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Thyroidectomy under local versus general anesthesia in health camp settings in Uganda: a randomized prospective equivalence single-blind controlled trial

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Abstract

Background Endemic goiter is highly prevalent in Uganda, placing a considerable surgical burden on the healthcare system. Across Africa, prevalence varies widely, reaching 60.2%, with visible goiter affecting 30% of Uganda's rural population despite salt iodization programs. Despite evidence supporting thyroidectomy under local anesthesia (LA) for selected cases, its importance is underestimated moreover with limited access to general anesthesia (GA) and critical care providers in resource-constrained settings. The trial compared outcomes of thyroidectomy under LA versus GA in grade 1–2 uncomplicated euthyroid goiter patients in Uganda, with an aim to assess feasibility of LA as an alternative technique.

Methods In this prospective equivalence randomized, single-blind controlled trial, participants with grade 1–2 uncomplicated euthyroid goiters were enrolled and randomly assigned to two arms (LA and GA) during surgical camps in Uganda. The study compared early postoperative outcomes, including nausea, vomiting, hematoma formation, transient voice changes, and pain at 6, 12, and 24 h. It also assessed overall incurred material and medication costs, patient satisfaction using a 5-point Likert scale, and willingness to undergo a similar procedure with the same anesthetic technique at 30 days.

Results Fifty-eight participants undergoing thyroidectomy received random assignment, twenty-nine for each arm. No significant differences were found between the 2 groups in demographics, symptom duration, and early post-operative complications or patients' level of satisfaction ($P > 0.05$). However, the overall material and medication costs were significantly lower in the LA Group ($P < 0.001$).

Conclusions Thyroidectomy under LA can be performed in a well-selected patient population with low complication rates and comparable patient satisfaction to GA. These findings may support LA for thyroidectomy as a valuable cost-efficient alternative, especially in low-resource settings with fewer GA providers.

Trial registration First registered on 31/07/2022, PACTR202208635457430 by Pan African Clinical Trial Registry.

Keywords Thyroidectomy, Local anesthesia, General anesthesia, Critical care, Africa

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Introduction

Endemic goiter, linked to iodine deficiency and goitrogens, is the most common glandular condition in resource-limited countries. Across Africa, its prevalence varies widely, reaching 60.2%, with visible goiter affecting 30% of Uganda's rural population despite salt iodization programs [1–3]. Limited healthcare access in affected regions results in advanced disease presentations, symptoms, and reduced quality of life, often requiring thyroidectomy when unresponsive to medical interventions like iodine supplementation and thyroxine suppressive treatment [2, 4–8].

Thyroidectomy is done once normal thyroid hormone levels (euthyroidism) are attained and historically exclusively performed under GA [5, 9, 10]. GA offers benefits such as relaxed operating room environment but has drawbacks including: extended recovery times, longer hospital stays, delayed return to work, and reduced patient turnover [11].

These GA limitations along with limited healthcare infrastructure and few critical care and anesthesia physicians in resource-constrained regions ultimately result into the unmet need for surgery [5]. For instance, Uganda faces a critical shortage of anesthesiologists, with less than 0.05 anesthesia providers per 100,000 people, in contrast to high-income countries such as the UK, which have over 18 physician anesthesia providers per 100,000 populations [12].

LA, administered by surgeons or physician assistants, has been proposed as an alternative anesthesia technique for thyroidectomy based on a paucity of observational and randomized studies [13–15],thus a few western surgeons reportedly perform thyroidectomy exclusively under LA with varying results concerning the benefits and post-operative outcomes; impacting factors such as patient satisfaction, costs, and complications [9].

However, existing studies have compared thyroidectomy under LA vs. GA in typical hospital environment [9, 10] which the majority of our population cannot afford due to prohibitive out of pocket expenditures for specialized surgical care, which compel such patients to wait for free or subsidized care during surgical camps. Validation via robust randomized controlled trials while putting local factors into context is crucial for guiding and translating research into clinical practice [16], particularly in resource-limited settings where resource allocation faces competing demands.

Thus, our study aimed to address this knowledge gap through a randomized controlled trial comparing thyroidectomy outcomes under LA vs. GA in surgical camp settings. The null hypothesis of this trial was that there is no difference in early postoperative outcomes, material and medication costs, and patient satisfaction between thyroidectomy performed under LA versus GA.

We assessed postoperative pain, complications, patient satisfaction, and overall incurred material and medication costs of thyroidectomy to evaluate the suitability of LA in resource-limited settings. The findings can guide surgical practices in low-income countries and help meet the demand for surgical services, especially for advanced goiters, also bridging the gap between surgical research and clinical practice, aiding evidence-based healthcare decisions.

Methods

The findings of this study have been meticulously documented in accordance with the guidelines established by the Consolidated Standards of Reporting Trials (CONSORT-10) Guidelines [17].

Trial design

A prospective parallel equivalence randomized single-blind controlled trial with fifty-eight patients in 5 Ugandan health camps, allocated 1:1.

Inclusion criteria

Euthyroid patients aged 18–65 with grade 1 and 2 goiter, who were consenting to the study, were included.

Exclusion criteria

Excluded: Grade 3 goitre (where WHO grade 1 A: goitre is only palpable, grade 1B: goitre seen when the neck is hyper-extended, grade 2: goitre is visible when the neck is in the normal position, and grade 3: goitre is very large and visible from a distance) [18], retrosternal goiter, obesity, prior neck surgeries, diabetes mellitus, infiltrative goiters, and non-consenting patients.

Study setting and locations

The study took place in five healthcare camps organized by non-government organizations (NGOs) and local governments, in remote Ugandan districts: Gulu, Mayuge, and Bugiri. These collaborations aimed to provide cost-effective healthcare to rural families. A primary NGO coordinated free services from various agencies.

The camps offered surgery, gynecology, public health, ophthalmology, dental care, and imaging. Patients were informed through mass communication and underwent comprehensive evaluations by medical officers a week preceding each camp. Attendance averaged 3,000 patients daily, with 10 to 15 thyroidectomies and 150 to 400 surgeries per camp, spanning a week.

The surgical team was composed of consultant surgeons, surgery residents, anesthesiologists, assistant anesthesia providers, nurses, and additional medical staff members. For the sake of standardization in our study, thyroidectomies were performed by consultant surgeons, assisted by surgery residents.

Follow-up involved outpatient assessments at the 30-day mark and, if warranted, telephone interviews, with limitations set by approval from the Institutional Review Board and Ethics Committee (IREC).

Interventions

Patients aged 18–65 with grade 1 and 2 euthyroid goiter, meeting inclusion and exclusion criteria, and scheduled for euthyroidectomy, were assigned into two groups: LA and GA.

Eligible participants provided written informed consent and underwent pre-anesthetic assessments in designated camp tents 24 h prior to surgery. Adherence to WHO surgical safety checklist and fasting guidelines was enforced, and participants received 1 g of intravenous ceftriaxone one hour pre-surgery. Vital signs, including pulse rate, oxygen saturation, blood pressure, and ECG, were monitored within 24 h of perioperative period.

In the LA group, an anterior field block was administered using a mixture of 0.5% bupivacaine and 2% lignocaine with 1:200,000 adrenaline, adhering to maximum allowable doses (3 mg/kg for bupivacaine, 7 mg/kg for lignocaine) [14]. This 60 ml solution was distributed as follows: 20 ml for the anterior field block, 10 ml along the incision line, 10 ml under the pre-tracheal fascia post-sub-platysma muscle elevation, and the remaining 20 ml equally divided between the thyroid poles [19]. During draping, the patient's mouth and nose remained exposed to facilitate communication and spontaneous breathing, ensuring timely identification of any laryngeal nerve injury [19].

The subsequent surgical procedure steps were standardized for both the LA and GA groups in accordance to standard operative texts of thyroidectomy [9, 14, 20]; comprising patient positioning, incision, fascia dissection, vascular pedicle management, nerve and parathyroid gland preservation, vessel manipulation, thyroid bed dissection, hemostasis, and wound closure, all conducted under aseptic conditions [19].

Post-procedure, participants received 75 mg intramuscular diclofenac sodium followed by 100 mg oral diclofenac sodium every 8 h for 5 days [19]. Thyroidectomies were performed by consultant surgeons assisted by surgery residents.

Discharge was contingent on achieving a score of at least 9 on the post-anesthesia discharge scoring system [21], and a 30-day follow-up was conducted in an outpatient setting or via telephone interview for non-attendees.

If a participant under LA experienced significant adverse effects, such as excessive pain, they could cross over to GA. Stronger analgesics other than those prescribed in the trial were an option, with ultimate individual termination from the trial. All surgical procedures were performed by the same surgical team for purposes of standardization of practice.

Outcomes

Early 30-day post-operative complications were verbally reported to attending physicians and documented in accordance with MedDRA® version 4.21 standardized reporting. Pain levels were assessed using a visual analogue scale ranging from 0 (no pain) to 10 (worst pain) at 6, 12, and 24-hour intervals. Nausea and vomiting severity were recorded using a scale from 0 (no symptoms) to 9 (severe symptoms). Complications (hematoma, voice changes, surgical site infections) were classified using the Clavien Dindo system [22]. Grade I indicated no additional intervention needed, Grade II required pharmacological treatment, Grade III demanded radiological or surgical re-intervention, and Grade IV denoted life-threatening complications with organ dysfunction requiring intensive care admission [22].

The costs per patient encompassed materials and medication costs, based on National Drug Authority, Uganda quotations. Patient satisfaction with the procedure and overall experience was verbally conveyed and recorded using a 5-point Likert scale (1 = very dissatisfied, 5 = very satisfied) at the 30-day follow-up. Their willingness to undergo a similar surgery with the same anesthetic technique was also noted as either "yes" or "no."

Sample size estimation The sample size was determined to mirror the 58-participant study by Snyder et al., resulting in 29 participants per arm (1:1 allocation) [15].

Randomization, blinding, allocation concealment and study implementation

Eligible patients were randomly allocated to receive either LA or GA in a 1:1 ratio using concealed envelopes. Permuted balanced block randomization, facilitated by web-generated sequences (https://www.random.org/), was employed. In the operating room, ethical considerations precluded patient blinding, ensuring their understanding of anesthesia techniques.

Outcome assessors were blinded, and attending clinicians were only unblinded if there were anesthesia-related adverse events that warranted disclosure to surgeons and anesthesiologists. Further details are available in the published trial protocol [19].

Data analysis

Data were coded in Excel 2016 and analyzed using STATA 14.2. An intention-to-treat model was employed to minimize bias and reflect real clinical practice, including all eligible randomized patients. Categorical data were presented as frequencies and percentages, compared with the chi-square test.

Continuous variables were assessed for normality using the Shapiro-Wilk test. Normally distributed data were summarized as means and standard deviations, compared with the Independent Samples t-test. Non-normally distributed data were expressed as medians and interquartile ranges, with comparisons made using the Independent-Samples Kruskal-Wallis Test.

Analyses were performed at a 95% confidence interval, with statistical significance set at $p < 0.05$.

Results

A total of seventy-three patients were screened and fifty-eight participants who met the inclusion criteria were recruited between October 2022 and April 2023, with May 2023 as the final follow-up month upon sample size completion. Two patients initially assigned to the LA group were converted to GA due to respiratory distress. However, the intention-to-treat model was applied to minimize bias and reflect clinical practice, keeping both in the LA group for analysis (Fig. 1).

Mean age was 41.1 (SD = 12.3) years. Majority of the participants were females 53(91.4), from rural areas 52(89.7). The mean duration of preoperative symptoms was 110.1(92.4) months with the majority having either difficulty in breathing (56.9%), difficulty in swallowing (55.2%) or voice changes (65.5%). Most participants had grade 2 thyroids (77.6%) and underwent near total thyroidectomy (69.0%).

There was no significant difference in these baseline characteristics between the patients that underwent general anesthesia and those who had local anesthesia since all p values were above 0.05(Table 1).

The study found no significant differences in early post-operative complications, including nausea, vomiting, hematoma formation, transient voice symptoms,

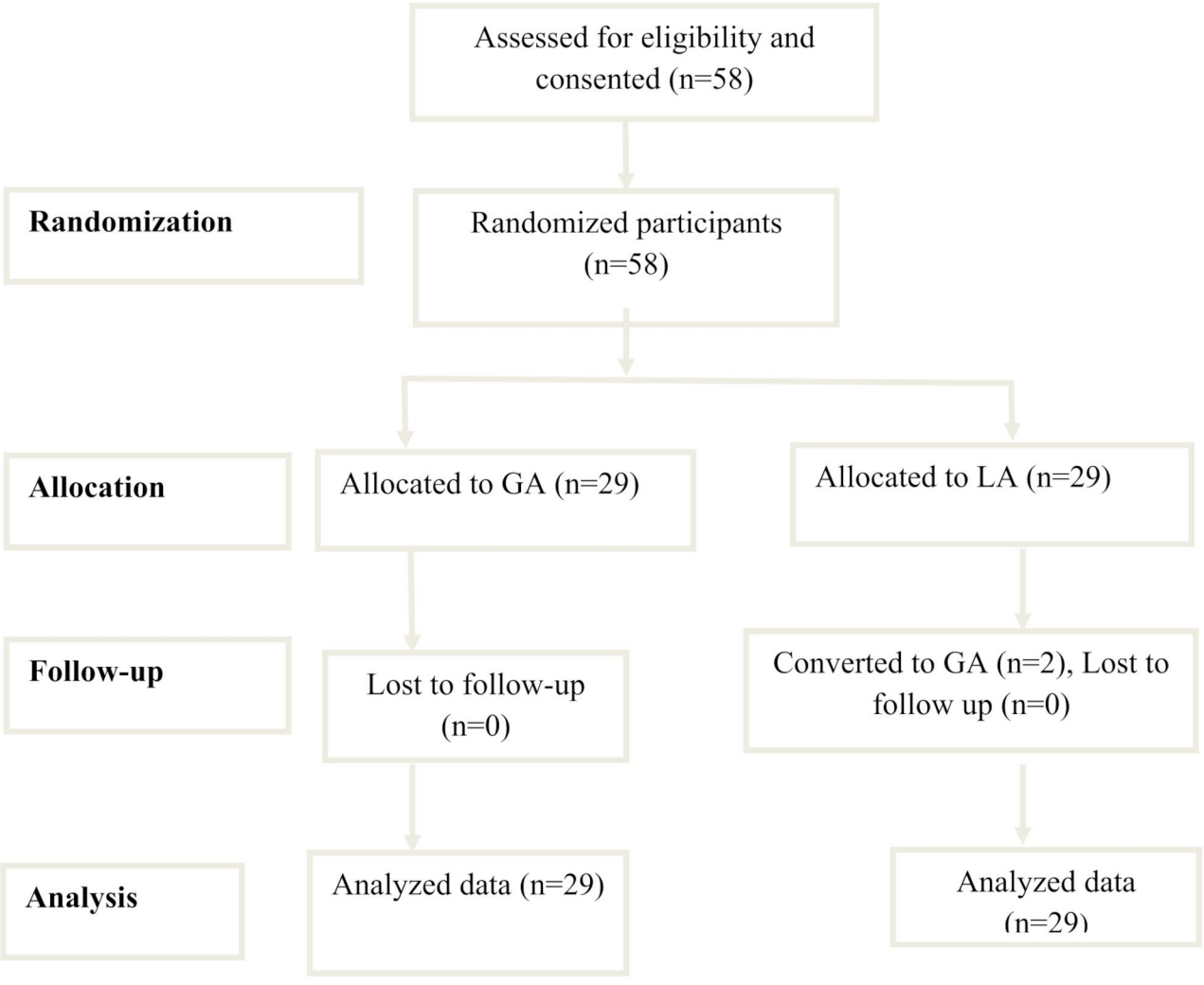

Fig. 1 Consolidated standards of reporting trials flow diagram

Table 1 Comparison of demographic and clinical characteristics of the study participants between the GA and LA Group

Characteristic	General anesthesia (29)*N*(%)	Local Anesthesia (29) *N*(%)	Overall (58)*N*(%)	Chi square(X^2)*P* value except for "b"
Age (years)	43.5(10.0)[a]	39.3(14.1)[a]	41.4 (12.3)	0.204[b]
Sex				0.640
Female	26(89.7)	27(93.1)	53(91.4)	
Male	3(10.3)	2(6.9)	5(8.6)	
Marital status				0.896
Married	25(86.2)	24(82.8)	49(84.5)	
Cohabiting	2(6.9)	2(6.9)	4(6.9)	
Single	2(6.9)	3(10.3)	5(8.6)	
Education				0.445
None	8(27.6)	5(17.2)	13(22.4)	
Primary	14(48.3)	13(44.8)	27(46.6)	
Secondary	7(24.1)	11(37.9)	18(31.0)	
Residence				0.389
Rural	25(86.2)	27(93.1)	52(89.7)	
Urban	4(13.8)	2(6.9)	6(10.3)	
Symptom duration (months)	115.0(92.2)[a]	105.1(93.9)[a]	110.1(92.4)[a]	0.687[b]
Difficulty in breathing				0.063
No	9(31.0)	16(55.2)	25(43.1)	
Yes	20(69.0)	13(44.8)	33(56.9)	
Difficulty swallowing				0.113
No	16(55.2)	10(34.5)	26(44.8)	
Yes	13(44.8)	19(65.5)	32(55.2)	
Voice change				0.097
No	7(24.1)	13(44.8)	20(34.5)	
Yes	22(75.9)	16(55.2)	38(65.5)	
WHO grade				0.936
1 A	2(6.9)	2(6.9)	4(6.9)	
1B	4(13.8)	5(17.2)	9(15.5)	
2	23(79.3)	22(75.9)	45(77.6)	
Surgery type				1.000
HT	9(31.0)	9(31.0)	18(31.0)	
NTT	20(69.0)	20(69.0)	40(69.0)	

b = Independent samples test *p* value, a = Mean and standard deviation, HT = Hemi- thyroidectomy, NTT = Near total thyroidectomy

and post-operative pain, all with p-values greater than 0.05(Table 2).

No significant difference was found in the median Likert scores ($p = 0.442$) between the two groups (Table 3). Most patients in both groups expressed satisfaction with their allocated anesthesia type, except for one patient who would not prefer general anesthesia if he or she was given a choice to choose again.

There was a significant difference in thyroidectomy costs between the GA and LA groups ($P < 0.001$). The median cost of materials and medications for thyroidectomy was 12.9 USD lower in the LA group compared to the GA group (Table 4).

Discussion

The comparison of baseline characteristics between the GA and LA groups revealed no statistically significant differences. All calculated p-values exceeded 0.05, confirming the groups' effective balance and minimizing the influence of confounding patient characteristics on observed outcome differences, thereby enhancing the study's internal validity.

When examining thyroidectomies performed under LA and GA, it is observed that they are more frequently applied in the 18–65 age groups [23–25]. In our study, the average age was 41.8 years. Although some authors reported lower mean age groups [9, 13, 23], Burali et al. reported a mean age of 44 years, consistent with our findings [2]. Both studies were conducted in remote Ugandan regions during health camp initiatives. The elevated prevalence of goiter in these locales tends to be disregarded owing to local perceptions. Limited surgical access contributes to delayed medical attention or reliance on interventions during free medical outreach.

Males constituted only 5(8.6), while 53(91.4) were females, resulting in a male-to-female ratio of 1:10.6.

Table 2 Comparison of the operation outcomes of thyroidectomy under LA and GA

Outcome	General anesthesia (29)*N*(%)	Local Anesthesia (29) *N*(%)	Overall (58)*N*(%)	Chi squired test *P* value except for b
Nausea				
No	12(41.4)	16(55.2)	28(48.3)	0.293
Yes	17(58.6)	13(44.8)	30(51.7)	
Vomiting				
No	22(75.9)	18(62.1)	40(69.0)	0.256
Yes	7(24.1)	11(37.9)	18(31.0)	
Hematoma formation				
No	29(100.0)	27(93.1)	56(96.6)	0.150
Yes	0(0.0)	2(6.9)	2(3.4)	
Transient voice symptoms				
No	23(79.3)	22(75.9)	45(77.6)	0.793
Yes	6(20.7)	7924.1)	13(22.4)	
Post-operative pain				
VAS at 6 h	4(3–5)[a]	4(3–5) [a]	4(3–5) [a]	0.642[b]
VAS at 12 h	3(2–4) [a]	3(2–4) [a]	3(2–4) [a]	0.569[b]
VAS at 24 h	2(2–3) [a]	2(2–3) [a]	2(2–3) [a]	0.072[b]

b = Independent-Samples Kruskal-Wallis Test *p* value, a = median and Interquartile range, VAS = Visual analog score for pain

Table 3 Comparison of patients' satisfaction levels for thyroidectomy under LA and GA

Satisfaction assessor	General anesthesia (29)*N*(%)	Local Anesthesia (29)*N*(%)	Overall (58)*N*(%)	Chi squired test *P* value except for b
Likert score	4(4–5)[a]	4(4–5)[a]	4(4–5)[a]	0.442[b]
Repeat with same anesthesia				
No	1(3.4)	3 (10.3)	4 (6.9)	0.300
Yes	28(96.6)	26 (89.7)	54 (93.1)	

b = Independent-Samples Kruskal-Wallis Test *p* value, a = median and Interquartile range

Table 4 Comparison of overall material and medication costs for thyroidectomy under LA and GA

Cost	General anesthesia (29)*N*(%)	Local Anesthesia (29) *N*(%)	Overall (58)*N*(%)	Chi squired test *P* value except for b
Cost in USD	78.0(72.7–79.3)[a]	65.1(61.5–67.1)[a]	70.1(65.1–78.4)[a]	**< 0.001[b]**

b = Independent-Samples Kruskal-Wallis Test *p* value, a = median and Interquartile range

When stratified by anesthesia method, the ratios for males to females were 1:13.5 and1:8.7 for the LA and GA groups, respectively. Given the documented higher prevalence of goiter in females, a correspondingly elevated frequency of thyroidectomies among females is anticipated, irrespective of the chosen anesthesia modality [24, 26, 27].

Consistent patterns are evident in the existing scholarly literature. In their investigation of the outcomes of hemithyroidectomy under LA and GA for a period of 22 months, Budhathoki et al., revealed a distribution of three males and 27 females (male: female = 1:7) [23]. Similarly, Aliyu et al. documented a prevalence of goiter in 52 females and7 males in their descriptive case series of 59 patients who underwent thyroidectomy under LA [14]. Numerous scholars have consistently reported a female predominance in patients undergoing thyroidectomy under either LA or GA partly due to autoimmune disorders and increased iodine demand during pregnancy and lactation among females [2, 28, 29].

Most patients in both anesthesia groups resided in rural areas (89.3%), in stark contrast to the 10.7% from urban areas. The predominant educational background comprised primary or no formal education, with a substantial proportion identifying as married. Patients characterized by these demographics are expected to possess limited knowledge about nutritional supplements and thyroid diseases, encountering impediments in accessing surgical interventions.

Notably, married females frequently confront financial constraints, given the customary spousal control over finances in rural African settings. Seeking treatment in camps, where no foreseeable access to surgery exists, emerges as the sole alternative [30, 31].

Consistent with the literature [2, 32, 33], the majority of patients in our study presented with compressive neck symptoms, such as difficulty in breathing, swallowing,

and voice changes. These symptoms were observed in both the GA and LA groups, with average symptom duration of 115.0 months for the GA group and 109.3 months for the LA group.

The predominant proportion of patients exhibited WHO goitre grades 1 A, 1B, or two, notably with grade 2 being the most prevalent (45, 80.4%). The ethical exclusion of WHO goitre grade 3 cases from the study elucidates the absence of any surgeries for this severity. Intriguingly, Aliyu's study reported a substantial 54.2% of cases with WHO grade 3 undergoing thyroidectomy under LA [14] but the limited human and infrastructural resources and relatively shorter duration of follow-up for long term complications such as recurrence in surgical camp settings restrict inclusion of this patient category.

Hemithyroidectomy comprised 30.4% of cases, with 16.1% and 14.3% performed under GA and LA, respectively. Near total thyroidectomy was favored (35.7% GA, 33.9% LA, and overall, 69.6%). In contrast, Aliyu et al. reported subtotal thyroidectomy as most common (49.2% of patients) [14] and the differences result from variation in the inclusion criteria. In a study from Bangladesh on thyroid surgery under LA, hemithyroidectomy was the most prevalent procedure in 53.3% of 30 patients [23]. Our surgeons excluded those with toxic and malignant goiters, contributing to the absence of total thyroidectomy.

No statistically significant difference in early 30-day post-operative complications, such as vomiting, bleeding, and hematoma formation, was observed when comparing GA and LA groups ($p > 0.05$). These results indicate comparable safety and efficacy between the two anesthesia modalities, consistent with prior research by Ojuka et al. in Kenya, despite their small sample size of seven participants [34].

However, Kim et al. [10] and Inabnet et al. [20] reported lower rates of nausea, vomiting, throat discomfort, and voice changes with LA, while Snyder et al. [15]noted higher vomiting rates in the LA group. We observed a subtle decrease in the overall incidence of voice changes, amounting to 23%, in contrast to a study conducted at Mulago Hospital [32], where transient voice symptoms were documented at a rate of 30%.

Conversely, a study conducted in the United States by Snyder et al. reported significantly lower overall incidences, documenting transient voice changes at a notably reduced rate of 6% [15]. These variations may arise from differences in patient profiles, surgical techniques, and healthcare settings, underscoring the importance of considering specific contexts and patient populations when interpreting these findings.

In this study, a visual analog scale was employed for the assessment of postoperative pain. The mean pain scores were four at 6 h, three at 12 h, and two at 24 h postoperatively with no statistically significant differences between groups. These results concur with other comparative studies by Mamede and Raful, as well as Kim et al. and Budhathoki, where no significant difference in perceived post-operative pain was established between patients who underwent thyroidectomy under GA or LA [35]; [23, 36].

The evaluation of median Likert scores revealed no significant distinction in patient satisfaction between euthyroidectomy conducted under LA and GA, with only one patient expressing reluctance towards GA. However, it is essential to note that most participants in both groups reported being satisfied or very satisfied with their anesthesia experience. All patients in each group expressed a willingness to undergo the same type of anesthesia for future surgeries. These findings align with previous studies conducted by Budhathoki et al., Kim et al., and Snyder et al., where all patients who underwent thyroidectomy under either LA or GA recommended the same method of anesthesia to others [10, 15, 23]. Notably, the two patients converted from LA to GA preferred GA for similar subsequent surgeries.

The cost implications of surgical procedures and associated requisites emerge as pivotal considerations in the assessment of surgical healthcare within low-income contexts. In this trial, the professional procedural costs remained unexplored, given the provision of these procedures without charge. Noteworthy, however, the overall material and medication costs were lower within the LA cohort in contrast to the GA cohort. This finding aligns with the conclusions drawn by Budhathoki et al. [23], and Mamede & Raful [35], all of whom reported a reduction in the overall cost of thyroidectomy when performed under LA compared to GA. This notable decrease in cost was primarily attributed to diminished expenses related to medications [23, 35].

Limitations

This study had notable limitations. First, the follow-up period was ethically restricted by the approving IRB, but long term follow up could establish which of the voice changes were permanent. Secondly, it was not possible to determine hypocalcemia due to laboratory diagnostic resource limitations in rural surgical camp settings although this study was meant to depict the real situation and challenges in such settings. To put this limitation in context, reports from the British Association of Endocrine and Thyroid Surgeons show that permanent and transient post-thyroidectomy hypocalcemia occur in 12.1% and 27.4% respectively, potentially due todevascularization and or injury to the parathyroid glands [37]; with some scholars reporting incidence of up to 21–42% within the first 24–48 h of post-operative period [38]. Further evidence suggest that the incidence

of hypocalcemia is reportedly higher following total thyroidectomy compared to lobectomy [37, 38]. In a larger sample sized study of 7366 post-thyroidectomy patients, severe hypocalcemia occurred in 5.8% (428), and in only 0.5% of those who underwent subtotal thyroidectomy [39]. In our low-income settings, the imminent fear for transient hypocalcemia, hypothyroidism, and the need to minimize the cost for thyroid hormonal replacement drive the surgeons' decision to perform near total or hemi-thyroidectomy for benign thyroid goiters, and to embrace the practice of administering perioperative oral calcium and vitamin D supplements for patients undergoing total thyroidectomy.

A recent systematic review found that seven out of nine clinical trials validated this clinical practice, with an absolute risk reduction of laboratory hypocalcemia of up to 60% [40]. In a bid to cut the laboratory costs and due to limited accessibility to laboratory infrastructure in remote camp settings, only patients who demonstrate clinical features of symptomatic hypocalcemia such as fatigue, numbness, tingling sensations in digits and perioral region or cardiac arrhythmias in the post-operative period undergo laboratory assessment and often these samples are processed in external urban laboratories outside camp settings. Patients found to have transient hypocalcemia are typically followed up from the first post-operative day up to six months under the care of an endocrinologist. However, there were no such adverse events reported during post-operative reviews in this trial, obviating the study limitation for possibility of missing asymptomatic hypocalcemia. Lastly, our smaller sample size may have underpowered the study to detect a clinically meaningful difference.

Conclusions

LA proves to be a safe, effective, and cost-efficient alternative for thyroidectomy in resource-limited surgical camp settings in Uganda. Importantly, this transition does not compromise patient satisfaction and does not result in an increased incidence of complications, offering a viable option for surgical care in countries with constrained infrastructure and healthcare resources. However, we caution against the use of the LA technique by inexperienced surgeons or in ultra-low-resource settings for the first time. Future studies should be long-term multicenter clinical trials with robust sample sizes to capture diverse outcomes including hypocalcemia.

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Author contributions
U.K. served as the Principal Investigator, leading the study's design, literature review, data collection, analysis, manuscript writing, and critical review. H.L. contributed to study design, method section writing, and manuscript review. J.O.F. provided critical manuscript reviews. All authors read and approved the final manuscript.

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Data availability
All materials are accessible to any scientist seeking non-commercial utilization, without breaching the confidentiality of participants from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was performed in accordance with the Declaration of Helsinki and all methods were performed in accordance with the relevant guidelines and regulations. Ethical approval was granted by the Kampala International University Research and Ethics committee (Ref: KIU-2022-190). Following approval by the KIU-REC, the trial was duly registered with the Pan African Clinical Trials Registry under the registration number PACTR202208635457430 on 31/07/2022. All participants and or their legally authorised representatives signed an informed consent form prior recruitment into the study. Noted that the protocol of this trial was published by BMC trials under the link: https://trialsjournal.biomedcentral.com/articles/https://doi.org/10.1186/s13063-023-07387-w.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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