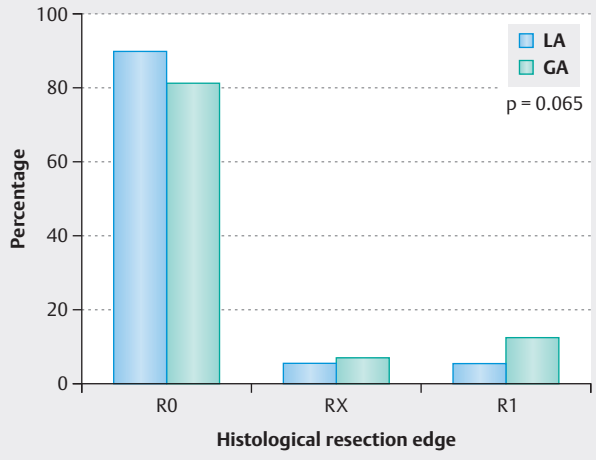
The mean age was 44 years in the GA group and 42 years in the LA group, and did not differ significantly (mean difference − 2.78 [95% CI [− 0.44.6; 0.11] p = 0.23).

Serious complications from the different forms of anaesthesia did not occur. Postoperative vomiting occurred three times in the GA group, and brief tachycardia occurred once in the LA group.

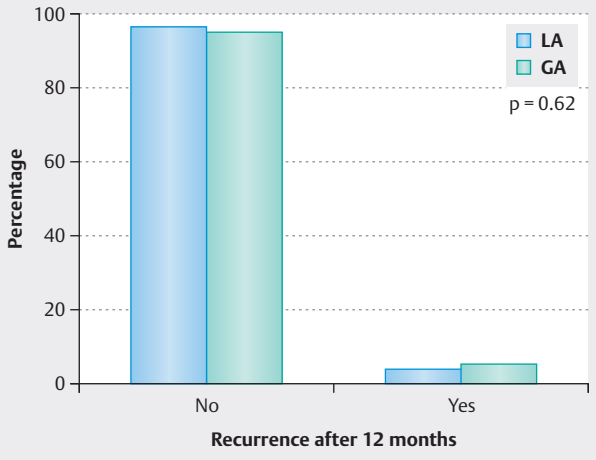
In summary, based on our comparative data on patient satisfaction and postoperative pain sensation, we were able to show that there were no significant clinically relevant differences between the LA group and the GA group with respect to the parameters we studied.



▶ **Fig. 8** Treatment satisfaction after a median postoperative follow-up of 12 months LA group versus GA group. Comparison of treatment satisfaction for cervical dysplasia approximately 12 months after surgical therapy. Survey by telephone questionnaire. Comparison of both groups (LA n = 133 vs. GA n = 58) by means of the nonparametric Mann–Whitney test (n = 191).



▶ **Fig. 9** Histopathological R status of the excised tissue for the LA group (n = 178) versus the GA group (n = 80). Comparison of both groups (LA vs. GA) with respect to histopathological R status. R0 = cranial resection edge free, RX = resection edge unclear, R1 = HSIL/AIS up to cranial resection edge (n = 258). Comparison of both groups by means of the nonparametric Mann-Whitney test.



▶ **Fig. 10** Recurrence rate after a median postoperative follow-up of 12 months for the LA group versus the GA group. Comparison of recurrence/persistence rate of dysplasia in the operated patients after approximately 12 months. Survey by telephone questionnaire. Comparison of both groups (LA n = 133 vs. GA n = 58) by means of the nonparametric Mann–Whitney test (n = 191).

Discussion

The **development of local anaesthesia** for the surgical treatment of lesions on the uterine cervix got off to a "bumpy" start and was initially associated with pain and cramps for the patients: In an American prospective clinical study, LOOP (i.e. loop excision) was performed in 77 patients with intramucosal or paracervical LA. For a pain score of 0–10, the median score was 4 versus 3 and the score for cramps was 2 versus 3 (n.s.). 89.6% of patients experienced pain, 64.9% reported cramps [6].

The use of vasoconstrictors also resulted in significant side effects: In an English study, their combination of local anaesthetics was applied to large loop excision of the transformation zone (LLETZ): Prilocaine/felypressin (n = 50) was compared with lignocaine/adrenaline (n = 60). Both combinations were considered safe and effective and the following parameters did not differ significantly: no pain (86% vs. 88%), surgery time ≤ 5 minutes (72% vs. 78%), dizziness or nausea (10% vs. 11.6%). There were differences for no bleeding (68% versus 80%) and with tremors (32% versus 82%). The latter caused confusion and stress. A further study was suggested in the publication during which tremors were to be avoided [7].

In a Scottish study, 40 patients were treated with LLETZ under LA with 4 ml prilocaine 30 mg/ml with felypressin 0.03 units/ml (Citanest with octapressin). The LAP pain score up to 100 mm was evaluated for 24 hours in a questionnaire at different intervals. 28%–35% of the patients indicated a pain score greater than 30 mm, which continued for at least 4 hours for 33%. The authors concluded that this may result in reduced acceptance of LA for LLETZ and reduced compliance for the follow-up visits [8].

After local anaesthesia was established as a valid alternative, several international studies **compared it with general anaesthetic** in terms of morbidity, complete removal of the lesion, and risk of re-operation, and found no disadvantages of LA for the parameters investigated: An Australian study compared morphological parameters and morbidity in 465 women after LLETZ, of whom 33% had surgery under anaesthesia and 15% had surgery under LA (for 52% the anaesthetic technique was not documented). The resection status as well as the size of the resected tissue and perioperative morbidity did not differ between anaesthetic techniques [9].

In a comment on the above study in the same journal, a colposcopist reported that he had performed over 1000 LOOP procedures under LA with an R1 rate of 12%. After the procedure under LA, not a single patient wanted the procedure in the clinic under anaesthesia. The cost was 400 versus 1796 Australian dollars, resulting in savings of 75–85% [10].

No economic comparisons are available for the German healthcare system. The reimbursement by the health insurance companies through evidence-based medicine (EBM) or the Medical Fee Schedule (GOÄ) is the same for both surgical procedures, with anaesthesia under LA costing about 150 euros according to EBM and about 420 euros according to the GOÄ. However, to compare the economic cost of both procedures, cost accounting must be created.

A study from Ireland compared 829 women with LLETZ under LA versus 136 women under anaesthesia, of whom 46 needed anaesthesia due to another pathological finding, 56 women were considered to need general anaesthesia by colposcopists because of anatomical problems, and 34 women wanted general anaesthesia. Over the 3-year duration of the study, the rate of women who were recommended for general anaesthetic decreased by half. The rate of complete removal of precancerous lesions was the same between the LA and anaesthesia patients. The authors con-

cluded that general anaesthesia for LLETZ rarely leads to an improvement in diagnostic or therapeutic quality indicators. The categorisation of patients under anaesthesia into 3 groups could be used to increase the number of LLETZ under LA [11].

A prospective French observational study investigated the influence of LA (n = 30) versus GA or spinal anaesthesia (n = 70) for the size of the excised tissue after LOOP. The formalin-fixed excised tissue was 8.8 mm in height versus 11.2 mm (p = 0.002) and 1.6 ml in volume versus 2.3 ml (p = 0.01). The endocervical R1 rate was 27 % versus 14 %, which was not statistically different. The authors concluded that LA reduces the size of the tissue excised in a loop electrosurgical excision procedure (LEEP) without having a negative impact on the rate of in sano resections [12].

Another Australian study compared 93 patients who underwent an outpatient loop electrosurgical excision procedure (LEEP) under local anaesthesia versus 52 patients who underwent an inpatient LEEP under general anaesthesia. The rates of R0 resections and postoperative pain or anxiety did not differ significantly between the two groups. The outpatient operation was significantly assessed as more satisfactory, but was significantly associated with more intraoperative pain. The authors concluded that the fear of the operation should be reduced, as it also reduces the sense of pain [13].

A retrospective cohort study from Israel compared the rates of R1 resections and persistent dysplasia between LEEP under general anaesthesia (n = 71) versus LA (n = 75). The proportion of R1 endocervical or ectocervical resections was not significantly different for general anaesthesia versus LA (22.5 % vs. 21.3 % and 19.7 % vs. 14.7 %). The same applies to the diagnosis of an HSIL in the first 2 years after LEEP by biopsy (4.2 % vs. 1.3 %) or repeat LEEP (7.0 % vs. 9.3 %). The authors conclude that the anaesthetic technique of choice for a LEEP should be LA [14].

Long-term safety data on loop excision are available from a study from England: Prospective cytological and histological findings for HSIL were investigated depending on the R status in 967 patients up to 5 years after LLETZ under LA. 42 % of patients had R1 status, which occurred significantly more frequently in CIN 3 versus CIN 2. Abnormal cytological findings occurred most frequently after 12 months (16 %), regardless of CIN severity or R status. The histological diagnosis of recurrence or persistence was also most common after 12 months (15 %), but was significantly associated with CIN severity or R status. The authors concluded that performing LLETZ for HSIL as an outpatient surgery under LA is safe, therapeutically effective, and reduces costs [15].

A recent Turkish prospective randomised study looked at the postoperative pain in 123 women after LEEP under LA versus 121 women under GA. There was no significant difference in subjective and objective pain sensations at 1, 2 and 4 hours postoperatively. The median volume of the excised tissue was 2.0 cm^3 in the LA group versus 2.4 cm^3 in the GA group. Both procedures showed no significant difference in R status, repeat operation, surgery time, and blood loss [16].

Interestingly, these studies mainly investigated morphological quality parameters and only two analyses also asked about patient satisfaction. **Hermeneutic quality parameters** are of particular importance from the patient's point of view, and were therefore the focus of our study.

In a German randomised study, patient satisfaction under local and general anaesthetic was measured immediately and 14 days after LEEP. Immediately after surgery, there was no difference (Likert scale 100 [80–100] vs. 100 [90–100], p = 0.079). After 14 days, satisfaction was greater in the LA group (Likert scale 100 [90–100] vs. 100 [80–100], p = 0.026). The removed tissue volumes were significantly smaller for LA (1.11 cm^3 vs. 1.58 cm^3; p < 0.001) with non-significantly different R1 status (6.6 % vs. 2.1 %, p = 0.26), significantly less blood loss (Delta haemoglobin, 0.2 g/dl vs. 0.5 g/dl, p < 0.001). The surgeons preferred GA (90 vs. 100; p = 0.001). The duration of the loop excision, the duration of haemostasis, and the rate of complications did not differ significantly between the two groups [3].

The following observational studies dealt with pain processing and anxiety: In a French study, 70 patients were asked by telephone interview about their satisfaction with a conization under LA. 88.6 % of patients were satisfied with the surgery performed, 75.7 % had no or moderate pain during the surgery, and 91.4 % said they would advise others to do the same. The R1 rate was 31.4 % and increased postoperative bleeding occurred in 7.1 % of patients. The authors concluded that outpatient conization under LA was well received by patients due to low pain without an increased risk of R1 resection or secondary bleeding [17].

An Australian study evaluated the experience of patients who underwent LLATZ under LA. Between 2014 and 2016, 105 patients completed a questionnaire beforehand, immediately afterwards, and after a further 4–6 weeks. The mean pain score was 2 on a scale between 0 and 10. The fear of the procedure usually dissipated after the procedure. Anxiety was significantly higher when the surgical procedure was not explained to the patients beforehand. The sensation of pain was not associated with fear, prior information about the surgical procedure, or the anaesthetic technique. The same was true for R1 status, which was diagnosed in 42.9 % of patients. The majority of patients were satisfied with their treatment and underwent follow-up examinations. The authors concluded that LLETZ under LA was well tolerated by patients and resulted in high levels of satisfaction and compliance. Preoperative information on the course of the surgical procedure helped to minimise the fear of the procedure [18].

Increased acceptance of local anaesthesia can be achieved if anxiety and stress for the patient can be significantly reduced. Listening to music during the procedure might be helpful here, but it did not seem to have much effect on women in Thailand: A randomised clinical trial evaluated the effect of accompanying music on the patient's anxiety during LLATZ under LA. Anxiety was assessed using the State Anxiety Inventory before and after surgery in 36 patients who listened to music perioperatively and intraoperatively vs. 37 patients in the control group. The mean anxiety score was 46.8 vs. 45.8 points preoperatively and 38.7 vs. 41.3 points postoperatively (not significant). The pain score was 2.55 versus 3.33 (not significant). The authors concluded that music therapy during LLETZ under LA did not alleviate the patient's anxiety and recommended alternative methods to reduce the agitation and stress in the patient [19].

What are the reasons for patients to undergo loop excision under general anaesthesia, and are there strategies to ensure that as

many women as possible can benefit from the advantages of local anaesthesia?

A retrospective English study analysed what the indication for anaesthesia was when "80 % of the biopsies or excisions for HSIL were performed under LA" over a 2-year period. 204 out of 1003 patients received general anaesthesia. The rate of general anaesthesia varied widely among colposcopists, ranging from 0–16.5 %, however the reason for this discrepancy was unclear. The most common reason given was "the patient requested anaesthesia" [20].

Another English randomised double-blind study evaluated the influence of inhaled gases in addition to LA when performing LLETZ: 198 women inhaled isoflurane and desflurane themselves and 198 women inhaled a placebo. The pain score was 22.4 versus 29 ($p = 0.003$). There was no significant difference in the anxiety score before and after LLETZ for both groups. A benefit of inhalation was seen in 78 % versus 67 % ($p = 0.012$) of women who had a high anxiety potential on the Hospital Anxiety and Depression Scale (HADS) score. They showed a significantly higher acceptance of the operation, felt inhalation was beneficial, and showed willingness to undergo similar surgery. The authors conclude that fluoride inhalation may be particularly useful for anxious patients to avoid anaesthesia [21].

If we now compare the data from our study with the literature presented, we come to the following conclusions: The pain intensities recorded for our patients do not exceed the pain scores reported in the literature. Higher pain scores were reported in the majority of published studies, although different measuring instruments were used. The same applies to the comparison with postoperative pain after anaesthesia, where there is no disadvantage for the patients who underwent surgery under LA. Overall satisfaction with the LA treatment was very high. 97 % percent of patients expressed satisfaction or were very satisfied and 95 % would choose an operation under LA again. This is also in line with the studies cited.

What is new is our prospective assessment by colposcopists that 90 % of patients with HSIL or AIS could receive a loop excision under LA. Equally new is the preoperative question to women about what pain they would consider acceptable. As a clear indication of the high level of acceptance of LA, patients stated in the postoperative interview that the desired pain threshold was not exceeded on average. Also not reported in the literature so far is the differentiation between pain with injection and pain with excision. Surprisingly for us, the injection pain score was twice as high. The topical application of an anaesthetic ointment before injection seems to be a potential improvement here [22, 23].

Lidocaine spray also appears to be an alternative here: in a randomised study from Thailand, 66 women were treated with a paracervical block of 10 ml 2 % lidocaine with 1 : 100 000 epinephrine compared to 66 women who received 4 puffs of 10 % lidocaine spray. The mean pain score for loop excision was not significantly different and was 5.2 with the spray versus 4.2 with the block [24].

Finally, it is interesting to note that surgeons clearly underestimated the patient's perception of pain, and that it seems imperative to always get reassurance from the patient that there is no pain.

Our results and the findings derived from them also need to be viewed critically. The following **restrictions** must be discussed: We evaluated only those patients for whom both forms of anaesthesia were an option. As the form of anaesthesia was ultimately selected by the patient herself, the LA cohort includes more patients who had no or few concerns about local anaesthesia. However, in clinical practice, it is handled in the same way: a patient is offered both anaesthetic techniques and she alone chooses either LA or GA.

The drop-out rate is distributed differently in both groups. 32 % of patients in the GA group did not return a questionnaire vs. 14 % in the LA group. This may have contributed to the distortion of the results.

There are great differences in the type of application forms of local anaesthesia. The mechanism of application, the amount of LA applied, and the choice of specific local anaesthetic differ in most studies, making it difficult to compare the studies.

The average pain score we present does not take into account the individual patient and their subjective feelings. For injection pain, 7 out of 178 patients and for surgery pain, 9 out of 178 patients had a pain score above 60. Although this pain is only of short duration, pain of this magnitude is not acceptable.

Factors that may lead to reduced acceptance of local anaesthesia during a gynaecological procedure include feeling of shame, a sense of loss of dignity, the gender of the surgeons, or negative perceptions of the procedures in the relevant medical institution [8].

These feelings of the patients were also mentioned by the patients in our study in isolated cases, but they affected both groups and were the exception.

In addition, there are patients for whom the benefits of general anaesthetic, such as the additional intensive care provided by the anaesthesia team or unconsciousness during the procedure, are of great importance.

In a summary of our results, we can show that our hypothesis that the loop excision under LA versus GA is equivalent in terms of postoperative pain sensation is valid, and is justified by the high level of patient satisfaction. In addition, our data are congruent with the literature and we have been able to gain additional insights not previously studied and reported in relation to loop excisions and LA.

Since it is possible to avoid the disadvantages of anaesthesia (need for supervision by a caregiver for 24 hours, possibility of postoperative nausea and vomiting [PONV], refraining from driving for 24 hours, need to fast, need to insert a peripheral intravenous catheter) with at least an equivalent quality of life for the patient, local anaesthesia must in future be offered to all women as an anaesthetic method for loop excision as an alternative to anaesthesia. In the future, an algorithm should be developed to help identify the patients for whom LA is appropriate and for whom it is not the appropriate procedure. In addition, procedures should be established and evaluated to significantly reduce injection pain.

Online Appendix

- Questionnaire immediately after colposcopy (feasibility study)
- Questionnaires on LA and GA (comparative study)
- Telephone questionnaire 12 months postoperative (comparative study)

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Conflict of Interest

The authors declare that they have no conflict of interest.

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