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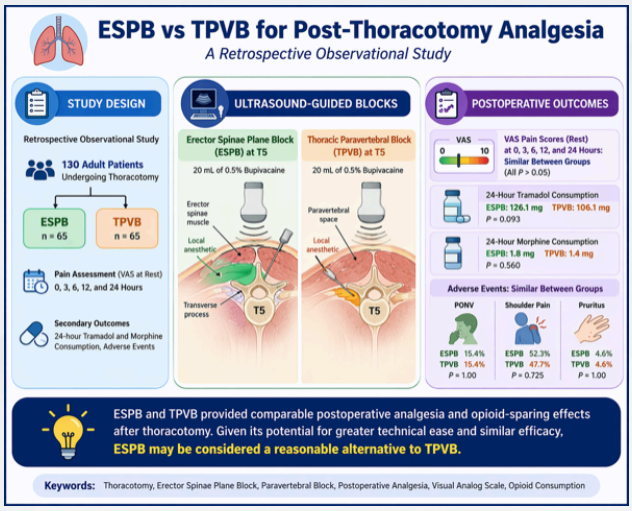

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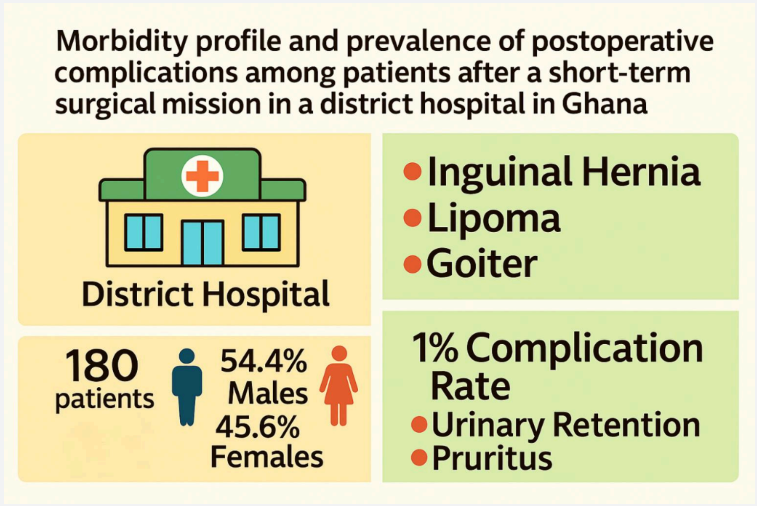

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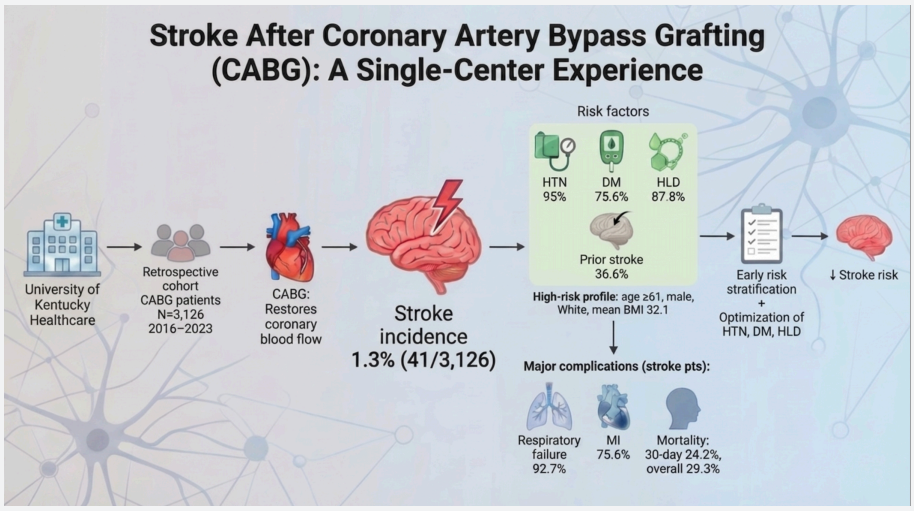

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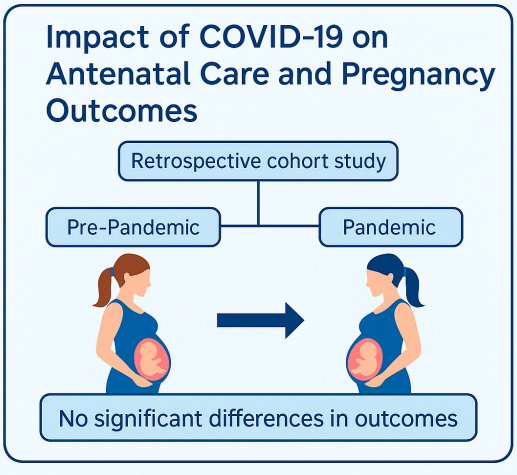

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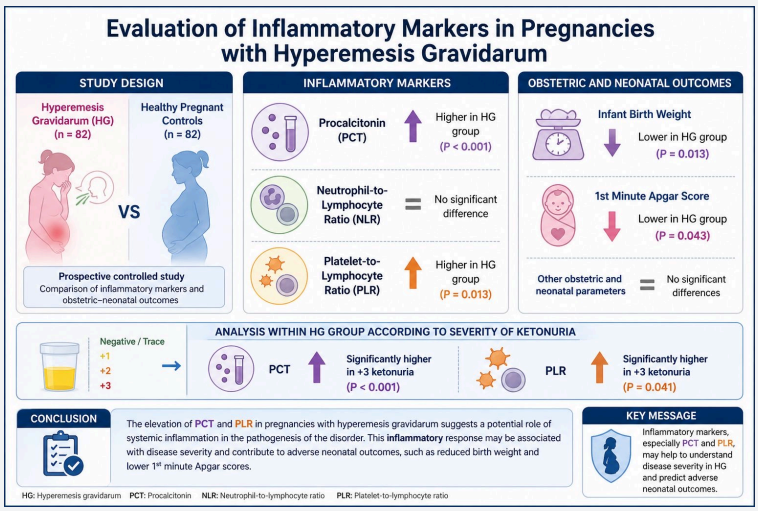

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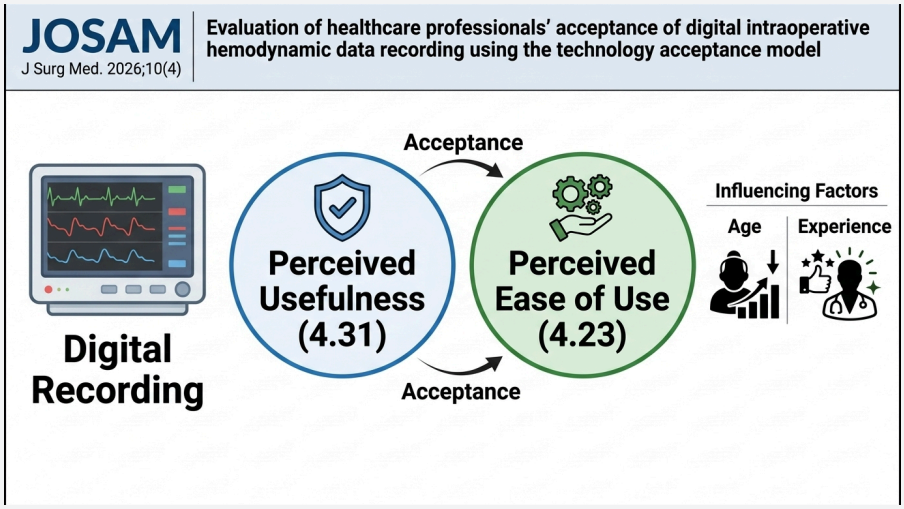

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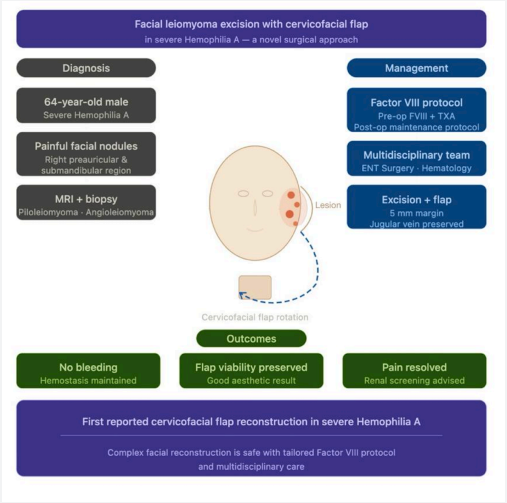

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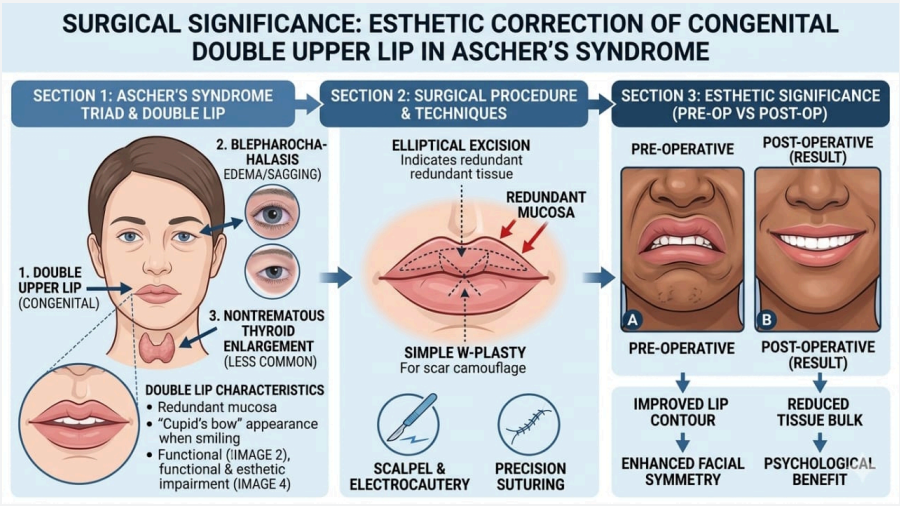

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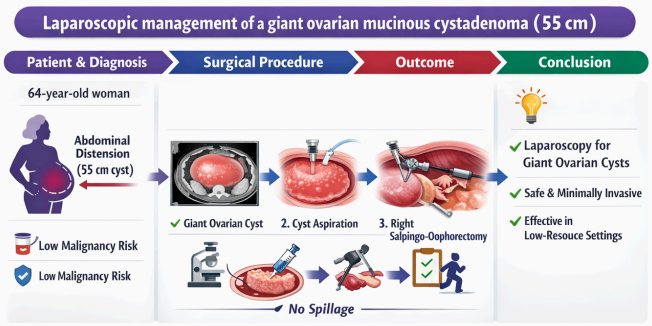

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Laparoscopic management of a giant ovarian mucinous cystadenoma

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Comparison of erector spinae plane block and thoracic paravertebral block for analgesia after thoracotomy

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Ethics Committee Approval
The study was approved by the Gaziantep University Clinical Research Ethics Committee (decision no: 2021/241, dated 2021 July 7). All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

Financial Disclosure
The authors declared that this study has received no financial support.

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Abstract

Background/Aim: Post-thoracotomy pain is severe and often necessitates effective regional analgesia. We aimed to compare the postoperative analgesic efficacy of ultrasound-guided erector spinae plane block (ESPB) versus thoracic paravertebral block (TPVB).

Methods: We retrospectively evaluated 130 adults (ESPB, n=65; TPVB, n=65) undergoing thoracotomy. The primary outcome was pain at rest, assessed using the visual analogue scale (VAS) at 0, 3, 6, 12, and 24 hours postoperatively. Secondary outcomes included postoperative opioid consumption (tramadol, morphine) and adverse events. A prespecified sensitivity analysis adjusted comparisons for sex.

Results: Resting VAS scores did not differ significantly between the ESPB and TPVB groups at any time point (all $P>0.05$). Postoperative tramadol and morphine consumption were comparable ($P=0.093$ and $P=0.560$, respectively). The incidence of adverse events (postoperative nausea/vomiting, shoulder pain, pruritus) was also similar between groups. In sex-adjusted analyses, all group differences remained non-significant.

Conclusion: ESPB and TPVB provide comparable postoperative analgesia and opioid-sparing effects after thoracotomy. Given its potential for greater technical ease and similar efficacy, ESPB represents a reasonable alternative to TPVB. Further prospective research is required to validate these results and assess long-term outcomes.

Keywords: thoracotomy, erector spinae plane block, postoperative analgesia, paravertebral block, visual analog scale, opioid consumption

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Introduction

Thoracic surgery is notoriously painful and, if inadequately managed, can lead to significant complications, including respiratory compromise, prolonged hospitalization, and the development of chronic post-surgical pain. The pain is multifactorial, originating from surgical incisions, rib retraction, chest tubes, and suturing [1, 2]. A multimodal approach integrating systemic and regional analgesia is the gold standard for managing postoperative pain and facilitating recovery.

In this context, the adoption of ultrasound (US)-guided techniques has significantly advanced the application of regional analgesic methods. Among these, the erector spinae plane block (ESPB), first described by Forero et al. [3] for thoracic neuropathic pain, has gained considerable attention. The ESPB is an ultrasound-guided fascial plane technique where local anesthetic is injected deep to the erector spinae muscle at the level of the transverse process. This injection achieves a cranio-caudal spread, potentially blocking multiple dermatomes. Compared to more invasive techniques like thoracic epidural anesthesia, or other plane blocks, ESPB is often considered technically simpler, faster to perform, and associated with a more favorable safety profile [4, 5].

Thoracic paravertebral block (TPVB), a well-established technique, provides potent unilateral thoracic analgesia by delivering local anesthetic into the paravertebral space to block the ventral and dorsal rami of spinal nerves. Both ESPB and TPVB are widely used for post-thoracotomy pain control. However, rigorous head-to-head comparisons of their clinical efficacy are still emerging, providing the rationale for the present study [6].

This study aims to compare the postoperative pain relief provided by ultrasound-guided ESPB versus TPVB in patients undergoing thoracotomy. The primary outcome was the Visual Analog Scale (VAS) score for pain at rest, assessed at 0, 3, 6, 12, and 24 hours postoperatively. Secondary outcomes included cumulative 24-hour tramadol and morphine consumption.

Materials and methods

This retrospective, observational study received ethical approval from the Clinical Research Ethics Committee (decision no. 2021/241, 7 July 2021) and adhered to the principles of the 2013 Declaration of Helsinki. We reviewed the medical records of patients who underwent thoracotomy between 1 October 2020 and 31 May 2021. At our institution, patients provide prospective written consent for their surgical/anesthetic care and for the potential research use of de-identified data; therefore, the need for study-specific informed consent was waived. No study-specific interventions were performed. The study was retrospectively registered at ClinicalTrials.gov (NCT06778161).

We included 130 patients aged 18–75 years with American Society of Anesthesiologists (ASA) physical status I–III who underwent thoracotomy and received either ultrasound-guided ESPB or TPVB for postoperative analgesia. The study excluded emergency cases and patients with ASA IV–V, peripheral vascular disease, pregnancy, heart failure, known allergy to local anesthetics, or incomplete medical documentation.

Patients were categorized into two groups (n=65 each) based on the regional analgesia technique administered: **Group ESPB** (Erector spinae plane block) and **Group TPVB** (Thoracic paravertebral block). We retrospectively collected data on patient demographics (age, gender, height, body weight, BMI), ASA classification, comorbidities, smoking status, indication for thoracotomy, side of surgery, duration of operation, postoperative VAS scores (at 0, 3, 6, 12, and 24 hours), total tramadol and morphine consumption, and the incidence of postoperative nausea, pruritus, and shoulder pain.

All patients received standard intraoperative monitoring (ECG, SpO_2, non-invasive blood pressure) and underwent general anesthesia using conventional induction and maintenance agents. Lung-protective ventilation strategies and hemodynamic management followed standardized institutional protocols.

After surgery but before extubation, all regional blocks were performed by a single senior anesthesiologist to minimize inter-operator variability. Patients were positioned laterally, and the procedure was conducted under full aseptic conditions using ultrasound guidance (GE Logiq E, 10–12 MHz linear probe, in-plane technique).

ESPB Procedure: The transverse process at the T5 level was identified. Following negative aspiration, 20 mL of 0.5% bupivacaine was injected into the fascial plane deep to the erector spinae muscle, confirming proper spread.

TPVB Procedure: Using a similar probe position, the paravertebral space at the T5 level was visualized. After the needle penetrated the superior costotransverse ligament, 20 mL of 0.5% bupivacaine was injected under direct ultrasound guidance following negative aspiration.

Prior to completing surgery, all patients received standard multimodal analgesia consisting of tramadol 100 mg IV and antiemetic prophylaxis with metoclopramide 10 mg IV. Following uneventful extubation, patients were transferred to the post-anesthesia care unit (PACU) for monitoring. Once a Modified Aldrete Score of ≥9 was achieved, patients were transferred to the intensive care unit (ICU).

Postoperative pain scores were recorded using the Visual Analogue Scale (VAS, 0–100 mm) at 0, 3, 6, 12, and 24 hours. A standardized rescue analgesia protocol was applied to both groups based on the Numerical Rating Scale (NRS, 0-10) or equivalent VAS scores:

- Patients reporting **NRS 4–5** (or VAS 40–59 mm) received intravenous **tramadol 100 mg**.
- Patients reporting **NRS ≥ 6** (or VAS ≥ 60 mm) received subcutaneous **morphine 5 mg**.
- No additional analgesia was administered if the NRS was ≤ 3 (or VAS ≤ 39 mm).

This fixed-dose, as-needed regimen was identical for both the ESPB and TPVB groups.

Statistical Analysis

Statistical analysis was performed using SPSS 22.0. Continuous data are presented as mean (SD) and categorical data as n (%). Baseline comparisons were made using independent-samples t-tests for continuous variables and χ^2 or Fisher's exact tests for categorical variables.

Due to a significant baseline difference in sex distribution, primary and secondary outcomes were adjusted for sex. VAS scores were analyzed using a repeated-measures general linear model (ANCOVA) with group, time, and sex as factors

(Greenhouse–Geisser correction applied where necessary). The secondary opioid outcome was dichotomized (any rescue opioid: yes/no) and analyzed using sex-adjusted logistic regression. Results are presented as adjusted mean differences (MD) or adjusted odds ratios (OR) with 95% confidence intervals (CIs). A two-sided α of 0.05 was considered statistically significant; *P*-values are reported to three decimals or as *P*<0.001.

Results

The groups were broadly comparable at baseline. The only statistically significant difference was sex distribution, with a higher proportion of males in the TPVB group (89.2%) compared to the ESPB group (75.4%) (OR 2.71, 95% CI 1.03–7.11; *P*=0.039). All other demographic variables (age, height, weight, BMI, ASA class, and smoking status) showed no significant between-group differences (Table 1).

Table 1: Demographic data of the patients

	Group ESPB (n=65)	Group TPVB (n=65)	Effect estimate (95% CI)	*P*-value
Age (years)	55.3 (14.1)	53.2 (11.1)	MD 2.1(-2.3 to 6.5)	0.411
Sex, male (n) (%)	49 (75.4%)	58 (89.2%)	OR 2.71(1.03-7.11)	0.039*
Height (m)	1.7 (0.1)	1.7 (0.1)	MD 0.00 (-0.034 to 0.034)	0.636
Weight (kg)	75.4 (15.5)	72 (14.5)	MD 3.4 (-1.76 to 8.56)	0.194
BMI (kg/m^2)	27.2 (5.9)	25.6 (4.9)	MD 1.6 (-0.26 to3.469	0.104
Smokers (n) (%)	46 (70.8%)	47 (72.3%)	OR 0.93 (0.43-1.99)	0.846
ASA (I/II/III)	2/ 23/40	5 /26 /34	χ^2	0.376

*Significant at p<0.05, BMI: Body Mass Index, ASA: American Society of Anesthesiologists Classification

While the ESPB group had a greater prevalence of hypertension, other comorbid conditions were similarly distributed across groups (Table 2). Indications for thoracotomy, side of surgery, and mean operative duration did not differ significantly between the ESPB and TPVB groups.

The primary outcome, resting postoperative VAS scores, did not differ significantly between the ESPB and TPVB groups at any measured time point (0, 3, 6, 12, and 24 hours). Mean scores were comparable at all intervals (e.g., 0 h: 31.5 (14.0) vs. 30.5 (10.7); 24 h: 24.4 (10.8) vs. 24.7 (13.9)). Mean differences were small and not statistically significant (all *P*>0.05) (Table 3).

Secondary outcomes were also similar. Total 24-hour opioid consumption did not differ between groups for either tramadol (MD 20.0 mg, 95% CI −3.5 to 43.5; *P*=0.093) or morphine (MD 0.4 mg, 95% CI −0.9 to 1.7; *P*=0.560). The incidence of adverse events, including PONV (OR 1.00), shoulder pain (OR 1.21), and pruritus (OR 1.00), was comparable (all *P*>0.05) (Table 4).

Given the baseline imbalance in sex, we performed the prespecified sex-adjusted analyses. These adjusted comparisons confirmed the primary findings: there were no significant intergroup differences in VAS scores at any time interval (all *P*>0.05). Furthermore, the likelihood of requiring any rescue analgesia (modeled as a binary outcome) was also similar between groups after adjusting for sex (adjusted OR 1.41, 95% CI 0.65–3.03, *P*=0.383).

Table 3: Postoperative VAS scores of the ESPB and TPVB groups

Time point	ESPB group (n=65)	TPVB group (n=65)	Mean difference (95%CI)	*P*-value
0 h	31.46 (14.02)	30.46 (10.74)	1.00 (-3.29 to 5.29)	0.734
3 h	33.31 (10.8)	32.46 (10.24)	0.85 (-2.77 to 4.47)	0.570
6 h	36.31 (12.22)	35.38 (10.58)	0.93 (-3.00 to 4.86)	0.723
12 h	30.92 (14.28)	30.46 (12.49)	0.46 (-4.15 to 5.07)	0.996
24 h	24.38 (10.84)	24.69 (13.86)	-0.31 (-4.59 to 3.979	0.590

Values are mean (SD). MD: Mean difference; CI: Confidence interval; VAS: Visual Analog Scale (0–100).

Discussion

This retrospective analysis of 130 thoracotomy patients compared the analgesic outcomes of ESPB and TPVB. While thoracic epidural analgesia and TPVB are considered cornerstone techniques for managing post-thoracotomy pain, the technically simpler ESP block has emerged as a viable alternative [7-9].

Our findings of non-inferiority contrast with some previous research. For example, a study by Das et al. [10] evaluating ESPB, TPVB, and serratus anterior plane block (SAPB) demonstrated that ESPB provided superior pain relief, delayed the need for rescue analgesia, and reduced total opioid consumption compared to TPVB and SAPB. Conversely, another study by Duran et al. [11] comparing PVB and ESPB reported that PVB resulted in significantly lower morphine consumption during the first 24 hours, although pain scores at rest and during coughing were similar. Our study aligns with the latter finding (no difference in pain scores) but conflicts with the former, as we identified no significant difference in opioid consumption. These discrepancies across studies likely reflect variations in methodology, patient populations, block techniques, and specific analgesic protocols.

Table 2: Clinical characteristics and operative data of the ESPB and TPVB groups

Variable	ESPB group (n=65)	TPVB group (n=65)	Effect estimate (95% CI)	*P*-value
Comorbidity, any	50 (76.9%)	45 (69.2%)	OR 1.48 (0.68–3.24)	0.323
Diabetes mellitus	19 (29.2%)	11 (16.9%)	OR 2.04 (0.86–4.81)	—
Hypertension	19 (29.2%)	7 (10.7%)	OR 3.44 (1.33–8.93)	—
COPD	5 (7.6%)	4 (6.1%)	OR 1.27 (0.33–4.86)	—
Asthma	3 (4.6%)	3 (4.6%)	OR 1.00 (0.20–4.95)	—
Coronary artery disease	7 (10.7%)	10 (15.3%)	OR 0.66 (0.23–1.93)	—
Chronic renal failure	2 (3.1%)	0 (0%)	—	—
Pulmonary malignancy	20 (30.7%)	16 (24.6%)	OR 1.36 (0.64–2.88)	—
Extrapulmonary malignancy	9 (13.8%)	10 (15.3%)	OR 0.89 (0.34–2.34)	—
Other diseases	16 (24.6%)	13 (20.0%)	OR 1.31 (0.57–3.00)	—
Indication for thoracotomy	Mass 46 (70.8%) Malignancy 14 (21.5%) Hydatid cyst 5 (7.7%) Bronchiectasis 0 (0%)	Mass 38 (58.5%) Malignancy 16 (24.6%) Hydatid cyst 9 (13.8%) Bronchiectasis 2 (3.1%)	χ^2 test	0.257
Thoracotomy side	Right 35 (53.8%) Left 30 (46.2%)	Right 39 (60.0%) Left 26 (40.0%)	OR 0.78 (0.39–1.56)	0.479
Duration of operation, min	190.92 (31.84)	185.77 (33.54)	MD 5.2 (−6.2 to 16.6)	0.371

Values are n (%) or mean (SD). OR: Odds Ratio; CI: Confidence Interval; COPD: Chronic Obstructive Pulmonary Disease.

Table 4: Opioid consumption (mg) and adverse effects of the ESPB and TPVB groups

Variable	ESPB group (n=65)	TPVB group (n=65)	Effect estimate (95% CI)	*P*-value
Tramadol consumption, mg	126.1 (69.1)	106.1 (70.4)	MD 20.0 (−3.5 to 43.5)	0.093
Morphine consumption, mg	1.8 (3.1)	1.4 (2.4)	MD 0.4 (−0.9 to 1.7)	0.560
PONV	10 (15.4%)	10 (15.4%)	OR 1.00 (0.38–2.65)	1.000
Shoulder pain	34 (52.3%)	31 (47.7%)	OR 1.21 (0.60–2.45)	0.725
Pruritus	3 (4.6%)	3 (4.6%)	OR 1.00 (0.20–5.03)	1.000

Values are mean (SD) or n (%). MD: Mean Difference; OR: Odds Ratio; CI: Confidence Interval; PONV: Postoperative nausea and vomiting.

Our results are consistent with a growing body of evidence, including several meta-analyses, that suggests comparable analgesic efficacy between ESPB and TPVB for thoracic surgery [12–16]. A key strength of our study is the confirmation of this equivalence even after performing a sensitivity analysis to adjust for a significant baseline sex imbalance. After adjustment, both VAS scores and the use of rescue opioids remained similar. Collectively, our findings support ESPB as a clinically equivalent alternative to TPVB, offering a practical option where technical ease and safety profile are prioritized.

Interpretation of these findings is subject to several limitations. The retrospective design is inherently susceptible to selection bias and documentation errors. While we identified a significant sex imbalance between groups, we attempted to mitigate this by performing sex-adjusted analyses, which confirmed the primary results. Furthermore, the fixed-dose rescue protocol (100 mg tramadol or 5 mg morphine) limited our ability to detect finer variations in opioid requirements and may have biased the VAS scores. Finally, this was a single-center study with no follow-up beyond 24 hours, precluding assessment of long-term outcomes like chronic pain. Prospective, multicenter, randomized controlled trials (RCTs) are warranted to confirm these findings.

Conclusion

In conclusion, this study found that ultrasound-guided ESPB and TPVB provide comparable postoperative analgesia and have similar opioid-sparing effects following thoracotomy. While TPVB is a well-established standard, ESPB appears to be a clinically equivalent alternative, potentially offering advantages in technical simplicity. The choice between these techniques should be guided by patient-specific factors, surgical context, and institutional expertise. Further large-scale, prospective RCTs are needed to confirm these findings and evaluate long-term outcomes.

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Morbidity profile and prevalence of postoperative complications among patients after a short-term surgical mission in a district hospital in Ghana

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Ethics Committee Approval
The study complied with the Declaration of Helsinki (1964) and its later amendments. The standardized written informed consent procedure for surgery, as outlined by the Ghana Health Service, was used during the STSM. Ethical approval for the study protocol was obtained from the Ghana Health Service Ethics Review Committee (GHS-ERC:018/05/25).

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Background/Aim: In most of Africa, including Ghana, access to surgical care is limited by socioeconomic factors, infrastructural constraints, and shortages in human resources. Short-term surgical missions (STSMs) have been used to bridge this gap by providing free surgical services, especially in rural areas. This study aimed to determine the morbidity profile and prevalence of postoperative complications among patients who underwent surgery during an STSM at a municipal hospital in the Volta Region of Ghana.

Methods: This cross-sectional descriptive study involved a secondary analysis of data from 180 patients who underwent surgical procedures during an STSM at Ketu North Municipal Hospital, Volta Region, Ghana, from October 27 to November 2, 2024. The mission was conducted by a local team of 38 health professionals, including surgeons, nurses, and anesthetists. Patients' selection was based on predetermined criteria.

Results: The mean age of the patients was 45.7 (18.7) years, with a range of 2 to 82 years. Most patients were male (54.4%). Surgical care was provided for general surgical and gynecologic conditions. Inguinal hernia was the most common diagnosis (35.0%), with right-sided hernia being the predominant type, followed by lipoma (24.4%) and goiter (15.6%). Spinal anesthesia was the most frequently used anesthetic technique (47.8%). A low complication rate of 1.0% was observed, consisting mainly of urinary retention and pruritus.

Conclusion: Short-term surgical missions can effectively address surgical needs in low-resource settings such as rural Ghana by providing safe surgical care with minimal complications. These findings underscore the importance of a well-organized mission and sustainable local partnerships to improve access to surgical care and patient outcomes.

Keywords: short-term, surgical mission, morbidity, diagnosis, case type, prevalence, complication

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Introduction

According to the World Health Organization (WHO), safe and affordable surgical care must be made available to achieve universal health coverage (UHC) and the health-related Sustainable Development Goals (SDGs) [1, 2]. However, the cost of surgical operations is a significant barrier to accessing healthcare in Africa [3]. Access to surgical care is severely limited, with an estimated 5 billion people worldwide lacking access to such services [4]. Barriers to surgical access include socioeconomic factors, lack of infrastructure, and insufficient human resources [5].

Ghana faces significant challenges in providing accessible surgical care, particularly in rural areas. These challenges include the limited availability of health facilities capable of performing essential surgical procedures, as well as a lack of trained surgical personnel and resources [6]. Over 77% of surgical procedures are essential operations performed at district-level hospitals, which often lack adequate infrastructure and supplies [7]. Financial barriers also exist, with patients covering up to 91% of surgical costs out of pocket [7].

Short-term surgical missions (STSMs) or medical outreach have traditionally been an approach to address the lack of access to surgical care in low- and middle-income countries, but their long-term impact is questioned [8, 9]. Although communities value these missions, which offer free services, they are often confronted with obstacles such as language barriers and a lack of oversight [10]. To improve sustainability, there is a shift toward local missions and partnerships with host countries [8, 11]. Training activities during missions are considered the most impactful, with emphasis on collaboration with local actors and long-term follow-up [8]. There is a growing emphasis on transitioning from traditional STSMs to sustainable partnerships with local healthcare systems [8]. As the focus shifts from international to local missions, particularly in middle-income countries, there is potential for sustainable improvement in surgical care access across Africa [11].

In Ghana, STSMs aim to address healthcare gaps, particularly in rural areas [10]. STSMs can effectively address surgical needs in low-resource settings, but they also present challenges regarding long-term patient outcomes and complications. Long-term follow-up studies have reported high patient satisfaction and symptom improvement, with complications within an acceptable range [12]. Studies have reported complication rates ranging from 16% to 30%, emphasizing the need for careful patient selection and follow-up protocols [12, 13].

Despite complications, patient satisfaction and symptom improvement are generally high. Essential surgical care can be provided during STSMs without incident if high-risk situations are avoided, patient safety procedures are followed, and patients are carefully chosen [14]. Thus, this study sought to determine the morbidity profile and prevalence of postoperative complications among patients after undertaking STSMs at the Ketu North municipal hospital in the Volta Region, Ghana.

Materials and methods

Study design

This was a cross-sectional descriptive study using secondary data analysis of all patients who underwent surgical procedures during the STSM organized from October 27 to November 2, 2024, at the Ketu North municipal hospital located in Weta in the Volta Region, Ghana.

Mission description

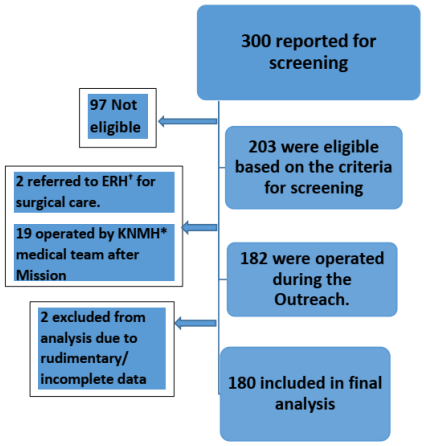
The STSM was undertaken by a local (Ghana) mission team of 38 health professionals, comprising nurses, nurse anesthetists, medical officers, and specialists in the fields of family medicine, public health, general surgery, and gynecology. The inclusion of consultants, often not available at peripheral health facilities like Ketu North municipal hospital and highly skilled in their areas of specialty, underscored the level of preparedness and commitment not only to provide service but to train and pass on competencies. The addition of surgical residents to the team reinforced the training component. The professional characteristics of the mission team are presented in Table 1.

Table 1. Professional characteristics of the mission team

Profession (N = 38)	Professional Characteristics	Frequency
Doctors (N = 11)	**Specialty**	
	Obstetrics and Gynaecology	3
	General Surgery	2
	Family Medicine	1
	Public Health	1
	Surgery Resident	1
	Anaesthesiologist	1
	Medical Officer	2
	Years of Practice	
	1 to 5 years	2
	6 to 15 years	5
	16 to 25 years	2
	26 years or more	2
	Country of Medical School	
	Belarus	1
	Cuba	1
	Russia	1
	Ukraine	1
	Ghana	7
	Country of Postgraduate/Specialist Training	
	Cuba	1
	Ghana	8
	Non-specialist	2
	Present Duty Station	
	Pretoria	1
	Eastern Regional Hospital, Koforidua	7
	Koforidua Technical University, University Health Directorate	1
	University of Cape Coast, School of Medical Sciences	1
	Korle-Bu Teaching Hospital	1
Nurse Anesthetist (N = 6)	**Number of years practising as an Anaesthetist**	
	10 years and below	2
	Above 10 years	4
	Present Duty Station	
	Eastern Regional Hospital, Koforidua	2
	Adidome Govt Hospital	1
	Keta Municipal Hospital	1
	Ketu North Municipal Hospital, Weta	2
Nurses (N = 21)	**Nursing Duty**	
	Scrub Nurses	9
	Recovery Ward Nurses	12
	Qualification	
	Bsc. Nursing	6
	Diploma	13
	Certificate	2
	Number of years practising in current Nursing duty	
	10 years and below	19
	Above 10 years	2
	Present Duty Station	
	Eastern Regional Hospital, Koforidua	15
	Ketu North Municipal Hospital, Weta	6

The mission started with the triage of patients and pre-screening by the local/facility healthcare teams. Triage was performed by medical officers based on pre-determined criteria. The pre-screened and selected patients were cleared for surgery after anesthetic assessment and review. The procedures were then performed for all selected patients over a period of seven days. Figure 1 shows the trajectory of case selection for the STSM.

Figure 1. Flowchart of the trajectory of case selection for surgeries. ERH: Eastern Regional Hospital; KNMH: Ketu North Municipal Hospital.



Out of a total of 203 eligible patients after screening, 182 were operated on during the surgical mission, 2 were referred to the Eastern Regional Hospital for surgical care, and 19 had less serious conditions and were operated on by the hospital's local healthcare providers after the STSM ended. Data from 180 patients were used in the final analysis because 2 patients were excluded due to rudimentary/incomplete data. The latter was facilitated by competencies transferred during the short-term mission by developing confidence in the local hospital team to perform mop-up surgeries after the visiting team had left. Follow-up of patients continued after discharge, one week after the mission, through phone calls.

Study setting

The Ketu North Municipality shares boundaries with the Republic of Togo on the East, Akatsi North District on the North, Akatsi South on the West, Keta Municipality on the Southwest, and Ketu South Municipality on the South. The Municipality consists of 332 communities and six sub-municipalities. It has a population of 119,720. The main religions of the inhabitants are Christianity and Traditional worship. Major economic activities include fishing, salt mining, and general farming.

Ketu North municipal hospital (KNMH) officially opened on March 9, 2022, as a 60-bed capacity primary health facility. Ghana operates the 3-tier system of primary health care comprising Maternal and Child Health (MCH)/Community-based Health Planning and Services (CHPS) at the community level (Level A), Health Centre (Level B), and the District/municipal hospital (Level C) [15]; KNMH belongs to the apex of this system at Level C.

Operating with a rudimentary staff of less than 20 per cent established posts, the hospital runs nearly all the departments, except for child health, which is integrated into the maternal care unit. The hospital offers a comprehensive range of services, including General Outpatient and Inpatient care, special clinics for Tuberculosis (TB) and antiretroviral therapy (ART), Mental Health, Eye Care, Dental care, Pharmaceutical Services, Accident and Emergency, Laboratory Services, Reproductive, Maternal, and Child Health Services, as well as Mortuary Services.

In 2023, Malaria, Urinary Tract Infection, and Typhoid fever were the leading causes of morbidity and admissions. In the same year, the hospital recorded 53 minor and 66 major surgeries. The minor cases comprised lipoma excision, circumcisions, and suturing of lacerations, and the major cases included Caesarean sections, Myomectomy, Hysterectomy, and Hernia Repairs. This feat was achieved by 3 doctors, 1 Family Physician who doubles as the Medical Superintendent, and 2 Medical Officers.

Sample size and sampling procedure

Given the retrospective nature of the study, a census approach was used to select medical records of all patients who participated in the STSM. There was no predetermined sample size, mainly because the STSM was conducted as part of service provision and not initially in the context of research. The sample size was based on all data available from the monitoring database of the Surgical Outreach.

Study participants

The study participants (N = 180) were all patients who underwent surgical procedures during the STSM in the facility. The inclusion criteria were patients with inguinal swellings, other hernias, scrotal swellings, bumps and lumps, thyroid tumors, fibroids, breast tumors, general surgical conditions, and general gynecologic conditions. Exclusion criteria included patients with co-morbidities, malignancies, unresectable tumors, major orthopedic or urological conditions, situations requiring intensive care or long follow-ups, and those who needed vascular surgeries or major plastic repair.

Data extraction and variables

Data was extracted from the patients' monitoring database of the surgical outreach and included demographic information (age and sex), pre-operative diagnosis, type of anesthesia, main postoperative findings, and postoperative complications identified and recorded from the end of surgery until patient discharge. Post-operative complications were identified using a combination of reported patient complaints, review of Nurses' notes, and follow-up notes of Doctors assigned to review each patient after the surgery.

Data was entered into an Excel spreadsheet and manually cross-checked for errors. A standardized data extraction form was developed and designed into a monitoring chart to ensure consistency of data across all records. To address potential sources of bias, the study employed a standardized data extraction form and manual cross-checking procedures to ensure consistency and accuracy across all patient records.

Study size

The study used a census approach to extract data on all 180 patients with complete data treated during the STSM. The flowchart in Figure 1 explains how the study size was arrived at.

Statistical analysis

Descriptive statistics were used to summarize the demographic characteristics. Means (SD) were used to summarize continuous data, whereas frequencies and percentages were used to summarize categorical variables. Morbidity of patients was expressed in frequencies, and percentage/proportion was used to determine the prevalence of postoperative complications. Statistical analyses were conducted using SPSS version 25.

Ethical considerations

The study complied with the Declaration of Helsinki. Written informed consent for the surgical procedure was obtained from all patients. Patients' confidentiality and data security were maintained throughout the study. To ensure participant confidentiality and data security, all information was anonymized and stored on a password-protected computer.

The standardized written informed consent procedure for surgery by the Ghana Health Service was used during the STSM. Administrative approval to use data from the STSM in a letter with reference: GHS/KNMH/S/09 was obtained from the Ketu North municipal hospital management team, which permitted the publication of the study findings retrospectively. Ethical approval of the Study protocol was also obtained from the Ghana Health Service – Ethics Review Committee (GHS-ERC:018/05/25).

Results

The surgical procedures under this STSM were undertaken for a period of 7 days. A total of 180 patients, with a mean age of 45.7 (18.7) years, ranging from 2 to 82 years, were operated upon. The age distribution showed that the majority of the patients were in the 35–44 years and 45–54 years age groups. The sex distribution of the patients was 54.4% male and 45.6% female. The age and sex distribution of patients are presented in Table 2.

Table 2. Age and sex distribution of patients

Variable	Frequency (N=180)	Percentage (%)
Age (years), Mean(SD), (range)	45.7 (18.7), (2, 82)	
Age group (years)		
0 – 14	15	8.3
15 – 24	9	5.0
25 – 34	18	10.0
35 – 44	41	22.8
45 – 54	39	21.7
55 – 64	29	16.1
65 – 74	18	10.0
75 – 84	11	6.1
Sex		
Male	98	54.4
Female	82	45.6

The morbidity profile was dominated by general surgical conditions, with inguinal hernias (35%) and lipomas (24.4%) being the two most common diagnoses, together accounting for nearly 60% of all cases (Table 3). For the other surgical conditions, one case of each of the following was diagnosed: abdominal diatheses, bilateral varicocele with hydrocele, congenital right inguinal hernia, ganglion, granuloma, incisional hernia, keloid, left parotid mass, left undescended testis, left accessory breast, and syndactyly.

In terms of the type of anesthesia, the majority of patients (47.8%) received subarachnoid spinal block, and the duration of hospital admission varied, with one night stay being the predominant duration of stay (48.3%).

The majority of patients (99%) experienced no postoperative complications. Post-operative complications were reported in 1% of the patients after their surgeries. The complications observed were urine retention and pruritus following opioid administration.

Table 3. Morbidity profile, type of anesthesia, and duration of hospital admission

Variable	Frequency (N=180)	Percentage (%)
Diagnosis		
Inguinal Hernias (Overall)	63	35.0
Right Inguinal Hernia	40	22.2
Left Inguinal Hernia	13	7.2
Bilateral Inguinal Hernia	10	5.6
Lipoma	44	24.4
Goitre	28	15.6
AUB-L and Uterine Fibroid	19	10.6
Hydrocele	9	5.0
Hemorrhoid	2	1.1
Phimosis	2	1.1
Umbilical/Para-umbilical Hernia	2	1.1
Other Surgical Conditions†	11	6.1
Type of Anesthesia		
Sub-Arachnoid Spinal Block	86	47.8
General Anesthesia	46	25.6
Local Anesthesia	45	25.0
Sub-arachnoid block with General Anaesthesia	3	1.7
Duration of Hospital Admission		
Day Surgery	41	22.8
1 Night	87	48.3
2 Nights	42	23.3
3 Nights	8	4.4
4 Nights	1	0.6
6 Nights	1	0.6

† Other surgical conditions included abdominal diatheses, bilateral varicocele with hydrocele, congenital right inguinal hernia, ganglion, granuloma, incisional hernia, keloid, left parotid mass, left undescended testis, left accessory breast, and syndactyly.

Discussion

Overall, this Short-Term Surgical Mission (STSM) was successful regarding the availability of a local (Ghana) mission team with diverse expertise and the reach and scope of surgical conditions managed. The most common surgical conditions encountered were inguinal hernia (35%), lipoma (24.4%), and goitre (15.6%). The mission team, comprising 38 health professionals, performed different surgical procedures for over 180 patients within one week, operating with limited funding in a low-resource setting. Compared to other STSMs in Sub-Saharan Africa, this study reports data on a relatively high volume of surgeries completed within a shorter duration. For instance, Djedjo et al. reported consulting 97 female patients during three different missions over one year in Guinea-Bissau, whereas Honeyman et al. reported 70 patients undergoing surgery between 2008 and 2016 during STSMs [13, 16].

The STSM provided care for patients across different age categories, spanning from pediatric patients (2 years) up to older adults (82 years). The dominant age groups also suggest that middle-aged adults are more likely to undergo surgical procedures, possibly due to the onset of age-related conditions. The sex distribution shows a slight male predominance, with 54.4% of the patients being male and 45.6% being female. This aligns with previous studies that have reported higher surgical intervention rates among males, potentially due to differences in health-seeking behavior and the prevalence of certain conditions [17].

The STSM undertaken was multi-specialty, providing surgical care for patients with disease conditions in general surgery, plastic surgery, and gynecology. The patient population also consisted of both sexes, adult and pediatric patients. This contrasts with other STSMs where the focus was a single specialty or disease condition, such as head and neck reconstruction or only breast disease [13, 16, 18, 19]. In deciding the type of surgical specialty to include in an STSM, one could consider the unmet surgical needs of the patients or the community [20, 21].

The morbidity profile highlights that inguinal hernia was the most common diagnosis, representing 35% of the cases. This was followed by lipomas (24.4%), which have been identified in the literature as common benign tumors that often require surgical removal [22]. The high prevalence of hernias may be attributed to factors such as heavy lifting, obesity, and genetic predisposition [17]. Similar to this current study, multiple studies have consistently found a higher incidence of right-sided inguinal hernias compared to left-sided ones [23-29]. Similarly, studies among pediatric patients have shown that inguinal hernias can occur on either side of the groin, but they are more frequent on the right side [26, 30-33]. In Turkey, Erdoğan et al. [31] reported 61.1% right-sided versus 29.4% left-sided hernias in a large study involving 3776 pediatric patients. Ademuyiwa et al. [30] in Nigeria reported 55.8% right inguinal hernias versus 35.8% left inguinal hernias among a small sample of pediatric patients. The preponderance of right inguinal hernias is thought to be caused by the right side's patent processus vaginalis closing more slowly than the left and the persistence of the diameter of the processus vaginalis on the right relative to the left in children [25, 34].

The postoperative complication rate was remarkably low, with only 1% of patients experiencing complications (urine retention and pruritus). This suggests that the surgical procedures and perioperative care provided were effective in minimising adverse outcomes. The low complication rate is a positive indicator of the quality of care and the proficiency of the surgical team [22]. STSMs in resource-limited settings can provide safe, essential general surgery with low complication rates, given careful patient selection and adherence to safety protocols [14].

Many district hospitals in Ghana lack physicians with formal surgical training beyond medical school and internship, leading to concerns about the quality of surgical care [35]. Training activities during STSMs can be considered in resource-limited settings where a large number of patients undergo surgical procedures within a relatively shorter time. Other proposed solutions to the lack of physicians with formal surgical training include compulsory short-term surgical training for medical officers, continuing education opportunities, incentives for surgically trained physicians, and training non-physician clinicians to perform common emergency procedures [35].

Limitations

This study has limitations inherent in retrospective data analyses, such as potential biases in record keeping and missing data. To mitigate some of the limitations, rigorous data-cleaning procedures were employed. The study could not curate data on other sociodemographic characteristics. Also, due to the nature of the STSMs, long-term follow-up of patients for complications beyond 30 days was a challenge. Furthermore, the findings are limited in terms of generalisability.

Conclusion and recommendations

The findings highlight the prevalence of certain conditions, such as lipomas and inguinal hernias, during the STSM. There were low complication rates, which may stem from rigorous patient selection and synergy of team effort. Generally, the output of providing surgical care to over 180 patients within one week in this STSM in a low-resource setting suggests that with enough funding and adequate health professionals, more patients can receive surgical care during such STSMs.

STSMs may help alleviate the gap of low surgical rates in peripheral hospitals in Ghana, which may be the result of inadequately equipped infrastructure, rudimentary and demotivated human resources, and low surgical competence. It may also serve as an opportunity for surgical training for residents in training facilities with little exposure to practice their surgical skills due to congestion and competition for patients. This study observed pruritus with opioid administration, and a detailed study into this complication is worthy of pursuit. The cost-effectiveness of STSMs in Ghana is also worth evaluating, as well as the long-term complications of such missions.

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Stroke after coronary artery bypass grafting (CABG): A single center experience

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Ethics Committee Approval
The study was approved by the Institutional Review Board (IRS) on 05/02/2024 – May 2 or February 5?, number 95954 at the University of Kentucky.
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Coronary artery bypass grafting (CABG) is among the ten most commonly performed surgical procedures in the United States. Despite advances in surgical techniques and perioperative care, stroke remains a serious complication, associated with significant morbidity and mortality. The aim of this study is to determine the incidence of stroke following CABG at a single institution, compare it with published rates from other centers, and identify common perioperative risk factors to support targeted, population specific prevention strategies.

Methods: We conducted a retrospective chart review of 3,126 adult patients who underwent isolated coronary artery bypass grafting at our institution between 2016 and 2023. Data were collected on demographic variables, comorbidities, and perioperative factors. The incidence of postoperative stroke was determined, and comparative statistical analysis were performed to identify potential risk factors.

Results: Postoperative stroke occurred in 1.3% of patients (41 of 3,126). The majority of affected individuals were white males aged 61 years or older. Common preoperative comorbidities included hypertension (95%), hyperlipidemia (87.8%), diabetes mellitus (75.6%), and a history of atrial fibrillation (26.7%). Postoperative respiratory failure was observed in 92.7% of stroke patients. Overall mortality in this group was 29.3%, with 24.2% of the casualties occurring within 30 days of surgery and an additional 4.9% within five years.

Conclusions: The incidence of stroke following CABG at our institution (1.3%) falls within the range reported in the literature (1.2%–5.2%). Stroke was associated with longer hospital stays and increased mortality. Hypertension, diabetes mellitus, and hyperlipidemia emerged as the most prominent risk factors. These findings highlight the need for early risk stratification and proactive management of modifiable comorbidities to minimize stroke incidence in patients undergoing CABG.

Keywords: coronary artery bypass grafting, stroke, hypertension, diabetes, hyperlipidemia, risk factors

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Introduction

Cerebrovascular injury following coronary artery bypass grafting (CABG) remains a serious complication associated with high morbidity and mortality rates [1]. CABG is often indicated for patients with significant coronary artery disease who are not suitable candidates for percutaneous coronary intervention (PCI), and it continues to be the preferred revascularization strategy in cases involving diabetes mellitus, left ventricular systolic dysfunction, or rescue intervention after failed PCI [2]. Although the overall incidence of stroke following CABG is relatively low [3], its profound impact on patient recovery and long-term survival underscores the importance of continued investigation.

Despite a global decline in stroke incidence after CABG procedures [4], gaps remain in the literature regarding institutional variations in outcomes and the longitudinal impact of specific risk factors. Numerous studies have explored associations between stroke and both preoperative and postoperative characteristics. Factors, such as advanced age, hypertension, diabetes mellitus, peripheral vascular disease, atrial fibrillation, and the number of grafts, have been identified as significant contributors to stroke risk [1, 3, 5–7]. However, comparative analyses across healthcare centers remain limited.

The primary objective of this study is to determine the incidence of stroke following CABG at our institution and compare it with rates reported by other centers. Additionally, we aim to identify perioperative risk factors associated with both early and delayed stroke occurrence to support improved risk stratification and preventative strategies in this population.

Materials and methods

After obtaining approval from the Institutional Review Board (IRB), we conducted a retrospective cohort study of adult patients (aged 18-90 years) who underwent isolated CABG between January 1, 2016, and December 31, 2023, at our institution.

Clinical and demographic data were extracted from electronic medical records, including age, sex, smoking history, and medical comorbidities such as diabetes mellitus, hypertension, peripheral vascular disease, atrial fibrillation, prior stroke, previous cardiac surgery, hyperlipidemia, and chronic obstructive pulmonary disease (COPD). Surgical details, stroke type, discharge status, and postoperative complications were also recorded.

In-hospital outcomes and long-term events (up to 10 years) were assessed when data were available. Patients were included if they had undergone isolated CABG, but had no preoperative neurological deficits.

Statistical analysis

Statistical analyses were performed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA). Continuous variables were summarized as mean values, and categorical variables were expressed as frequencies and percentages.

Comparisons between short-term (<72 hours) and long-term (>72 hours) stroke groups were performed using the Student's t-test for continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate. A two-tailed *P*-value <0.05 was considered statistically significant.

Results

Among 3,126 patients who underwent isolated CABG, 41 (1.3%) experienced postoperative stroke. Affected patients were predominantly older, white males with elevated BMI. Hypertension, diabetes mellitus, and hyperlipidemia were the most usual comorbidities among stroke patients. Prior stroke, atrial fibrillation, and smoking history were also common. Full distributions of demographic and preoperative variables are presented in Table 1.

Nearly all stroke patients underwent on-pump CABG, with mean bypass and clamp times exceeding two hours. Strokes were more common after multi-vessel procedures, particularly those involving three or more grafts (Table 2).

Table 1: Preoperative characteristics of stroke patients undergoing CABG (n=41)

Variable	No. (%)
Hypertension	39 (95)
Hyperlipidemia	36 (87.8)
Diabetes mellitus	31 (75.6)
Prior stroke	15 (36.6)
Smoker	14 (34)
Past smoker	13 (31.7)
Prior Atrial Fibrillation	11 (26.7)
Chronic Obstructive Pulmonary Disease (COPD)	11 (26.7)
Peripheral vascular disease	6 (14.5)
Prior cardiac surgery	6 (14.5)

Table 2: Operative characteristics of stroke patients (n=41)

Variable	No. (%)
On pump	40 (97.6)
Cardiopulmonary Bypass time, mean	157.5
Clamp time, mean	115.4
Patients with unknown clamp and bypass time	2 (4.9)
Type of surgery	
CABG single vessel	2 (4.9)
CABG two vessels	5 (12.2)
CABG three vessels	**16 (39)**
CABG four vessels	**12 (29.3)**
CABG five vessels	5 (12.2)
CABG six vessels	1 (2.3)

CABG: coronary artery bypass graft

Most strokes occurred within 24 hours of surgery, with an additional cluster around day 10. Respiratory failure and myocardial infarction were the most frequent complications, and mortality approached one-third of these cases. Only a minority of patients were discharged and sent home, with many requiring rehabilitation or long-term care (Table 3).

When stratified by timing, short-term (<72h) and long-term (>72h) strokes shared similar risk profiles. However, patients with short-term stroke were more likely to require rehabilitation (*P*=0.02), whereas those with long-term stroke were more frequently discharged and sent home (*P*=0.01). Stroke subtypes also differed, with periventricular infarctions predominating early and thalamic events occurring more commonly later (*P*=0.03) (Table 4).

Table 3: Postoperative outcomes among stroke patients (n=41)

Variable	No. (%)
30-d after surgery mortality	10 (24.2)
1-y after surgery mortality	0 (0)
5-y after surgery mortality	2 (4.9)
+5-y after surgery mortality	0 (0)
Time between surgery and stroke	
Time between surgery and stroke (24h)	14 (34)
Time between surgery and stroke (3d)	3 (7.2)
Time between surgery and stroke (10d)	13 (31.7)
Time between surgery and stroke (20d)	6 (14.5)
Time between surgery and stroke (30d)	5 (12.2)
Length of Stay Data	
Days at hospital, mean	21.9
Days at ICU, mean	8.4
Perioperative stroke	33 (80.5)
Discharge	
Discharge status (home)	13 (31.7)
Discharge status (rehab)	17 (41.5)
Discharge status (hospice)	1 (2.3)
Discharge status (Nursing home/long-term)	3 (7.2)
Discharge status (dead)	6 (14.5)
Discharge status (other)	1 (2.3)
Post-Op Complications	
Post-op bleeding	4 (9.7)
Post-op infection	2 (4.9)
Post-op atrial fibrillation	18 (43.9)
Post-op renal failure	15 (36.6)
Post-op respiratory failure	38 (92.7)
Perioperative myocardial infarction	31 (75.6)
Type of stroke	
White matter periventricular infarction	20 (48.8)
Thalamic stroke	7 (17)
Stroke due to occlusion of left middle cerebral artery	3 (7.2)
Stroke due to stenosis of left anterior cerebral artery	2 (4.9)
Occlusion of left posterior inferior cerebellar artery with infarction	1 (2.3)
Stroke due to occlusion of left carotid artery	1 (2.3)
Stroke due to embolism of right middle cerebral artery	1 (2.3)
Stroke due to embolism of cerebral artery	1 (2.3)
CVA due to thrombosis of left middle cerebral artery	1 (2.3)
CVA due to thrombosis of right middle cerebral artery	1 (2.3)
CVA due to bilateral occlusion of posterior cerebral arteries	1 (2.3)
Right temporal lobe infarction	1 (2.3)
Right pontine stroke	1 (2.3)

CVA: cerebrovascular accident

Table 4: Comparison of short-term and long-term stroke cases after CABG

Variable	Short term (n=17)	Long term (n=24)	*P*-values
	No. (%)	No. (%)	No.
Age, mean	66.8	64.7	-
Male	13 (76.5)	15 (62.5)	0.499
Body Mass Index, mean	32.3	31.9	-
White	16 (94)	24 (100)	0.415
Diabetes Mellitus	13 (76.5)	18 (75)	1.000
Hyperlipidemia	16 (94)	20 (83.2)	0.382
Hypertension	16 (94)	23 (95.7)	1.000
Peripheral vascular disease	3 (17.5)	3 (12.5)	0.679
Atrial fibrillation	6 (35.3)	5 (20.7)	0.476
Chronic Obstructive Pulmonary Disease (COPD)	5 (29.3)	6 (25)	1.000
Prior stroke	8 (47)	7 (29.2)	0.328
Prior cardiac surgery	3 (17.5)	3 (12.5)	0.679
Smoker	4 (23.4)	10 (41.7)	0.321
Past smoker	4 (23.4)	9 (37.5)	0.499
Days at hospital, mean	20.4	23.1	-
Days at ICU, mean	16.3	11.2	-
Discharge status (home)	1 (5.9)	12 (50)	0.005
Discharge status (rehab)	11 (64.7)	6 (25)	0.023
Discharge status (hospice)	0 (0)	1 (4.2)	1.000
Discharge status (Nursing home/long-term)	1 (5.9)	2 (8.2)	1.000
Discharge status (dead)	4 (23.4)	2 (8.2)	0.212
Discharge status (other)	0 (0)	1 (4.2)	1.000
Post-op bleeding	2 (11.8)	2 (8.2)	1.000
Post-op infection	1 (5.9)	1 (4.2)	1.000
Post-op atrial fibrillation	7 (41.2)	11 (45.7)	1.000
Post-op renal failure	7 (41.2)	8 (33.2)	0.745
Post-op respiratory failure	15 (88.1)	23 (95.7)	0.560
Mortality	4 (23.4)	8 (33.2)	0.729
On pump	17 (100)	24 (100)	1.000
Perioperative myocardial infarction	12 (70.6)	19 (79.2)	-
Cardiopulmonary Bypass time, mean	167.1	150.2	-
Clamp time, mean	130	104.2	-
Patients with unknown clamp and bypass time	0 (0)	2 (8.2)	0.502
Type of surgery			
CABG single vessel	1 (5.9)	1 (4.2)	1.000
CABG two vessels	3 (17.5)	2 (8.2)	0.633
CABG three vessels	7 (41.2)	9 (37.5)	1.000
CABG four vessels	5 (29.3)	7 (29.2)	1.000
CABG five vessels	1 (5.9)	4 (16.7)	0.072
CABG six vessels	0 (0)	1 (4.2)	0.417
Type of stroke			
White matter periventricular infarction	7 (41.2)	3 (12.5)	0.152
Occlusion of left posterior inferior cerebellar artery with infarction	1 (5.9)	0 (0)	1.000
Stroke due to occlusion of left middle cerebral artery	1 (5.9)	2 (8.2)	0.523
Stroke due to occlusion of left carotid artery	1 (5.9)	0 (0)	1.000
Stroke due to embolism of right middle cerebral artery	0 (0)	1 (4.2)	0.417
Stroke due to embolism of cerebral artery	1 (5.9)	0 (0)	1.000
Stroke due to stenosis of left anterior cerebral artery	1 (5.9)	1 (4.2)	1.000
CVA due to thrombosis of left middle cerebral artery	1 (5.9)	0 (0)	1.000
CVA due to thrombosis of right middle cerebral artery	0 (0)	1 (4.2)	0.417
CVA due to bilateral occlusion of posterior cerebral arteries	1 (5.9)	0 (0)	1.000
Thalamic stroke	2 (11.8)	5 (20.7)	0.028
Right temporal lobe infarction	0 (0)	1 (4.2)	0.417
Right pontine stroke	1 (5.9)	0 (0)	1.000

Discussion

Neurologic complications after CABG remain a significant concern despite advances in surgical and perioperative care [5]. In our single-center cohort of 3,126 patients, the stroke incidence was 1.3%, consistent with published rates of 1.2% - 5.2% [3, 8–12].

Age emerged as an important non-modifiable risk factor, as stroke patients were on average older than the general CABG population. These findings are parallel with prior studies linking advanced age with increased susceptibility to both embolic and hypoperfusion-related stroke [5–6, 13–14].

Common comorbidities among stroke patients included hypertension, diabetes, and hyperlipidemia. While these conditions are prevalent in the CABG population overall, their high frequency in our cohort underscores their shared pathophysiologic role in atherosclerosis. This aligns with earlier reports that identified these comorbidities as independent predictors of perioperative stroke [2]. Optimizing their control remains central to prevention strategies.

Interestingly, the majority of stroke cases occurred in men, in contrast with some studies that reported higher risk in women [3, 15]. This discrepancy may reflect population-specific differences and warrants further study.

We also observed a trend toward greater stroke risk in patients undergoing multi-vessel CABG. Prior research similarly links surgical complexity, longer bypass times, and increased aortic manipulation with elevated stroke risk [6].

Postoperative atrial fibrillation was frequent among stroke patients, reinforcing its role as a modifiable predictor of embolic stroke [6, 16, 17]. Careful rhythm surveillance and timely anticoagulation may help mitigate this risk.

Complications such as respiratory and renal failure were common, consistent with previous studies associating multisystem complications with poor neurologic outcomes [8]. Neuroimaging patterns suggested dual mechanisms: hypoperfusion (white matter infarctions) and embolism (thalamic and MCA strokes); this aligns with prior pathophysiologic models.

Mortality among stroke patients was high, with most deaths occurring within 30 days of surgery, a trend also described in previous studies [3, 8]. These findings highlight the need for early identification of high-risk patients [18] and system-level preventive strategies, including comprehensive preoperative evaluation and intraoperative monitoring.

Overall, our results support the implementation of targeted risk reduction and dedicated stroke-prevention pathways for CABG patients [19].

Limitations

This study was a single-center retrospective analysis, which may limit the generalizability of the findings to other institutions or populations. Additionally, the relatively small number of stroke cases (n=41) reduced the statistical power to detect associations with less prevalent risk factors. Missing data on certain intraoperative variables, such as bypass and clamp times, and incomplete long-term follow-up for some patients may have introduced bias. Future prospective, multicenter studies with larger sample sizes and comprehensive data collection are needed to validate and extend these observations.

Conclusions

The incidence of stroke following CABG at our institution aligns with rates reported by other centers. Notably, the identification of key risk factors including hypertension, diabetes mellitus, and perioperative respiratory failure, underscores critical targets for intervention. The implementation of tailored perioperative strategies addressing these modifiable risks may help reduce postoperative complications and improve overall patient outcomes. Future prospective studies are needed to assess the effectiveness of such interventions in lowering stroke incidence and improving long-term prognoses in this population.

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Did the COVID-19 pandemic have an impact on pregnant women's participation in routine antenatal care and on pregnancy and neonatal outcomes?

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Ethics Committee Approval
The study was approved by the Ethics Committee of Ankara Training and Research Hospital, 2021/575.
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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Abstract

Background/Aim: The COVID-19 pandemic disrupted healthcare systems, affecting pregnant women's access to routine antenatal care. Changes in health policies and heightened anxiety may have influenced care utilization and outcomes. This study aimed to assess the pandemic's impact on antenatal attendance and compare pregnancy and neonatal outcomes with the pre-pandemic period in a tertiary center.

Methods: We retrospectively included all women who delivered at Ankara Training and Research Hospital between September 2020 and January 2021 (pandemic period) and those who delivered between September 2019 and January 2020 (pre-pandemic control). Pregnancies with any documented SARS-CoV-2 infection were excluded. Demographics, number of antenatal visits, antenatal screening tests, obstetric complications, and perinatal outcomes were compared.

Results: A total of 532 women delivered during the pandemic and 650 before the pandemic. The cesarean section rate was higher during the pandemic (40.4% vs 33.8%; P=0.020), with a higher primary cesarean rate (18.4% vs 11.2%; P<0.001). Antenatal visit categories were <4, 4–10, and >10 visits for pandemic vs pre-pandemic groups as follows: 39.4% vs 38.5%, 36.8% vs 42.1%, and 23.8% vs 19.4%, respectively (overall comparison P=0.087). While not statistically significant, there was a trend toward fewer women having 4–10 visits and more having >10 visits during the pandemic. Antenatal screening tests (Down syndrome screening, gestational diabetes screening, and second-trimester anomaly screening) were performed more frequently during the pandemic (all P<0.05). The mean gestational age at delivery was higher during the pandemic (39.25 (1.42) vs 38.65 (2.84) weeks; P<0.001), with fewer preterm (<37 weeks) births and more post-term (>41 weeks) births (P=0.012). Other neonatal outcomes were comparable, except for a small but statistically significant difference in 1-minute Apgar scores (9.02 (0.71) vs 9.10 (1.19); P=0.001).

Conclusion: During the pandemic, overall antenatal attendance did not differ significantly from the pre-pandemic period, although screening tests were utilized more frequently and cesarean delivery was more common. Despite these changes, pregnancy and neonatal outcomes were largely similar between periods.

Keywords: antenatal care; COVID-19; pandemic

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Introduction

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), rapidly disrupted health systems and society worldwide [1]. Beyond morbidity and mortality, the pandemic affected health-seeking behaviors and service delivery [2]. Anxiety, altered risk perception, and changes in health policy led many patients to defer non-urgent care. Pregnant women, a population requiring regular antenatal care (ANC), were particularly affected. Reports from Europe and elsewhere described modifications to antenatal service provision and utilization during the pandemic [3]. Symptoms of anxiety and depression also increased among pregnant individuals [4]. These factors may influence ANC attendance and pregnancy outcomes. We aimed to determine the effect of the COVID-19 pandemic on antenatal attendance and to compare pregnancy and neonatal outcomes among women who delivered during the pandemic versus the preceding year in our tertiary center.

Materials and methods

Study design and setting

This retrospective comparative study was conducted at Ankara Training and Research Hospital, Turkey. Ethical approval was obtained from the institutional review board (approval number: 2021/575).

Study population

We included all pregnant women who delivered at our center between September 2020 and January 2021 (pandemic group) and those who delivered between September 2019 and January 2020 (pre-pandemic control). To isolate the indirect effects of the pandemic on service utilization and outcomes, women with any documented COVID-19 infection during pregnancy were excluded.

Data sources and variables

Data were retrieved from the hospital electronic medical records and patient files. We recorded maternal age, body mass index (BMI), gravida, parity, nationality, number of antenatal visits, performance of antenatal screening tests [first-trimester combined test and/or second-trimester maternal serum screening; gestational diabetes mellitus (GDM) screening with 50 g, 75 g, or 100 g oral glucose tests; and second-trimester ultrasound anomaly screening], obstetric complications, gestational age at delivery, mode of delivery and indications for cesarean section, neonatal sex, birth weight, 1- and 5-minute Apgar scores, need for neonatal intensive care unit (NICU) admission, intrapartum/postpartum complications, and length of hospital stay.

Statistical analysis

Data distribution was assessed with the Kolmogorov–Smirnov test. Equality of variances, where relevant, was examined using Levene's test. Group comparisons used the independent-samples t-test for parametric data, the Mann–Whitney U test for non-parametric data, and the chi-square test for categorical variables. Correlations were assessed using Pearson or Spearman coefficients as appropriate. A two-sided *P*-value <0.05 was considered statistically significant. Analyses were conducted using SPSS for Windows, version 23.0 (SPSS Inc., Chicago, IL, USA).

Results

During the pandemic period, 549 women delivered at our hospital; 17 with COVID-19 were excluded, yielding 532 women in the pandemic group and 650 in the pre-pandemic group. The pandemic group was younger on average. The overall cesarean section rate and the primary cesarean rate were higher during the pandemic. Antenatal screening tests (Down syndrome screening, GDM screening, and second-trimester anomaly screening) were performed more frequently during the pandemic.

Regarding ANC utilization, the distribution across <4, 4–10, and >10 visits differed modestly between groups, but the overall comparison did not reach statistical significance (*P*=0.087). The mean number of visits was similar between groups.

The mean gestational age at delivery was higher during the pandemic, with fewer preterm (<37 weeks) births and more post-term (>41 weeks) births. Birth weight, NICU admission, and 5-minute Apgar scores were comparable between groups. A statistically significant difference was observed in 1-minute Apgar scores; however, the absolute difference was small. Correlation analysis showed that the number of antenatal visits correlated positively with maternal age, primary cesarean delivery, birth weight, presence of gestational complications, and hospital stay, and negatively with gravida and parity. Detailed data are presented in Tables 1–4.

Table 1. Demographic variables, types of delivery, C/S indications and gestational complications of the study groups

	During pandemic n=532	**Before pandemic n=650**	***P*-value**
Ages (years), Mean (SD)	26.56 (6.36)	27.79 (5.85)	<0.001
Gravida, Mean (SD)	2.78 (1.59)	2.77 (1.49)	0.821
Parity, Mean (SD)	1.47 (1.32)	1.49 (1.26)	0.627
BMI (kg/m2), Mean (SD)	25.72 (4.97)	26.35 (5.21)	0.452
Nationality n (%)			
Turkish	350 (65.8)	438 (67.4)	
Syrian	71 (13.3)	109 (16.8)	0.012
Iraqi	99 (18.6)	96 (14.8)	
Other	12 (2.3)	7 (1.1)	
Type of delivery n (%)			
Vaginal	317 (59.6)	430 (66.2)	0.020
Cesarean section	215 (40.4)	220 (33.8)	
C/S indications n (%)			
C/S or myomectomy history	117 (54.4)	145 (65.9)	
Fetal distress	35 (16.3)	30 (13.6)	
CPD	21 (9.8)	16 (7.3)	0.097
Presentation abnormality	13 (6.0)	7 (3.2)	
Macrosomia	12 (5.6)	9 (4.1)	
Pre-eclampsia	7 (3.3)	5 (2.3)	
Placental abruption-previa	4 (1.8)	4 (1.8)	
Other	6 (2.8)	4 (1.8)	
Total	215 (100)	220 (100)	
Primary C/S delivery n (%)	98 (18.4)	73 (11.2)	<0.001
Gestational complications n (%)			
GDM	26 (4.9)	20 (3.1)	
GHT, pre-eclampsia, eclampsia	5 (0.9)	12 (1.8)	
Placental abrubsio-preiva	2 (0.4)	2 (0.3)	0.106
IUGR	4 (0.8)	4 (0.6)	
Intrauterine fetal demise	3 (0.6)	4 (0.6)	
Other	1 (0.2)	3 (0.5)	

C/S, Cesarean Section; BMI, Body Mass Index; CPD, Cephalo-pelvic Disproportion; GDM, Gestational Diabetes Mellitus; GHT, Gestational Hypertension; IUGR, Intrauterine Growth Restriction

Table 2. Number of antenatal visits and antenatal test status of the study groups

	During pandemic n=532	Before pandemic n=650	*P*-value
Number of antenatal visits n (%)			
<4	205 (39.4)	256 (38.5)	
4-10	224 (36.8)	239 (42.1)	0.087
>10	103 (23.8)	155 (19.4)	
Number of antenatal visits, Mean (SD)	5.87 (4.79)	5.99 (5.15)	0.736
(Total visits)	(3124)	(3899)	
Antenatal screening for Down's syndrome, n (%)			
First-trimester combined test and /or	251 (47.2)	245 (37.7)	0.001
Second-trimester maternal serum screening			
None	281 (52.8)	405 (62.3)	
GDM screening n (%)			
Tested	211 (39.7)	173 (26.6)	<0.001
Not tested	321 (60.3)	477 (73.4)	
Second-trimester ultrasound screening n (%)			
Tested	207 (38.9)	210 (32.3)	0.018
Not tested	325 (61.1)	440 (67.7)	

GDM, Gestational Diabetes Mellitus

Table 3. Pregnancy and neonatal outcomes of the study groups

	During pandemic n=532	Before pandemic n=650	*P*-value
Gestational age at Delivery n(%)			
<37 weeks	37 (7)	63 (9.7)	
37-41 weeks	433 (81.4)	540 (83.1)	0.012
>41 weeks	62 (11.6)	47 (7.2)	
Average Gestational age at Delivery, Mean (SD)	39.25 (1.42)	38.65 (2.84)	<0.001
Gender n (%)			
Male	276 (51.9)	314 (48.3)	0.222
Female	256 (48.1)	336 (51.7)	
Birth weight (gr), Mean (SD)	3245.63 (459.12)	3205.56 (458.18)	0.155
First-minute Apgar score, Mean (SD)	9.02 (0.71)	9.10 (1.19)	0.001
Fifth-minute Apgar score, Mean (SD)	9.81 (0.47)	9.84 (3.71)	0.310
Need for neonatal intensive care n (%)	51 (9.6)	59 (9.1)	0.764
Hospital stays (day), Mean (SD)	1.83 (1.06)	1.66 (0.77)	<0.001

Table 4. Spearman's correlation analysis of the number of antenatal visits with the other parameters

	r	*P*-value
Age	.157	<0.001
Gravida	-0.088	0.003
Parity	-0.154	<0.001
BMI	0.015	0.523
Presence of gestational complication	0.092	0.002
Intrauterine fetal demise after 24th weeks	-0.023	0.420
Primary C/S delivery	0.211	<0.001
Gestational age at delivery	0.022	0.510
First-minute Apgar score	-0.019	0.515
Fifth-minute Apgar score	-0.041	0.159
Birth weight	0.135	<0.001
Need for neonatal intensive care	0.024	0.419
Hospital stays	0.160	<0.001

BMI, Body Mass Index; C/S, Cesarean Section

Discussion

This study compared antenatal care utilization and perinatal outcomes before and during the COVID-19 pandemic in a large tertiary center. We observed higher cesarean delivery—particularly primary cesarean—during the pandemic, consistent with the possibility of altered risk perceptions or institutional practices during crisis conditions. While our study cannot determine causality, these findings may reflect changes in clinical decision-making, patient preference, or logistical considerations.

COVID-19 has brought many unknowns to our lives. Mood changes, especially increased anxiety and changes in risk perception, are commonly seen during this period [5-7]. Since the pandemic has become the top agenda of the world, it is expected that fewer people visit hospitals for non-COVID-19-related reasons, such as pregnancy follow-up. In the current study, although distribution across ANC visit categories shifted, overall antenatal attendance did not differ significantly. Notably, key antenatal screening tests were performed more frequently during the pandemic. This pattern may indicate prioritization of essential screening within fewer or reorganized in-person contacts; however, we did not capture data on telehealth or scheduling practices.

It is generally considered that antenatal care has a positive effect on the health of both the mother and baby [8-10]. There is a wide variety of guidelines in antenatal care, and not all of them are evidence-based. For example, the recommended number of antenatal visits varies considerably between Western countries [11-13]. It was previously shown that inadequate antenatal care was related to undesirable newborn and pregnancy outcomes, and it was suggested that unwanted pregnancy complications could be reduced with appropriate antenatal visit [14-21]. According to the World Health Organization, antenatal care visits should include at least four visits to medically trained personnel to prevent complications and ensure a safe delivery [22].

The mean gestational age at delivery was higher during the pandemic period, alongside fewer preterm and more post-term births. These shifts are internally consistent and may reflect differences in care pathways or thresholds for induction during the pandemic; definitive explanations require further study. Importantly, most neonatal outcomes were similar between groups. The statistically significant difference in 1-minute Apgar scores likely has limited clinical relevance given the high scores in both groups.

Strengths of this study include the use of a pre-pandemic control period within the same institution and comprehensive capture of antenatal testing and outcomes. Excluding women with COVID-19 infection isolated the indirect effects of the pandemic on care utilization and outcomes. Limitations include the single-center retrospective design, potential residual confounding, lack of data on telemedicine or timing of visits, and limited generalizability beyond the study setting.

In summary, essential antenatal services were largely maintained during the pandemic in our center, with increased utilization of screening and higher cesarean rates, but without major differences in perinatal outcomes.

Conclusion

In this single-center retrospective study excluding SARS-CoV-2–positive pregnancies, overall antenatal attendance did not differ significantly during the pandemic compared with the prior year, while antenatal screening tests were more frequently performed and cesarean delivery was more common. Despite these shifts, pregnancy and neonatal outcomes were largely comparable across periods.

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Evaluation of inflammatory markers in pregnancies with hyperemesis gravidarum

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Ethics Committee Approval
The study was approved by the Amasya University Ethics Committee (Date: October 19, 2023; Approval No: 111).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Hyperemesis gravidarum (HG) is a severe clinical condition characterized by intractable nausea and vomiting during pregnancy, yet its exact etiology remains elusive. This study aimed to investigate the association between HG and the inflammatory markers procalcitonin (PCT), neutrophil-to-lymphocyte ratio (NLR), and platelet-to-lymphocyte ratio (PLR) to better understand the role of systemic inflammation in the disorder.

Methods: This prospective controlled study included 82 pregnant women diagnosed with HG and 82 healthy pregnant controls. Demographic data, serum PCT levels, NLR, PLR, and obstetric and neonatal outcomes were compared between the two groups. Additionally, patients in the HG group were analyzed according to the severity of ketonuria.

Results: No significant differences were observed in demographic characteristics between the groups. The HG group demonstrated significantly higher PCT and PLR levels than the control group ($P<0.001$ and $P=0.013$, respectively). Regarding obstetric and neonatal outcomes, both infant birth weight and first-minute Apgar scores were significantly lower in the HG group ($P=0.013$ and $P=0.043$, respectively). Within the HG group, patients exhibiting +3 urinary ketones had significantly higher PCT and PLR values compared to those with lower ketone levels ($P<0.001$ and $P=0.041$, respectively). No significant differences were found in other obstetric and neonatal parameters.

Conclusion: The elevation of PCT and PLR in pregnant women with HG suggests a potential involvement of systemic inflammation in the pathogenesis of the disorder. This inflammatory response may be associated with disease severity and contribute to adverse neonatal outcomes, such as reduced birth weight and lower first-minute Apgar scores.

Keywords: hyperemesis gravidarum, procalcitonin, neutrophil-lymphocyte ratio, platelet-lymphocyte ratio

Introduction

Nausea, with or without vomiting, is a frequently encountered symptom during pregnancy. Although mild cases are generally considered physiological adaptations to gestation, severe and persistent forms may lead to substantial maternal weight loss, ketonuria, fluid and electrolyte imbalances, and acid–base disturbances, a condition referred to as hyperemesis gravidarum (HG) [1-3]. The incidence of severe HG ranges between 0.3% and 3%, with critical cases often necessitating hospitalization. Women affected by severe HG are at increased risk of serious complications, including central pontine myelinolysis and Wernicke's encephalopathy, both of which can be life-threatening [4, 5]. Furthermore, severe HG has been associated with adverse fetal outcomes such as intrauterine growth restriction (IUGR), low birth weight (LBW), preterm birth, and low Apgar scores [6, 7]. Consequently, early recognition and appropriate management are essential to protect both maternal and fetal health.

Despite extensive research, the pathophysiology of HG has not yet been fully elucidated. Various mechanisms—including hormonal alterations, *Helicobacter pylori* infection, gastrointestinal dysmotility, placental dysfunction, and psychosocial factors—have been proposed; however, the precise etiology remains controversial. Traditionally, HG has not been classified as an inflammatory disorder. Nevertheless, emerging evidence suggests a possible association with inflammatory processes, supported by reports of elevated inflammatory biomarkers in affected women [8-11].

Procalcitonin (PCT), a peptide precursor of calcitonin secreted by the parafollicular cells of the thyroid gland, is recognized as a proinflammatory mediator. It contributes to inflammatory responses by up-regulating CD16 and CD14 surface proteins on neutrophils and lymphocytes [12, 13]. Although PCT is primarily used to assess the severity of bacterial infections, evidence indicates that PCT levels may also increase in noninfectious chronic inflammatory conditions [14, 15]. Elevated PCT concentrations have been observed in several pregnancy-related complications, including preeclampsia, eclampsia, gestational diabetes mellitus (GDM), and preterm premature rupture of membranes (PPROM) [16, 17].

During systemic inflammation, characteristic changes occur in circulating leukocytes, typically involving an increase in neutrophil counts and a decrease in lymphocyte counts. This makes the neutrophil-to-lymphocyte ratio (NLR) a practical marker of inflammatory activity, where higher values indicate more pronounced inflammation [18]. Similarly, platelets play a pivotal role in immune and inflammatory responses, and the platelet-to-lymphocyte ratio (PLR) has emerged as another inflammation-related index influenced by cytokine-mediated mechanisms [19]. Both NLR and PLR have been investigated in various chronic inflammatory conditions, gynecologic malignancies, and reproductive disorders [20-22]. In obstetric practice, elevated NLR levels have also been reported in conditions such as GDM, preeclampsia, and intrahepatic cholestasis of pregnancy [19, 23].

In light of these considerations, the present study aimed to investigate the association between inflammatory markers—namely PCT, NLR, and PLR—and hyperemesis gravidarum. Elucidating these relationships may enhance the understanding of the potential inflammatory mechanisms involved in HG and contribute to improved strategies for preventing HG-related complications.

Materials and methods

Ethical approval for this study was obtained from the Amasya University Ethics Committee (Date: October 19, 2023; Approval No: 111). The study was conducted in accordance with the principles of the Declaration of Helsinki.

This prospective controlled study was conducted between November 1, 2023, and January 10, 2024, including 82 pregnant women diagnosed with HG and 82 healthy pregnant controls. The following variables were analyzed: demographic characteristics (age, weight, height, body mass index [BMI], educational status, parity, previous surgical history, presence of chronic disease, smoking and alcohol use, week of diagnosis, and steroid use), serum PCT levels, neutrophil, lymphocyte, and platelet counts, NLR, PLR, and obstetric and neonatal outcomes.

A diagnosis of HG was established in women presenting with severe vomiting before the 20th week of gestation, resulting in >5% weight loss and necessitating hospitalization. Exclusion criteria included hypertension, diabetes mellitus, thrombophilia, imminent abortion, autoimmune disorders, renal, cardiac, or hepatic disease, preeclampsia, GDM, HELLP syndrome, or other inflammatory conditions. Additional exclusions included fetal anomalies and maternal conditions causing nausea, such as urinary tract infection or migraine. Only participants with viable intrauterine pregnancies confirmed by fetal cardiac activity on ultrasonography were included. Informed consent was obtained from all participants prior to enrollment.

Ultrasonographic examinations were performed by a single clinician (A.T.T.) using a Mindray DC-7 Ultrasound System. Fetal assessment included gestational age, growth, cardiac activity, amniotic fluid volume, and examination of the gestational sac. Blood samples were obtained under standardized conditions for hemogram analysis (neutrophil, lymphocyte, and platelet counts), liver and renal function tests, and serum PCT concentration. Urinalysis was performed to determine ketone levels. Hematologic parameters were measured using a laser optics analyzer (XN-1000, Siemens, Japan). Serum PCT levels were quantified via electrochemiluminescence immunoassay (Cobas e 411, Roche, Japan), and urinalysis was performed using a digital flow-cell system (FUS-200, Dirui, China).

Obstetric and neonatal outcomes (birth weight, gestational week at delivery, mode of delivery, NICU admission, 1st- and 5th-minute Apgar scores) were recorded. HG patients were classified into three subgroups based on urinary ketone levels (+1, +2, +3) for subgroup analysis.

Sample size

The required sample size was calculated using G*Power 3.1 software based on a previous study [10]. With an effect size of w=0.951 and a two-tailed hypothesis at a 95% confidence level, a minimum of 80 participants per group was determined to provide adequate statistical power.

Statistical analysis

Data were analyzed using IBM SPSS Statistics Version 23.0. The Kolmogorov–Smirnov test assessed data normality. Categorical variables were analyzed using the Chi-square or Fisher's exact test. For continuous variables, independent samples t-test or Mann–Whitney U test was applied. For multiple group comparisons, one-way ANOVA or Kruskal–Wallis test was used. A *P*-value <0.05 was considered statistically significant.

Results

No significant differences were observed between the HG and control groups regarding demographic characteristics, smoking or alcohol consumption, gestational week at diagnosis, or steroid administration for fetal lung maturation (Table 1). Serum PCT and PLR levels were significantly higher in the HG group compared with the control group (0.050 (0.013) vs 0.043 (0.013), *P*<0.001 and 128.80 (35.56) vs 116.81 (45.56), *P*=0.013, respectively), while no statistically significant difference was observed in NLR (Table 2).

Table 1: Comparison of the groups in terms of demographic characteristics, smoking, alcohol use, diagnosis week and steroid administration for lung development

		Study group n=82	Control group n=82	*P*-value
		Mean (SD)	Mean (SD)	
Age (year)		27.84 (4.92) (18 - 42)	27.82 (6.47) (18 - 43)	0.696
Weight (kg)		64.65 (14.22) (45 - 130)	65.27 (13.35) (41 - 109)	0.612
Height (cm)		161.07 (5.40) (146 - 172)	160.91 (6.12) (148 - 180)	0.861
BMI (kg/m^2)		24.93 (5.45) (16.26 - 48.93)	25.24 (5.20) (16.80 - 42.58)	0.539
Diagnosis week		9.88 (2.68)	10.24 (2.52)	0.228
		n (%)	n (%)	
Parity	Nulliparity	45 (45.9%)	38 (46.3%)	0.274
	Multiparity	37 (45.1%)	44 (53.7%)	
Education	Primary school	13 (15.9%)	10 (12.1%)	0.836
	Middle school	20 (24.4%)	24 (29.3%)	
	High school	26 (31.7%)	24 (29.3%)	
	University	23 (28.0%)	24 (29.3%)	
Previous surgery		17 (20.7%)	10 (12.2%)	0.140
Chronic disease		9 (11.0%)	5 (6.1%)	0.264
Smoking		2 (2.4%)	2 (2.4%)	1.00
Alcohol use		0 (0.0%)	0 (0.0%)	-
Steroid administration		5 (6.1%)	5 (6.1%)	1.00

P-values were calculated with the independent t test (height), Mann-Whitney U test (age, weight, BMI and diagnosis week) and chi-squared test.

Table 2: Comparison of laboratory results of groups

		Study group n=82 Mean (SD)	Control group n=82 Mean (SD)	*P*-value
Procalcitonin (ng/mL)		0.050 (0.013)	0.043 (0.013)	<0.001
Neutrophil (×10^9 /L)		6.02 (1.89)	6.28 (2.00)	0.429
Lymphocyte (×10^9 /L)		2.06 (0.63)	2.54 (2.66)	0.141
Platelet (×10^9 /L)		249.64 (54.35)	238.23 (51.34)	0.212
NLR		3.08 (1.16)	3.04 (1.42)	0.488
PLR		128.80 (35.56)	116.81 (45.56)	0.013
		n (%)	**n (%)**	
Ketones in urine	0	0 (0.0%)	82 (100.0%)	<0.001
	+1	41 (50.0%)	0 (0.0%)	
	+2	24 (29.3%)	0 (0.0%)	
	+3	17 (20.7%)	0 (0.0%)	

P-values were calculated with the Mann Whitney U test and chi-squared test (Ketones in urine).

Within the HG group, the severity of ketonuria was recorded as follows: 50.0% of patients had +1 ketones, 29.3% had +2, and 20.7% had +3. Birth weight and first-minute Apgar scores were significantly lower in pregnancies complicated by HG compared with healthy controls (*P*=0.013 and *P*=0.043, respectively) (Tables 3 and 4).

Table 3: Comparison of obstetric and neonatal results of the groups

		Study group n=82 Mean (SD)	Control group n=82 Mean (SD)	*P*-value
Infant weight (g)		3073.35 (509.45)	3252.68 (447.23)	0.013
Birth week (week)		38.38 (1.76)	38.79 (1.67)	0.112
1st minute Apgar scores		8.57 (0.68)	8.78 (0.52)	0.043
5th minute Apgar scores		9.76 (1.15)	9.80 (0.39)	0.544
		n (%)	n (%)	
Delivery type	Vaginal birth	50 (61.0%)	44 (53.7%)	0.344
	Cesarean	32 (39.0%)	38 (46.3%)	
Indications of cesarean	Vaginal birth	50 (61.0%)	44 (53.7%)	0.798
	Previous cesarean	16 (19.5%)	18 (22.0%)	
	Fetal distress	9 (11.0%)	12 (14.6%)	
	Cephalopelvic disproportion	5 (6.1%)	6 (7.3%)	
	Prolonged action	2 (2.4%)	1 (1.2%)	
	Ablation placenta	0 (0.0%)	1 (1.2%)	
Preterm birth		12 (14.6%)	7 (8.5%)	0.222
Intrauterine growth retardation		9 (11.0%)	4 (4.9%)	0.148
Low-birth-weight infants		9 (11.0%)	5 (6.1%)	0.264
Post-maturity		6 (7.3%)	6 (7.3%)	1.00
Neonatal intensive care needs		10 (12.2%)	4 (4.9%)	0.094

P-values were calculated with the Mann Whitney U test (infant weight, birth week, 1st minute Apgar scores and 5th minute Apgar scores) and chi-squared test. IUGR: Intrauterine growth retardation, RDS: Respiratory distress syndrome

Table 4: Comparison of the groups formed according to ketone levels in patients with hyperemesis gravidarum in terms of demographic characteristics, smoking, alcohol use, diagnosis week and steroid administration for lung development.

		+1 ketone in urine n=41 Mean (SD)	+2 ketone in urine n=24 Mean (SD)	+3 ketone in urine n=17 Mean (SD)	*P*-value
Age (year)		28.12 (4.69)	26.83 (5.16)	28.59 (5.20)	0.471
Weight (kg)		66.29 (16.04)	61.83 (11.96)	64.65 (12.49)	0.481
Height (cm)		161.71 (5.19)	160.17 (5.85)	160.82 (5.34)	0.533
BMI (kg/m^2)		25.36 (6.06)	24.15 (4.83)	24.99 (4.90)	0.695
Diagnosis week		10.03 (3.14)	9.52 (2.13)	10.01 (2.22)	0.747
		n (%)	n (%)	n (%)	
Parity	Nulliparity	23 (56.1%)	15 (62.5%)	7 (41.2%)	0.391
	Multiparity	18 (43.9%)	9 (37.5%)	10 (58.8%)	
Education	Primary school	4 (9.8%)	4 (16.7%)	5 (29.5%)	0.368
	Middle school	10 (24.4%)	6 (25.0%)	4 (23.5%)	
	High school	17 (41.4%)	5 (20.8%)	4 (23.5%)	
	University	10 (24.4%)	9 (37.5%)	4 (23.5%)	
Previous surgery		11 (26.8%)	3 (12.5%)	3 (17.6%)	0.365
Chronic disease		6 (14.6%)	1 (4.2%)	2 (11.8%)	0.425
Smoking		1 (2.4%)	1 (4.2%)	0 (0.0%)	0.696
Alcohol use		0 (0.0%)	0 (0.0%)	0 (0.0%)	-
Steroid administration		4 (9.8%)	0 (0.0%)	1 (5.9%)	0.284

P-values were calculated with the Kruskal Wallis and Chi-square test.

Subgroup analysis based on ketone severity revealed that serum PCT levels were highest in the +3 ketone subgroup, while no significant difference was noted between the +1 and +2 subgroups (*P*<0.001). Similarly, PLR values were significantly elevated in the +3 ketone subgroup (*P*=0.041). However, no statistically significant differences were observed among the ketone subgroups regarding other obstetric or neonatal outcomes (Tables 5 and 6).

Table 5: Comparison of laboratory results of groups formed according to ketone levels in patients with hyperemesis gravidarum

	+1 ketone in urine n=41 Mean (SD)	+2 ketone in urine n=24 Mean (SD)	+3 ketone in urine n=17 Mean (SD)	*P*-value
Procalcitonin (ng/mL)	0.045 (0.01)a	0.050 (0.00)a	0.063 (0.00)b	<0.001
Neutrophil (×10^9 /L)	5.99 (2.41)	6.22 (1.69)	5.82 (1.54)	0.794
Lymphocyte (×10^9 /L)	2.21 (0.72)a	1.97 (0.54)ab	1.79 (0.37)b	0.048
Platelet (×10^9 /L)	255.60 (63.60)	231.33 (37.52)	261.11 (45.67)	0.137
NLR	2.87 (1.32)	3.28 (1.06)	3.31 (0.83)	0.274
PLR	125.63 (44.12)a	120.87 (22.28)a	147.64 (18.04)b	0.041

P-values were calculated with the Kruskal Wallis test.

Table 6: Comparison of obstetric and neonatal outcomes of groups formed according to ketone levels in patients with hyperemesis gravidarum

	+1 ketone in urine n=41	+2 ketone in urine n=24	+3 ketone in urine n=17	*P*-value
Infant weight (g)	3176.59 (575.87)	2955.42 (390.42)	2990.88 (458.58)	0.182
Birth week (week)	38.29 (1.92)	38.55 (1.61)	38.34 (1.63)	0.856
1st minute Apgar scores	8.61 (0.66)	8.63 (0.64)	8.41 (0.79)	0.556
5th minute Apgar scores	9.76 (0.48)	9.88 (0.33)	9.59 (0.50)	0.145
	n (%)	**n (%)**	**n (%)**	***P*-value**
Delivery type				
Vaginal birth	29 (70.7%)	12 (50.0%)	9 (52.9%)	0.191
Cesarean	12 (29.3%)	12 (50.0%)	8 (47.1%	
Indications of cesarean				
Vaginal birth	30 (73.2%)	12 (50.0%)	8 (47.1%)	0.344
Previous cesarean	5 (12.2%)	6 (25.0%)	5 (29.4%)	
Fetal distress	5 (12.2%)	3 (12.5%)	1 (5.9%)	
Cephalopelvic disproportion	1 (2.4%)	2 (8.3%)	2 (11.8%)	
Prolonged action	0 (0.0%)	1 (4.2%)	1 (5.9%)	
Preterm birth	7 (17.1%)	3 (12.5%)	2 (11.8%)	0.821
Intrauterine growth retardation	4 (9.8%)	3 (12.5%)	2 (11.8%)	0.937
Low-birth-weight infants	5 (12.2%)	2 (8.3%)	2 (11.8%)	0.885
Post-maturity	2 (4.9%)	2 (8.3%)	2 (11.8%)	0.640
Neonatal intensive care needs	5 (12.2%)	1 (4.2%)	4 (23.5%)	0.175

P-values were calculated with the Kruskal Wallis and Chi-square test. a-b: There is no difference between groups with the same letters ($p>0.05$). Different letters indicate significantly different groups ($P<0.05$).

Discussion

The main findings of the present study indicate that serum PCT and PLR levels were significantly higher in patients with HG compared with healthy pregnant controls. Conversely, no significant difference was observed in the NLR. Subgroup analysis revealed that patients with +3 ketonuria exhibited significantly higher PCT and PLR values than those with lower degrees of ketonuria. Furthermore, infant birth weight and first-minute Apgar scores were significantly lower in the HG cohort, which aligns with previous reports demonstrating an association between HG and adverse perinatal outcomes [6, 7].

Several studies have reported elevated NLR and PLR values in women with HG, supporting their potential role as diagnostic or prognostic markers [9, 20, 25, 26]. Nevertheless, evidence regarding the association between ketonuria severity and clinical severity remains inconclusive. While some studies have demonstrated a significant correlation between ketonuria levels and clinical severity [9, 25], others have failed to identify such an association [20, 26]. Data investigating the specific relationship between PCT and HG are scarce, and the clinical significance of PCT in this context is not yet firmly established.

In recent years, growing attention has been directed toward inflammatory processes in the pathogenesis of HG [25, 27, 28]. Studies have demonstrated elevated proinflammatory cytokines, such as TNF-α and IL-6, and alterations in hematological indices in HG patients [9-11]. Furthermore, higher circulating levels of vaspin and elevated serum sirtuin-1 concentrations have been observed in these patients, further supporting the inflammatory hypothesis [10, 29].

PCT is a well-established biomarker of systemic inflammation, released by various cell types during severe inflammatory responses [30]. It has been used to identify preeclampsia severity and PPROM [17, 31]. While data on PCT in HG are limited, the hematological pattern of increased neutrophil counts and reduced lymphocyte counts—the basis for NLR and PLR—is frequently seen in systemic inflammation [32, 33]. These markers have been investigated extensively in oncology, cardiology, and reproductive medicine [21, 22, 34-38].

In accordance with previous reports, the present study demonstrated significantly higher PLR values in pregnant women with HG, although no significant difference was observed in the NLR. The association between elevated PLR and PCT levels with increasing severity of ketonuria suggests a potential link between inflammatory activity and clinical severity.

Consistent with prior documentation, our findings revealed significantly lower neonatal birth weights and 1-minute Apgar scores in the HG group [6, 7]. However, the lack of significant differences in outcomes between ketone subgroups may be due to the relatively small sample size. This limitation suggests that a larger cohort might provide greater statistical power for evaluating the relationship between inflammatory markers and specific perinatal outcomes. A major strength of this study is the simultaneous assessment of PCT, NLR, and PLR in conjunction with neonatal parameters, offering a comprehensive view of inflammatory mechanisms in HG.

Conclusion

In conclusion, the elevated serum PCT and PLR levels observed in women with HG support the hypothesis that inflammatory mechanisms contribute to the etiopathogenesis of the disorder. The association between increased inflammatory markers and ketonuria severity may provide clinically useful insights for predicting disease severity. While HG is linked to adverse neonatal outcomes such as lower birth weight and reduced 1-minute Apgar scores, these outcomes do not appear to be directly correlated with ketonuria levels.

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Evaluation of healthcare professionals' acceptance of digital intraoperative hemodynamic data recording using the technology acceptance model

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Ethics Committee Approval
The study was approved by the Necmettin Erbakan University Ethics Committee with decision number 2024/5088, dated July 5, 2024. All participants' rights were fully protected, and written informed consent was obtained from each participant before inclusion in the study, in accordance with the Declaration of Helsinki. All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Background/Aim: This study aimed to evaluate a software prototype developed for the digitalization of intraoperative hemodynamic data recording and to examine healthcare professionals' acceptance of this system within the framework of the Technology Acceptance Model.

Methods: This single-center, cross-sectional, descriptive study was conducted in the operating room of a university hospital between January 1, 2025, and December 31, 2025. A total of 75 healthcare professionals actively involved in intraoperative patient monitoring were included. Data were collected using a Participant Information Form and the 28-item Technology Acceptance Model Scale. Statistical analyses included descriptive statistics, independent samples t-test, one-way analysis of variance, Pearson correlation analysis, and multiple linear regression analysis.

Results: Participants had high perceived usefulness and perceived ease of use scores, with mean (SD) values of 4.31 (0.56) and 4.23 (0.60), respectively. Age was negatively and significantly correlated with perceived usefulness (r=-0.348, *P*=0.002), indicating that perceived usefulness decreased with increasing age. Professional experience significantly differed according to perceived ease of use (*P*=0.042). No significant relationship was found between perceived ease of use and perceived usefulness (r=0.030, *P*=0.797). Multiple linear regression analysis showed that age was an independent significant predictor of perceived usefulness (β=-0.025, 95% CI: -0.040 to -0.009, *P*=0.002).

Conclusion: Digital intraoperative hemodynamic data recording was highly accepted by healthcare professionals. The finding that age was associated with technology acceptance suggests that generational differences should be considered during digital transformation. Automated recording systems may reduce workload and improve patient safety; however, organizational support and adequate technical infrastructure are critical for widespread implementation.

Keywords: anesthesia, digital health, intraoperative monitoring, technology acceptance model, hemodynamic data

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Introduction

Continuous monitoring of patients' hemodynamic parameters during the intraoperative period is a fundamental component of anesthesia management. Accurate and timely recording of heart rate, arterial blood pressure, oxygen saturation, and related variables is critically important for patient safety and clinical decision-making [1,2]. Traditionally, these data have been recorded manually; however, manual documentation is time-consuming and may be prone to errors, omissions, and data loss [2].

With the increasing digitalization of healthcare services, electronic health record systems and automated data collection solutions have become progressively integrated into clinical practice. In high-intensity environments such as operating rooms, automated data recording systems may reduce workload while improving data accuracy [3,4]. These systems allow continuous monitoring data to be recorded in an uninterrupted and standardized manner.

The adoption of new technologies in healthcare depends not only on technical adequacy but also on user acceptance. In this context, the Technology Acceptance Model (TAM) is a widely used framework for explaining technology use behavior. Developed by Davis, the model identifies perceived usefulness and perceived ease of use as the primary determinants of intention to use technology [5]. The model was later extended and validated in various fields by Venkatesh et al. [6]. Studies in health informatics have similarly demonstrated that these two variables are major determinants of technology acceptance [7].

Although numerous studies have examined user acceptance of electronic health record systems and clinical information technologies, studies evaluating user acceptance of digital intraoperative hemodynamic data recording systems remain limited. In particular, how healthcare professionals perceive automated recording systems used in the operating room environment and which factors influence this acceptance have not been sufficiently investigated. This study aimed to evaluate the effects of digital intraoperative hemodynamic data recording on healthcare professionals and to examine user acceptance of this system within the framework of the TAM. In addition, the effects of demographic and professional variables on technology acceptance were investigated.

Materials and methods

Ethical approval

The study was carried out after approval from the Necmettin Erbakan University Ethics Committee (decision no. 2024/5088, dated July 5, 2024). The study was conducted in accordance with the principles of the Declaration of Helsinki, and written informed consent was obtained from all participants.

Study design

This cross-sectional, descriptive study was conducted in the operating room of Necmettin Erbakan University Faculty of Medicine Hospital between January 1, 2025, and December 31, 2025. Routine intraoperative hemodynamic monitoring was performed using the Eretna Vitascope 190 (VT19-10001) bedside monitor. A software prototype was developed using the Python programming language to retrieve data from the monitor and automatically record measurements at predefined 5-minute intervals. Through this system, patient hemodynamic data were automatically documented and made available for reporting.

Study population

The study population consisted of healthcare professionals actively involved in intraoperative patient monitoring and hemodynamic data recording, including faculty members, resident physicians, anesthesia technicians or technologists, and nurses. A total of 75 healthcare professionals who met the inclusion criteria were enrolled. No formal sample size calculation was performed; all eligible participants were included. Healthcare professionals who were actively working in the operating room and willing to participate were included, whereas those who declined or were not involved in the intraoperative process were excluded.

Data collection

Data were collected using a two-part questionnaire. The first section, the Participant Information Form, assessed sociodemographic and professional characteristics, including sex, age, marital status, educational level, professional title, duration of professional experience, history of computer training, and level of computer use.

The second section consisted of the Likert-type Technology Acceptance Model Scale, which was used to evaluate attitudes toward electronic health record systems. The Turkish validity and reliability of the scale had previously been established [8]. The scale consisted of 28 items and included two subdimensions: perceived usefulness, with 14 items, and perceived ease of use, with 14 items. Each item was scored on a 5-point Likert scale ranging from 1, strongly disagree, to 5, strongly agree.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as mean (SD) for continuous variables and number with percentage, n (%), for categorical variables. Normality was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. For comparisons, the independent samples t-test and one-way analysis of variance were used when parametric assumptions were met. Pearson correlation analysis was used to evaluate relationships between variables. Multiple linear regression analysis was used to examine the effects of age, sex, and history of computer training on perceived usefulness. Model significance was assessed using the F test, and explanatory power was assessed using R^2. A *P*-value <0.050 was considered statistically significant.

Results

A total of 75 healthcare professionals were included in the study. The mean age of the participants was 37.29 (10.32) years, and 47 participants (62.7%) were female. Most participants were married (74.7%) and held doctoral or associate degrees. Regarding professional distribution, 40 participants (53.3%) were allied healthcare personnel, 28 (37.3%) were resident physicians, and 7 (9.3%) were faculty members. The most common duration of professional experience was 5-10 years (45.3%). Although formal computer training was uncommon (14.7%), more than half of the participants reported their computer use level as moderate

or good. Detailed sociodemographic and professional characteristics are presented in Table 1.

Table 1. Demographic characteristics of participants (n=75)

Variable	Value
Age, years, mean (SD)	37.29 (10.32)
Sex, n (%)	
Female	47 (62.7)
Male	28 (37.3)
Educational level, n (%)	
Doctoral degree	35 (46.7)
Associate degree	23 (30.7)
Bachelor's degree	17 (22.7)
Professional title, n (%)	
Allied healthcare personnel	40 (53.3)
Resident physician	28 (37.3)
Faculty member	7 (9.3)
Professional experience, n (%)	
<5 years	9 (12.0)
5-10 years	34 (45.3)
10-15 years	13 (17.3)
15-20 years	7 (9.3)
>20 years	12 (16.0)
Computer training, n (%)	
Yes	11 (14.7)
No	64 (85.3)
Level of computer use, n (%)	
Very low	5 (6.7)
Low	10 (13.3)
Moderate	32 (42.7)
Good	17 (22.7)
Very good	11 (14.7)

SD: Standard deviation. Allied healthcare personnel includes nurses and anesthesia technicians/technologists.

The mean scores for technology acceptance dimensions indicated a highly positive perception of the digitalized system. The mean perceived usefulness score was 4.31 (0.56), and the mean perceived ease of use score was 4.23 (0.60). These high values suggest that the software prototype was regarded as functional and user-friendly within the clinical workflow (Table 2).

Table 2. Descriptive statistics of technology acceptance variables

Variable	Mean (SD)	Minimum-maximum
Perceived usefulness	4.31 (0.56)	1.00-5.00
Perceived ease of use	4.23 (0.60)	1.00-5.00

SD: Standard deviation. Scores are based on a 5-point Likert scale.

Statistical comparisons showed that professional experience had a significant effect on perceived ease of use (F=2.629, *P*=0.042), whereas its effect on perceived usefulness was not statistically significant (*P*=0.127). The level of computer use showed a trend toward significance for perceived usefulness (F=2.393, *P*=0.059) but did not significantly affect perceived ease of use (*P*=0.809). No statistically significant differences were observed in perceived usefulness or perceived ease of use scores according to sex or history of computer training (*P*>0.050).

Correlation analysis identified a significant negative relationship between age and perceived usefulness (r=-0.348, *P*=0.002), indicating that perceived usefulness of the digital system decreased as age increased. However, age was not significantly correlated with perceived ease of use (r=0.017, *P*=0.884). No significant association was found between perceived usefulness and perceived ease of use (r=0.030, *P*=0.797), contrary to the standard assumptions of the TAM (Table 3).

Table 3. Relationships between demographic variables and technology acceptance components

Variable	Age	Perceived usefulness	Perceived ease of use
Age	—	-0.348 (*P*=0.002)	0.017 (*P*=0.884)
Perceived usefulness	-0.348 (*P*=0.002)	—	0.030 (*P*=0.797)
Perceived ease of use	0.017 (*P*=0.884)	0.030 (*P*=0.797)	—

Values are Pearson correlation coefficients with corresponding *P*-values.

The multiple linear regression model, which included age, sex, and computer training, was statistically significant (F=4.016, *P*=0.011, R^2=0.145). Among the predictors, only age was an independent and significant determinant of perceived usefulness (β=-0.025, 95% CI: -0.040 to -0.009, *P*=0.002). Sex and computer training did not significantly contribute to the explanatory power of the model. The distributions of perceived usefulness according to sex and computer training status and the relationship between age and perceived usefulness are presented in Figures 1-3.

Figure 1. Distribution of perceived usefulness by sex.

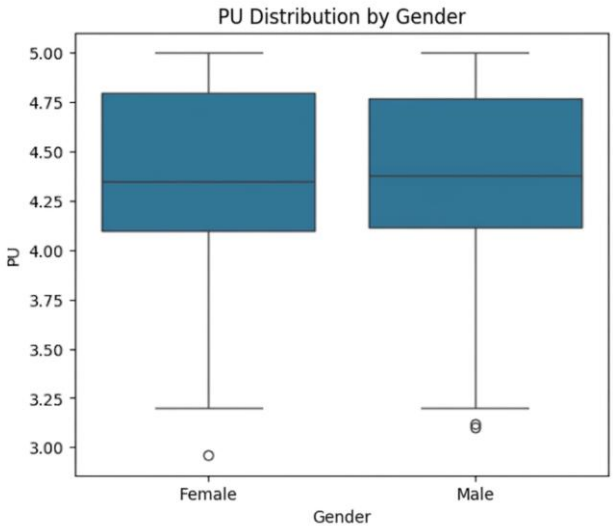
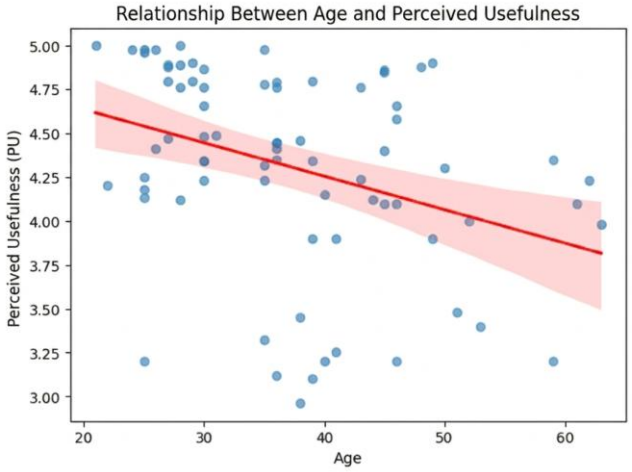


Figure 2. Perceived usefulness according to computer training status.

Figure 3. Relationship between age and perceived usefulness.



Discussion

In this study, the system developed for digital intraoperative hemodynamic data recording demonstrated a high level of acceptance among healthcare professionals. The high scores for perceived usefulness and perceived ease of use indicate that the system was regarded as both functional and user-friendly in clinical practice. These findings are consistent with recent literature highlighting the rapid adoption of digital tools in high-stakes clinical environments [9,10]. However, the unique nature of the intraoperative setting distinguishes these results from general electronic health record studies. Unlike standard ward documentation, the operating room requires rapid decision-making under substantial time pressure, particularly during critical phases such as induction and emergence from anesthesia. Automated recording systems directly address these high-workload moments by reducing the need for manual charting and allowing clinicians to maintain their focus on patient physiology rather than documentation [1,3].

One of the most important findings was the negative association between age and perceived usefulness. Although older clinicians did not appear to perceive the system as difficult to use, they rated its utility less favorably than younger participants. This finding suggests that technology acceptance among senior staff may be influenced by established clinical habits and long-standing reliance on traditional manual methods [6]. Therefore, digital transformation strategies in hospitals should not focus only on technical training but should also emphasize the specific clinical benefits and safety improvements of the system to bridge this generational gap in perceived utility.

Another key finding was the significant difference in perceived ease of use according to professional experience. This result suggests that familiarity gained through clinical practice, rather than formal computer training alone, may shape how intuitively a professional interacts with new medical software. While younger professionals may adapt quickly to digital interfaces, more experienced staff may evaluate ease of use through their deep understanding of clinical workflow. This interpretation is supported by the finding that formal computer training had no significant effect on acceptance, reinforcing the importance of user-centered design that reflects clinical reality rather than relying solely on prior technical instruction.

Contrary to the core assumptions of the TAM, perceived ease of use was not significantly associated with perceived usefulness [5]. This lack of correlation may be explained by a ceiling effect, as the high mean scores for both variables may have narrowed the variance and limited the ability to detect a statistical relationship. In addition, in specialized environments such as the operating room, the usefulness of a tool may be judged primarily by its immediate contribution to patient safety and data accuracy rather than by interface simplicity. For a clinician managing a complex case, a system's ability to prevent data loss and standardize records may outweigh the importance of its ease of operation.

The developed prototype offers potential clinical advantages, including reduced manual documentation errors and improved record standardization. By providing continuous data at 5-minute intervals, the system can generate a high-fidelity clinical record that may be difficult to achieve through manual entry [4]. However, the limited explanatory power of the regression model suggests that other external factors, such as organizational support, technical infrastructure, and the cognitive load of the environment, may also play important roles in technology adoption. Future research should incorporate these organizational variables to provide a more comprehensive understanding of digital transitions in anesthesia.

Limitations

This study has several limitations. First, the single-center design and relatively small sample size may limit the generalizability of the findings to different hospital settings or larger healthcare populations. Second, because data were collected through self-report measures, response bias cannot be entirely excluded; participants' perceptions may not fully reflect their actual clinical behavior. Third, the cross-sectional design precludes causal inference. In addition, the high mean scores for technology acceptance dimensions may have created a ceiling effect, potentially masking the statistical relationship between perceived ease of use and perceived usefulness. Finally, the model included only a limited number of demographic variables; other potential determinants, such as daily workload intensity, duration of technology exposure, and organizational support, were not evaluated. Future multicenter investigations with longitudinal follow-up and broader variable sets would strengthen the evidence base.

Conclusion

This study showed that a prototype for digital intraoperative hemodynamic data recording was well accepted by healthcare professionals. High perceived usefulness and perceived ease of use scores indicate that the system is practical and user-friendly in the operating room. Age negatively affected perceived usefulness, highlighting the need to consider generational differences in digital adoption. The lack of a relationship between perceived ease of use and perceived usefulness suggests that clinical value may depend more on functionality and safety than on simplicity alone. With appropriate infrastructure and organizational support, such systems can improve efficiency and patient safety.

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Case report
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Management of multiple facial leiomyomas with excision and cervicofacial flap reconstruction in a severe Hemophilia A patient: A case presentation

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Abstract

Cutaneous leiomyomas are rare, benign, smooth-muscle tumors that are particularly uncommon on the face. Surgical management of cutaneous leiomyomas in patients with severe Hemophilia A is challenging because of the substantial risk of bleeding, particularly when regional flap reconstruction is required. Here, we report the case of a 64-year-old male with severe Hemophilia A who presented with multiple painful cutaneous nodules in the right preauricular and submandibular region. MRI and biopsy confirmed multiple cutaneous leiomyomas of piloleiomyoma and angioleiomyoma types. A multidisciplinary team developed a perioperative recombinant factor VIII protocol to minimize bleeding risk. Surgical excision with a narrow 5 mm margin was performed, followed by cervicofacial flap reconstruction. The patient's intra- and immediate postoperative course was uneventful. Flap viability was maintained despite minor marginal ischemia, which resolved with conservative management. Factor VIII levels remained within therapeutic range throughout hospitalization, and histopathology confirmed the leiomyomas' benign status. Renal cancer screening was recommended because of the association with multiple leiomyomas. The patient achieved satisfactory aesthetic and functional recovery without bleeding complications. This case highlights that complex facial excision and flap reconstruction can be performed safely in patients with severe Hemophilia A using a tailored factor VIII replacement protocol and underscores the importance of multidisciplinary perioperative planning in such cases.

Keywords: hemophilia A, cervicofacial flap reconstruction, cutaneous leiomyoma, factor VIII replacement protocol, hemostasis

Introduction

Cutaneous leiomyomas are benign, smooth-muscle tumors that represent approximately 5% of all benign soft-tissue tumors [1]. Facial presentation is particularly rare, with fewer than 100 cases reported in the literature [2]. When these tumors occur in multiple locations, they may be associated with Reed's Syndrome (Multiple Cutaneous and Uterine Leiomyomatosis), which requires additional screening for renal cell carcinoma.

Severe Hemophilia A presents significant challenges for surgical intervention, with reported perioperative bleeding rates as high as 32% in major procedures [3].While factor replacement guidelines exist for orthopedic and abdominal surgeries, limited protocols are available for large facial excisions with a regional flap reconstruction [4]. This report addresses this gap and outlines a multidisciplinary approach to the successful management of multiple cutaneous leiomyomas of the face in a patient with severe Hemophilia A.

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Case presentation

Patient Information

A 64-year-old male with severe Hemophilia A presented with multiple painful nodular lesions localized to the right preauricular, submandibular, and upper cervical region. The patient reported pain exacerbated with cold exposure and aesthetic concerns. His past medical history included treated Hepatitis C and hypertension. There was no family history of similar lesions or syndromic features, and no preoperative genetic testing was performed for Reed's Syndrome or fumarate hydratase mutations.

Clinical Findings

Physical examination revealed multiple firm, tender, erythematous nodules over the right preauricular and submandibular area that extended posteriorly from the posterior mandibular angle to the anterior mandibular body, superiorly from the mid tragus to the hyoid bone (Figure 1). The largest lesion measured 2.5 cm in diameter.

Diagnostic Assessment

MRI revealed multiple cutaneous lesions in the submandibular and upper cervical region, isointense on T1-weighted imaging and mildly hyperintense on T2, with homogeneous contrast enhancement. No deep extension or pathological lymphadenopathy was observed. The imaging suggested a benign status; however, due to the multifocal nature and size of the lesions, malignancy could not be entirely excluded. Surgical biopsy was performed that revealed multiple cutaneous leiomyomas of piloleiomyoma and angioleiomyoma types.

Factor VIII Protocol

A comprehensive factor VIII protocol was implemented in collaboration with hematology. Immediately prior to incision, 3,000 units of recombinant factor VIII and 1 g of tranexamic acid were administered. Twelve hours postoperatively, 1,000 units of factor VIII were administered. On postoperative days 1–3, 2,000 units were administered each morning and 1,000 units were administered each evening, with factor VIII activity and aPTT measured on postoperative days 2 and 3. On postoperative days 4–7, 2,000 units were administered daily; on days 8, 10, 12 and 14, 3,000 units were administered each morning. Tranexamic acid was continued orally until day 10. No inhibitors were detected, and hemostasis was maintained without additional agents. Factor VIII activity remained between 21% and 36 % during the first postoperative week, which guided ongoing supplementation to ensure effective hemostasis.

Therapeutic Intervention

Under general anesthesia without muscle relaxants, a local excision with a narrow 5 mm margin was performed (Figure 2). The surgical specimen measured 10.5×8.0×0.5 cm. A cervicofacial flap reconstruction was performed with preservation of the external jugular vein and the greater auricular nerve (Figure 3). The flap was raised deep to the platysma (Figure 3) and was rotated and advanced to cover the defect. Closure was achieved using Vicryl 3-0 and 4-0 sutures for subcutaneous layers and Nylon 3-0 and 4-0 for the skin. A surgical drain was placed.

Pathological Findings

Histopathology revealed multiple cutaneous piloleiomyoma and angioleiomyoma types. The specimen contained multiple nodules, with the largest measuring 1.5 cm in diameter. A clinical workup for renal neoplasms was recommended due to the multiplicity of the lesions.

Figure 1. Preoperative clinical appearance showing multiple nodular lesions in the right preauricular and submandibular regions.

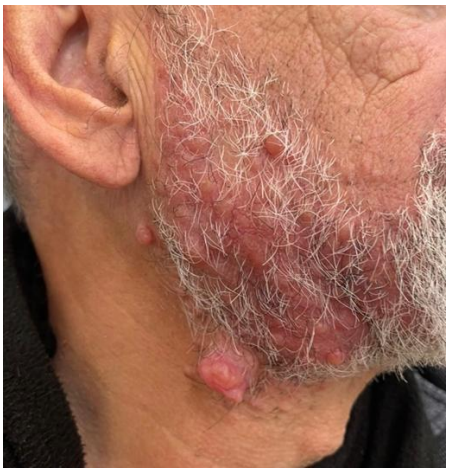

Figure 2. Intraoperative view of local excision of the cutaneous leiomyomas with narrow margins.

Figure 3. Elevation of the cervicofacial flap deep to the platysma for defect reconstruction.

Follow-up and Outcomes

The patient had an uncomplicated initial recovery. He remained afebrile with stable vital signs, and facial nerve function was preserved. On postoperative day 3, discoloration of the distal flap edge raised concern for marginal ischemia. The area was managed conservatively with daily flap stimulation and dressings. A small area of necrosis demarcated and was scheduled for outpatient debridement. The patient was treated with daily Vaseline dressings until granulation tissue epithelialized. The patient achieved satisfactory aesthetic and functional outcomes (Figure 4 and Figure 5), with resolution of temperature-related pain. No further complications were noted during follow-up.

Figure 4. Immediate postoperative result following cervicofacial flap inset and closure.

Figure 5. Healed postoperative outcome showing satisfactory aesthetic and functional results.

Discussion

This case demonstrates the feasibility of major head-and-neck reconstruction in cases of severe hemophilia when perioperative hemostasis is managed meticulously. The factor VIII protocol used here builds upon established recommendations but was tailored for head-and-neck surgery, where rich vascularity increases bleeding risk [5].

Importantly, the cervicofacial flap offered broad coverage, excellent color and texture match, and minimized the creation of new surgical planes, reducing potential bleeding surfaces. Alternative options such as submental or nasolabial flaps were considered but would have entailed additional donor-site morbidity and higher bleeding risk. To the best of our knowledge, the use of a cervicofacial flap in a patient with severe hemophilia has not been previously reported.

The coexistence of piloleiomyoma and angioleiomyoma components triggered consideration of Reed's Syndrome. However, this syndrome typically occurs in women with uterine leiomyomas. Because multiple cutaneous leiomyomas can indicate a hereditary tumor syndrome, renal-cell-carcinoma screening was recommended [2]. Overall, this successful outcome underscores the critical role of multidisciplinary planning, close hematologic collaboration, careful surgical technique, and vigilant postoperative monitoring in cases of cutaneous leiomyomas in patients with severe Hemophilia A.

Conclusion

This case demonstrates that complex facial reconstruction can be safely performed in severe hemophilia patients with appropriate perioperative planning. The detailed factor VIII protocol presented here may serve as a guide for similar cases. The use of a cervicofacial flap for reconstructive surgery in this context is a novel approach, highlighting the importance of interdisciplinary collaboration. This report underscores the need for future studies to develop guidelines for facial surgery in hemophilia patients.

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Congenital double lip: A report of two cases, one associated with Ascher's syndrome, highlighting clinical presentation and surgical management of a rare orofacial deformity

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Abstract

Double lip is an uncommon oral anomaly characterized by an additional fold of redundant mucosal tissue on the inner aspect of the lip, most frequently affecting the upper lip. It may present as an isolated finding or as part of Ascher's syndrome, which comprises the triad of double lip, blepharochalasis, and non-toxic thyroid enlargement. This condition primarily causes esthetic and functional concerns, affecting speech and smiling. Diagnosis is clinical, and surgical excision is the standard treatment to restore normal esthetics and function. This report describes two adult male patients with congenital double upper lip, their clinical presentation, and surgical management, which yielded excellent esthetic and functional results. The association of this condition with Ascher's syndrome is also presented and reviewed.

Keywords: double lip, Cupid's bow shape, Ascher's syndrome, transverse elliptical excision

Introduction

Double lip is one of the rarest forms of lip anomaly. It most commonly occurs in the upper lip [1], however, cases involving the lower lip or both lips have been reported. The anomaly is characterized by the presence of an excessive fold of areolar tissue and hypertrophy of the minor salivary glands without involvement of the surrounding muscles [2]. Double lip manifests as redundant tissues on either side of the midline, often asymmetrically, with one side being larger than the other [3]. The prevalence of double lip in the upper lip far exceeds that of the lower lip [4].

Double lip can be either congenital or acquired. The acquired form primarily arises from trauma or oral habits, such as lip sucking between a diastema or ill-fitting prosthetic restorations. The congenital variant typically develops during the first trimester of fetal growth. The upper lip mucosa is divided into an outer *pars glabrosa* and an inner *pars villosa*; between the second and third months of gestation, the *pars villosa* may hypertrophy due to the persistence of an exaggerated horizontal sulcus between the two layers, leading to its development [5].

The congenital type may also occur in association with a syndrome first described in 1920 by an ophthalmologist from Prague named Ascher [6]. The syndrome is characterized by recurrent edema of the upper eyelid and upper lip, resulting in blepharochalasis and double lip, with concurrent non-toxic goiter. This constitutes the classical (complete) Ascher syndrome. However, 10%-50% of cases do not present with non-toxic goiter (Incomplete Ascher's syndrome), and its absence does not preclude the diagnosis [7]. No definitive racial or gender-related predilection has been observed, but one study by Palma and Taub in 2009 showed a male predilection of 7:1 [8].

Surgical intervention remains the mainstay of treatment for double lip, with excision undertaken to improve esthetics and function. This case report aims to contribute to the limited literature on double lip by presenting its association with Ascher's syndrome, thereby enhancing awareness and guiding the management of this rare anomaly. Here, we discuss two patients with double lip managed by the author.

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Informed Consent
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Case presentation

Case 1

A 35-year-old male presented to the Dental department at Bugando Medical Center with a chief complaint of gradual upper lip enlargement over the past 15 years. The condition was first noticed at age 19 and had progressively enlarged. He reported an unpleasant appearance that caused embarrassment during speech, which was problematic as he is a high school teacher. The patient denied any history of trauma, parafunctional oral habits, or previous surgery on the upper lip. The patient reported no family history of a similar condition. His medical history was unremarkable.

On clinical examination, the patient had a visible double upper lip that was more accentuated when he smiled. A central constriction dividing the upper lip was observed, with more tissue prominence on the right side than the left. The excess tissue was less conspicuous when the patient's lips were at rest (Figure 1). The labial sulcus depth and frenal attachment were normal. The patient also had drooping upper eyelids with excess skin folds, giving him a "tired" appearance; this confirmed the presence of blepharochalasis (Figure 1A). Thorough clinical examination revealed no signs of thyroid enlargement. All routine bloodwork and thyroid function tests were normal. A clinical diagnosis of incomplete Ascher's syndrome was established. The patient was planned for lip reduction surgery under local anesthesia after obtaining informed consent.

Anesthesia was administered via deep bilateral local infiltration with 2% lignocaine. Subsequently, a transverse elliptical incision was made from one commissure to the other using a size 15 scalpel blade, crossing the midline of the frenulum (Figure 2). Blunt dissection was performed submucosally with scissors, sparing the orbicularis oris muscle and avoiding over-extension to ensure excellent post-operative lip competence and symmetry. The minor salivary glands in the surgical field were removed to prevent future mucoceles. Hemostasis was achieved, and the surgical defect was sutured in layers using interrupted Vicryl 3-0 sutures. The patient was prescribed analgesics and antibiotics for one week and provided with post-operative instructions. The patient was followed up after two weeks (Figure 3). There were no complications, healing was uneventful, and the patient was satisfied with the postoperative results.

Figure 1. Pre-operative clinical presentation of Case 1. (A) Note the blepharochalasis of both upper eyelids and the double upper lip at rest. (B) The double upper lip is more accentuated on the right side, with a central constriction.

Figure 2. Intra-operative view (Case 1) showing the transverse elliptical incision line extending from commissure to commissure.

Figure 3. Post-operative view (Case 1) at two-week follow-up, showing satisfactory esthetic outcome.

Case 2

A 29-year-old male presented to our facility with a chief complaint of "thick bulging tissues" under his upper lip, causing esthetic concern when speaking and smiling. According to the patient, the anomaly had been present since he was young and became more apparent as he aged, having progressively enlarged over time. Similar to the first case, the patient was systemically healthy with no prior history of trauma, oral habits, or surgery on the upper lip. There was no reported family history of the condition. The patient had neither blepharochalasis nor thyroid gland enlargement. A clinical diagnosis of congenital double upper lip was established (Figure 4A-B).

On clinical evaluation, he presented with an obvious double upper lip at rest and an inflated appearance when smiling. The double lip manifested as two soft folds of excess mucosal tissue on either side of the midline, featuring a central constriction that gave a characteristic "Cupid's bow" appearance (Figure 4A). The mucosal folds were soft and non-tender on palpation. The maxillary labial frenal attachment was positioned at the gingiva with a normal sulcus depth. The patient was scheduled for reduction cheiloplasty under local anesthesia.

A bilateral infraorbital nerve block with 2% lignocaine was performed, rather than local infiltration, to prevent tissue distortion during excision. Using a size 15 surgical blade, bilateral elliptical incisions were made around the excess labial tissues, with 2-mm extensions beyond the commissure on both sides, without involving the frenum. Blunt dissection followed, extending inferiorly to the submucosa so that a wedge-shaped block of tissue could be removed. The orbicularis oris muscle was preserved, and the accessory salivary glands were removed to prevent the development of mucoceles (Figure 5). Hemostasis was achieved through local compression, and the resulting defect was closed in layers using interrupted Vicryl 3-0 sutures. Post-operatively, the patient was prescribed oral analgesics and

antibiotics for one week, with reinforcement of post-operative and oral hygiene instructions. At the two-week post-operative follow-up (Figure 6), the surgical site was free of complications, and the patient's esthetic and functional concerns were satisfactorily achieved.

Figure 4. Pre-operative clinical presentation of Case 2. (A) Bilateral double upper lip with a characteristic "Cupid's bow" appearance at rest. (B) Symmetrical appearance with a central constriction.

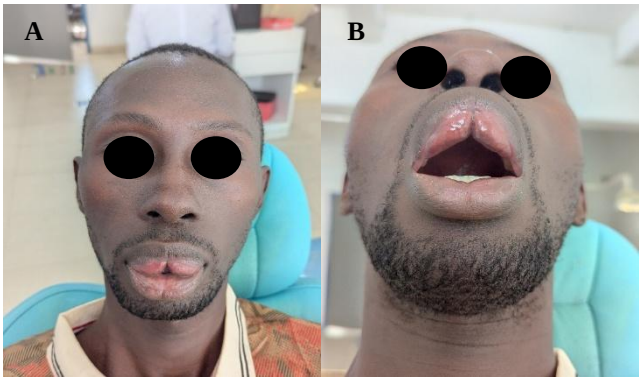
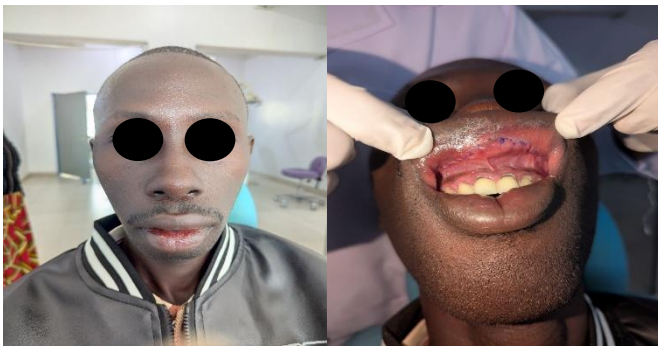


Figure 5. Intra-operative view (Case 2) showing the bilateral transverse elliptical excision, sparing the frenum. Note that the orbicularis oris muscle fibers are preserved.

Figure 6. Post-operative view (Case 2) at two-week follow-up, showing excellent esthetic results.



Discussion

Congenital double lip is a benign, non-inflammatory hypertrophy of the lip [9]. The exact etiology is not recognized, but studies propose it results from the persistence of the horizontal sulcus between the *pars glabrosa* and *pars villosa* [5]. Such enlargements are usually bilaterally symmetrical and typically take the form of a "Cupid's bow" when the upper lip is tensed [10]. The involvement of the upper lip far exceeds that of the lower lip, as seen in the two cases presented here. In both cases, there was no history of trauma or mentioned oral habits.

Although it is generally reported that the double lip is not noticeable when the patient's lip is at rest but becomes apparent when the lip is tensed (e.g., smiling), the deformity in both our reported cases was obvious even at rest. Differential diagnoses for double lip should encompass hemangioma, cheilitis glandularis, and angioedema. It is particularly important to rule out cheilitis glandularis, as it is associated with a higher risk of squamous cell carcinoma [4] and thus requires histopathological clarification. These differentials typically do not present with the central constriction seen in double lip [5], which is often a distinguishing clinical feature.

In very rare cases, congenital double lip has been associated with bifid uvula and cleft palate [11]. Although double lip is present at birth, it often becomes more obvious after the eruption of permanent teeth and can be exacerbated by oral habits, leading to its presentation during adulthood. This impacts self-esteem and provides the rationale for its correction [12]. It is possible that persistent, unrecognized oral habits aggravated the condition in our patients. Double lip has been reported by various authors to have a male predilection; this is consistent with our case report, in which both patients were male.

Congenital double lip can present as part of Ascher's syndrome, characterized by the additional presentation of blepharochalasis and non-toxic thyroid enlargement [13]. The syndrome often does not involve all three presentations and may be termed incomplete Ascher's syndrome. Thyroid enlargement is present in only 10%-50% of cases and is seldom involved [14], as was true in this article where the patients' thyroids were normal. In addition, blepharochalasis has been reported to present in 80% of cases. It usually manifests during puberty but is often not of as much cosmetic concern to the patient as the double lip [15], which is consistent with our first case. This condition can mimic other conditions, such as Melkersson-Rosenthal syndrome and Mounier-Kuhn syndrome [16].

Ascher's syndrome is frequently undiagnosed because of its rarity. In most cases, a dental surgeon or an ophthalmologist is the first to diagnose it [17]; this could be due to the patient's chief complaints relating to the head and neck region. Initial management with Dapsone 50 mg daily has been documented in an attempt to slow the syndrome's progression [18]; however, the mainstay of treatment is surgical correction for esthetic reasons.

Several surgical methods have been described for the correction of double upper lip, including W-plasty, electrosurgical removal, and triangular excision [19]; however, the most commonly recommended technique is transverse elliptical excision due to its ease of implementation and excellent post-operative results. In cases where significant tissue excision is required, a W-plasty can be performed for better anatomical results [20]. In both our cases, a transverse elliptical excision was carried out, as primary closure of the defect was feasible and yielded satisfactory results. This aligns with suggestions by most authors, where the mucosal and submucosal parts of the redundant tissue are excised while sparing the orbicularis oris muscle to prevent functional loss and allow primary closure [21].

Conclusion

Dental surgeons are often the first to diagnose congenital double lip. Their expertise allows them to identify related syndromic features, such as in Ascher's syndrome, which may not be the patient's primary complaint, facilitating a multidisciplinary management approach. Although congenital double lip is rare, diligent follow-up remains essential, particularly in suspected

Ascher syndrome cases, to ensure optimal outcomes. Further research on syndromes related to double upper lip is needed for better clinical judgment in distinguishing these closely related conditions, thereby tailoring management for patients based on an accurate diagnosis.

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Case report
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Laparoscopic management of a rare case of a giant ovarian mucinous cystadenoma occupying the entire abdominopelvic cavity: A case report

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Abstract

Ovarian mucinous cystadenoma represents 15-20% of all ovarian epithelial tumors. They have good prognoses. In developed countries, giant ovarian mucinous cystadenoma is rarely reported due to the availability of advanced imaging technologies that enable early diagnosis and treatment. Late medical consultation and limited resources in African countries lead to late diagnosis of giant ovarian cysts. Only a few cases of laparoscopic management of massive ovarian cysts have been reported in the medical literature. We present the case of a 64-year-old black African patient with intestinal transit disorders who complained of progressive abdominal distension for 2 years. An enhanced abdominopelvic computed tomography scan revealed a giant ovarian cyst occupying the entire abdominopelvic cavity, which was approximately 55 cm wide. Laparoscopic right salpingo-oophorectomy was performed after the cyst was aspirated without spilling its contents into the peritoneal cavity. The patient's postoperative recovery was uneventful, and she was discharged on postoperative day 2.

Keywords: giant ovarian cyst, mucinous cystadenoma, laparoscopic salpingo-oophorectomy

Introduction

Ovarian cysts are a frequent cause of gynecologic consultations worldwide and affect women of all ages. Ovarian mucinous cystadenoma is a multilocular cyst of the ovary that arises from its epithelial surface [1]. They can become huge, occupy the entire abdominopelvic cavity, and cause progressive abdominal distension with nausea or vomiting, abdominal discomfort, or abdominal pain. Giant or huge ovarian cysts are not well defined in medical literature. However, some authors have defined ovarian cysts that are more than 10 cm in diameter as large ovarian cysts, and others have defined giant ovarian cysts as those that reach above the umbilicus as measured by computed tomography (CT) scan [2]. Currently, in high-income countries, they are usually diagnosed and treated early, at small or medium-sized stages. Mucinous ovarian tumors represent approximately 80% of all ovarian mucinous tumors, 10% are borderline, and 10% are malignant. Mucinous ovarian tumors are rare before puberty and after menopause [3]. The most dreaded complication of ovarian mucinous cystadenoma is rupture leading to pseudomyxoma peritonei. The surgical management of giant ovarian mucinous cystadenoma typically requires midline laparotomy to reduce the risk of cell spillage in malignant tumors [4]. Others have described the laparoscopic management of giant ovarian cysts occupying the entire abdominal cavity using different surgical techniques to limit the possible intraabdominal spillage of cyst content. The benefits of this laparoscopy procedure include reduced postoperative analgesic requirements, earlier mobilization, cosmetic advantages, and an earlier return to normal activity [5]. We report the case of a 64-year-old black African female patient who was admitted with a massive ovarian mucinous cystadenoma that was 55 cm in diameter, occupying the entire abdominopelvic cavity, and managed laparoscopically.

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Informed Consent
The authors stated that the written consent was obtained from the patient presented with images in the study.

Conflict of Interest
No conflict of interest was declared by the authors.

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Case presentation

A 64-year-old multiparous black African female patient, gravida 7, parturition 6, with no medical or surgical history, presented to the surgical department of our hospital with a 2-year progressive abdominal distension. The patient also complained of constipation, nausea, postprandial vomiting, abdominal discomfort, and some vague abdominal pain. A general examination revealed a normal blood pressure of 120/70 mmHg, a heart rate of 68 beats/min, a respiratory rate of 18 breaths/min, and a temperature of 37 °C. Abdominal examination revealed a grossly distended and tense abdomen arising from the pelvis up to the epigastrium without generalized abdominal tenderness or shifting dullness (Figure 1). The remainder of the physical examination was unremarkable. A blood test was performed, and the hemoglobin rate was normal at 11.3 g/dl, the platelet count was 334,000 U/mm3, the WBC count was 8,000 U/mm3, the correct prothrombin level was 72%, and the CRP level was 18 mg/l. Tumor markers, including serum cancer antigen (CA) 125, carcinoembryonic antigen (CEA), cancer antigen 19.9 (CA19.9), and human epididymal protein 4 (HE4), were performed, showing normal results. The risk of malignancy algorithm (ROMA) value was 2.7. An enhanced computed tomography scan revealed a massive intraabdominal multilocular cystic mass occupying the entire abdominal cavity from the epigastrium to the pouch of Douglas and measuring approximately 55×42×34 cm. The surrounding fat planes appeared to be clean, with no evidence of ascites or lymphadenopathy (Figure 2). A diagnosis of a giant ovarian cyst was made. The patient was admitted to the operating room. The surgical procedure was performed in the supine position under general anesthesia. An open entry laparoscopy was performed 5 cm above the umbilicus to access the abdominal cavity and expose the cyst wall (Figure 3-A). A purse-string suture with a nonabsorbable suture was placed on the puncture site, and the cyst was punctured and aspirated (Figure 3-B). A total of 7100 ml of thick yellowish liquid was successfully aspirated. The purse-string suture was tightly closed. A 10-mm trocar was introduced into the open laparoscopy, and routine CO2 insufflation was performed. Three additional 5-mm ports were inserted into the right and left flanks and the suprapubic midline area. Laparoscopic exploration revealed a huge cystic mass arising from the right ovary (Figure 3-D). The left ovary and uterus were normal. No ascites, peritoneal implants, or liver nodules were observed. A right salpingo-oophorectomy was performed using a bipolar grasper and laparoscopic scissor (Figure 3-D). The laparoscopic procedure proceeded uneventfully (Figure 3-A). The surgical specimen was extracted via open laparoscopy (Figure 4). No spillage or cyst perforation. The pelvic peritoneal fluid was sent for cytology. Histopathological examination of the surgical specimen revealed a mucinous cystadenoma of the ovary (Figure 5), and cytological examination of the pelvic peritoneal fluid revealed no neoplastic cells. The patient made an uneventful postoperative recovery with minimal oral analgesic use and was discharged on postoperative day 2.

Figure 1: Image showing the much distended abdomen of the patient, image taken on the operating table

Figure 2: Abdominal CT scan showing a massive multilocular ovarian cyst occupying the entire abdominopelvic cavity. A: axial slice; B: sagital slice

Figure 3: Figure summarizing the surgical procedure. A: open laparoscopy and exposure of the cyst wall, B: performance of a purse-string suture and puncture and aspiration of the contents of the cyst, C: Intraoperative view of the right ovary containing the completely collapsed cyst, D: salpingo-oophorectomy surgical specimen

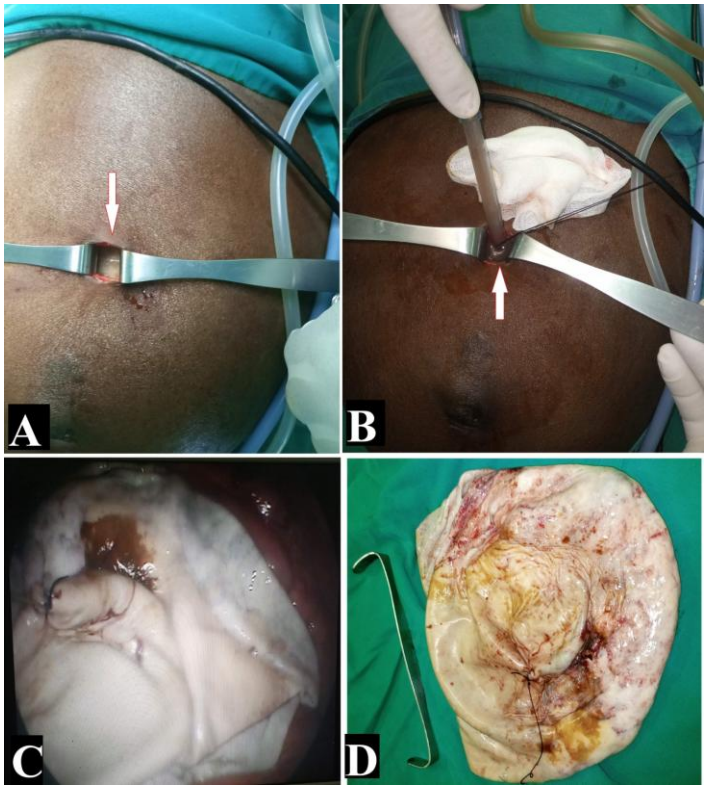
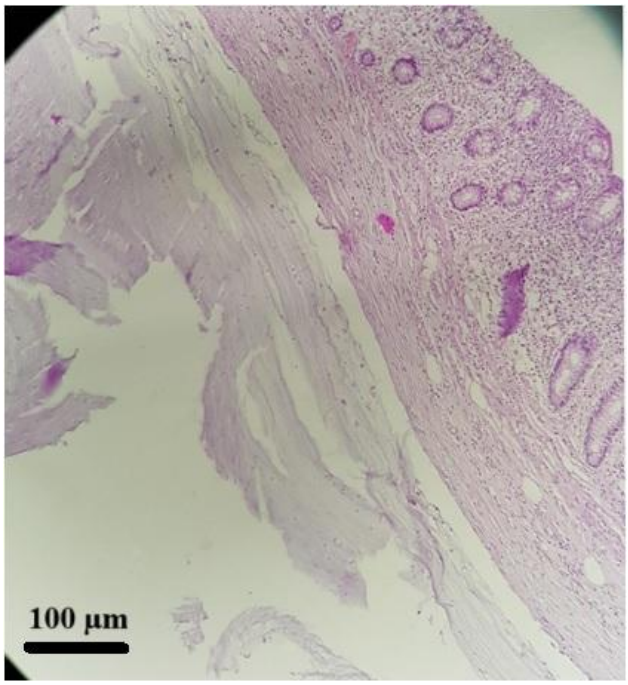


Figure 4: Immediate postoperative view of the patient's abdomen. A: Left side view, B: Front view, Black arrow: Open laparoscopy used for salpingo-oophorectomy, surgical specimen extraction

Figure 5: Microscopic image of the ovarian cyst showing a cyst wall lined by mucinous pseudostratified epithelium, with the presence of mucin within the cyst wall (hematoxylin and eosin [H&E] stain, original magnification ×200. Scale bar = 100 µm).



Discussion

Mucinous cystadenoma accounts for approximately 80% of all mucinous tumors. Similar to our patient, benign mucinous cystadenomas can increase in size and become massive. However, giant ovarian cystadenoma of this size is rare. They usually occur as large, multiloculated masses containing mucus fluid, generally affecting women of reproductive age (aged 20–40 years) [6]. Currently, laparoscopic surgery is considered the gold standard for the management of small and moderate-sized ovarian cysts. Only a few authors have reported the laparoscopic management of giant benign mucinous cystadenoma of the ovary, and this represents a major improvement in this field. Many authors have considered laparoscopic management in this situation to be technically inappropriate because of the size of the cyst and to avoid any spillage of the cyst content in the peritoneal cavity [7]. They chose midline laparotomy as the standard surgical route for large ovarian cyst excision. However, minimally invasive surgery has many advantages, such as better magnification, reduced operative morbidity, reduced invasiveness, reduced hospitalization time, and reduced postoperative pain. In addition, giant ovarian cysts are commonly serous or mucinous. Therefore, some surgeons recommend laparoscopic management of huge ovarian cysts to provide patients with the benefits of laparoscopy. The selection of appropriate patients to minimize the risk of draining malignant masses is mandatory. Currently, the evidence of laparoscopic management of huge ovarian cysts is increasing. Laparoscopic surgery expertize is the only thing needed by the surgeon. However, only a few case series and case reports are available in the medical literature [5]. Dubuisson et al. reported a case of six patients with laparoscopically managed huge ovarian cysts. The Alexis laparoscopic system was used for the minimally invasive surgical extraction of large ovarian cysts. The median size of the cysts at imaging was 22.8 cm (range, 15–30 cm), whereas the median volume was 5.9 L (range, 1.9–15.6 L). The mean age of the operated women was 59 years (range, 21–88 years). The size of the skin incision initially performed to puncture the cyst ranged

from 2.5 to 4 cm. On final pathological reports, two cysts were mucinous cystadenoma and four were serous cystadenoma [8]. In a case report of a huge ovarian cyst, Rabbani et al. used a Veres needle to aspirate and drain the contents of the cyst and perform a cystectomy [9]. Alobaid et al. described a case series of 5 patients with huge ovarian cysts successfully managed by laparoscopy. An open-entry laparoscopic technique was used to avoid puncturing cysts before evaluating the intraoperative cyst. They proceeded to laparoscopic oophorectomy or cystectomy in the usual manner. The cyst was then removed using a suprapubic trocar after the incision was extended to 1.5 cm [10].

Conclusion

In low-income countries, socioeconomic factors are the main cause of late medical consultation, and diagnosis is made in the advanced stage of the disease. Nevertheless, laparoscopic management is possible and should be encouraged in the context of limited resources and should be encouraged. We hope that this case report will increase the use of laparoscopic techniques in the management of large ovarian cysts in low-income countries.

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