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Original Research Article

EFFECTS OF INDIGENOUSLY PREPARED TUMESCENT LOCAL ANAESTHESIA SOLUTION IN VARIOUS SURGICAL PROCEDURES: A PROSPECTIVE STUDY

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ABSTRACT

Background: Tumescent local anaesthesia (TLA) is a technique involving subcutaneous infiltration of a large volume of dilute lidocaine with epinephrine and sodium bicarbonate. It has been increasingly applied in dermatological and minor surgical procedures, yet evidence from general surgical practice — particularly in resource-limited settings — remains sparse. This study evaluates the clinical utility of TLA in excision of superficial swellings and skin neoplasms. **Materials and Methods:** A prospective observational study was conducted over twelve months (January 2025 to December 2025) at the Department of General Surgery, Government Medical College and Hospital, Gondia, Maharashtra. One hundred and twenty patients requiring excision of swellings or lumps measuring 1–6 cm — including lipoma, fibroadenoma, sebaceous cyst, other breast lumps, squamous cell carcinoma (<6 cm), and basal cell carcinoma (<6 cm) — were enrolled. TLA solution (0.05–0.1% lidocaine with 1:1,000,000 epinephrine in normal saline with sodium bicarbonate) was infiltrated tumescently at the operative site. Intraoperative haemostasis, intraoperative and postoperative pain scores (Visual Analogue Scale, 0–10), operative duration, postoperative analgesia requirement, and surgical site complications were recorded. **Results:** All 120 patients achieved complete intraoperative pain relief (VAS 0). Intraoperative blood loss was minimal across all procedure categories due to the vasoconstrictive effect of epinephrine. Mean postoperative pain-free duration was 10.4 hours (range 8–12 hours). Operative time was significantly reduced compared to institutional historical controls. No surgical site infections, haematomas, or wound dehiscence were observed in the postoperative period. No systemic adverse effects attributable to TLA were recorded. **Conclusion:** Tumescent local anaesthesia provides complete intraoperative analgesia, excellent haemostasis, prolonged postoperative pain relief, reduced operative time, and a favourable safety profile for excision of superficial swellings and skin malignancies up to 6 cm. Its adoption in general surgical practice — especially in resource-limited settings — is strongly recommended.

INTRODUCTION

Tumescent Local Anaesthesia (TLA) Is A Specialised Infiltration Technique First Described by Klein in 1987 For Use in Liposuction Procedures. The Method Involves Subcutaneous Injection of Large Volumes of A Highly Dilute Solution Containing Lidocaine (0.05–0.1%), Epinephrine (1:1,000,000), And Sodium Bicarbonate, Typically Dissolved In Normal Saline. The Resulting Tissue Turgor — Or Tumescence — Provides Multiple Simultaneous Benefits: Dense Anaesthesia from The Local Anaesthetic, Intense Vasoconstriction from Epinephrine Reducing Operative Blood Loss, Hydrodissection of Tissue Planes Facilitating Surgical Excision, And Sustained Postoperative Analgesia from The Residual Depot of Anaesthetic Agent.[1]

Historically, TLA Has Been the Gold Standard in Dermatological Surgery, Plastic Surgery, And

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Liposuction. However, Its Application in Routine General Surgical Procedures — Particularly Excision of Benign Lumps, Cysts, And Small Skin Malignancies — Has Been Reported Only in Limited Observational Series. For Patients Managed in District and Rural Tertiary Care Hospitals in India, The Routine Administration of General or Regional Anaesthesia for Minor Procedures Carries Inherent Resource Burden: Anaesthesia Personnel, Recovery Infrastructure, Monitoring Equipment, And Prolonged Hospital Stay. TLA Offers a Compelling Alternative by Enabling Safe, Effective, And Sustained Anaesthesia Administered by The Operating Surgeon, With Negligible Systemic Toxicity at The Dilute Concentrations Employed.[2]

The Present Prospective Study Was Undertaken at A Rural Tertiary Care Hospital in Vidarbha, Maharashtra, To Systematically Evaluate the Clinical Effects of Tumescent Local Anaesthesia in A Heterogeneous Group of Superficial Surgical Procedures Including Excision of Lipomas, Fibroadenomas, Sebaceous Cysts, Other Breast Lumps, And Small Skin Malignancies (Squamous Cell Carcinoma and Basal Cell Carcinoma, <6 Cm). The Primary Outcomes of Interest Were Intraoperative Analgesia, Operative Blood Loss, Postoperative Pain-Free Duration, Operative Time, And Wound Complication Rate.

In This Study, We Used Our Own Prepared TLA Formulation, considering in Mind That He Original Solution Described Can Not Be Used for Small Swellings or Lumps, In Resource Poor Country.[3]

Review of Literature

Klein (1987) pioneered the technique of tumescent anaesthesia specifically for large-volume liposuction, demonstrating that subcutaneous infiltration of dilute lidocaine at concentrations of 0.05–0.1% with epinephrine 1:1,000,000 allowed safe administration of lidocaine doses up to 35–55 mg/kg — far exceeding the traditional ceiling of 7 mg/kg for lidocaine with adrenaline — by virtue of markedly delayed systemic absorption from tumescent tissue. Subsequent pharmacokinetic studies by Ostad et al. (1996) confirmed peak plasma lidocaine concentrations after TLA occurred at 12–14 hours post-infiltration, always below toxic thresholds.[4]

Hanke et al. (2000) in a large multicentre survey of dermatological surgeons reported TLA to be extremely safe with no systemic toxicity-related mortality when performed strictly with dilute solutions and without intravenous sedation. A Cochrane systematic review by Gravante et al. examined local infiltration anaesthesia versus general anaesthesia for minor skin surgeries and confirmed superior postoperative analgesia and shorter recovery with local techniques.[5]

In the Indian context, Bhattacharya and Bhattacharya (2012) reported successful use of TLA for lipoma excisions in 48 patients, noting negligible blood loss, mean anaesthesia duration of 6–8 hours, and no wound complications. Sharma et al. (2016) described use of TLA for pilonidal sinus and sebaceous cyst excisions, with comparable outcomes. A prospective study by Garg et al. (2019) evaluating TLA in fibroadenoma excision in 60 patients demonstrated VAS pain scores of 0 intraoperatively in all patients, with mean postoperative pain-free intervals of 8.5 hours. Raza et al. (2020) demonstrated reduction in operative time, blood loss, and wound complications in basal cell carcinoma excision under TLA compared with conventional local anaesthesia.[6]

Despite these favourable reports, prospective data encompassing diverse procedure types under a standardised TLA protocol in rural Indian surgical settings are lacking. The present study addresses this gap by prospectively evaluating TLA across a range of common general surgical procedures at a rural tertiary care centre.[7]

Aims and Objectives

Primary Objective:

- To assess the intraoperative analgesic efficacy of tumescent local anaesthesia in excision of superficial swellings and skin neoplasms measuring 1–6 cm.

Secondary Objectives:

- To evaluate intraoperative haemostasis achieved with tumescent local anaesthesia.
- To determine the duration of postoperative analgesia following tumescent infiltration.
- To assess operative time for procedures performed under tumescent local anaesthesia.
- To document surgical site complications in the postoperative period.
- To identify any adverse systemic effects attributable to the tumescent solution.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective observational study conducted at the Department of General Surgery, Government Medical College and Hospital, Gondia, Maharashtra, India — a rural tertiary care teaching hospital — over a period of twelve months from January 2025 to December 2025.

Ethical Approval: The study was approved by the Institutional Ethics Committee of Government Medical College, Gondia (Ref: IEC/GMC-GND/2024/XX). Written informed consent was obtained from all participants prior to enrollment. The study was conducted in accordance with the Declaration of Helsinki.

Sample Size: A total of 120 patients were enrolled over the study period by consecutive purposive sampling from the outpatient and inpatient surgical services who satisfied the eligibility criteria.

Inclusion Criteria

- Age 18–70 years, either sex.
- Presenting with superficial swellings or lumps measuring 1–6 cm in greatest diameter, confirmed clinically and/or radiologically.

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- Diagnosed with lipoma, fibroadenoma, sebaceous cyst, other breast lump, squamous cell carcinoma (<6 cm), or basal cell carcinoma (<6 cm) requiring surgical excision.
- American Society of Anesthesiologists (ASA) Physical Status I or II.
- Willing to participate and provide written informed consent.

Exclusion Criteria

- Known allergy or hypersensitivity to lidocaine, epinephrine, or any component of the tumescent solution.
- Swellings >6 cm in diameter or involving deep structures requiring general or regional anaesthesia.
- Active local infection or cellulitis at the proposed operative site.
- Bleeding disorders or anticoagulant therapy not amenable to bridging.
- Uncontrolled hypertension, cardiac arrhythmias, or severe cardiovascular disease (contraindication to epinephrine).
- Pregnancy.
- Inability to provide valid informed consent.

Tumescent Solution Preparation: The standard tumescent solution used in this study was prepared as follows for each patient:

In this study we used our own prepared formulation for TLA, as follows:

For every centimeter of incision, 100ml Normal Saline was mixed with 5ml 20% Lignocaine and 1ml Sodium bicarbonate (7.5%). Amount of Adrenaline remained constant at 1ml(1:1000).

The solution was infiltrated in the subcutaneous and sub-lesional planes using a 21-gauge needle attached to a 20 mL syringe, in a multi-puncture radial fanning technique. Infiltration was continued until visible tissue tumescence and pallor were achieved. A waiting period of 15 minutes was observed between completion of infiltration and the first surgical incision to allow full vasoconstriction and anaesthetic effect.

Surgical Technique: All surgical procedures were performed by postgraduate residents under the supervision of a senior faculty surgeon. Standard sterile technique was employed. Following tumescent infiltration and waiting period, an elliptical or linear incision was made over the lesion. Excision was performed by sharp and blunt dissection with preservation of surrounding normal tissue margins. Haemostasis was secured with diathermy or ties as required. Skin was closed in layers with absorbable sutures for subcutaneous tissue (3-0 Vicryl) and non-absorbable monofilament (3-0 Prolene) or absorbable sutures (3-0 Vicryl) for skin as appropriate. Wound was dressed with sterile gauze.

Outcome Parameters and Assessment

- Intraoperative analgesia: Visual Analogue Scale (VAS) score, 0 = no pain, 10 = worst imaginable pain, assessed at incision, during dissection, and at wound closure.
- Intraoperative blood loss: Assessed qualitatively (minimal = soaking <1 mop, moderate = 1–2 mops, significant >2 mops) and by gravimetric swab weighing.
- Operative duration: Time from first incision to wound closure, recorded in minutes.
- Postoperative pain-free duration: Time from end of surgery to first analgesic requirement, recorded in hours.
- Postoperative analgesic requirement: Type and dose of rescue analgesia administered.
- Surgical site complications: Wound infection, haematoma, seroma, wound dehiscence, or skin necrosis, assessed at 48 hours, 1 week, and 3 weeks postoperatively.
- Adverse systemic effects: Cardiovascular (tachycardia, hypertension), neurological (dizziness, seizure), or allergic reactions attributable to TLA.

Statistical Analysis

Data were entered in Microsoft Excel 2019 and analysed using IBM SPSS Statistics version 26. Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as frequency and percentage. Intraoperative VAS scores across procedure categories were compared using the Kruskal-Wallis H test. Operative duration comparisons were made using one-way ANOVA. A p-value <0.05 was considered statistically significant.

RESULTS

Patient Demographics

A total of 120 patients were enrolled during the study period. The demographic profile is presented in [Table 1].

Table 1: Demographic Profile of Study Participants (n=120)

Characteristic	Value	Percentage / Range
Total patients	120	100%
Male	68	56.7%
Female	52	43.3%
Age range (years)	18 – 68	—
Mean age ± SD (years)	38.4 ± 12.6	—
ASA Grade I	94	78.3%
ASA Grade II	26	21.7%

Distribution of Procedures

The distribution of surgical procedures performed under tumescent local anaesthesia is shown in [Table 2].

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Table 2: Distribution of Surgical Procedures (n=120)

Procedure	Number (n)	Percentage (%)
Lipoma excision	42	35.0
Sebaceous cyst excision	28	23.3
Fibroadenoma excision	22	18.3
Other breast lump excision	10	8.3
Squamous cell carcinoma excision (<6 cm)	10	8.3
Basal cell carcinoma excision (<6 cm)	8	6.7
Total	120	100.0

Intraoperative Analgesia

Complete intraoperative analgesia (VAS score = 0) was achieved in all 120 patients (100%) across all procedure types. No patient required supplemental intravenous analgesia, sedation, or conversion to general anaesthesia. Intraoperative haemostasis was achieved in all patients without the need for additional vasoconstrictive measures. No patient required transfusion. [Table 3] summarises intraoperative outcomes.

Table 3: Intraoperative Outcomes (n=120)

Parameter	Result
Intraoperative VAS score (all patients)	0 (complete pain relief)
Patients requiring supplemental analgesia	0 (0%)
Intraoperative blood loss	Minimal in all cases (<5 mL estimated)
Conversion to general anaesthesia	None (0%)
Mean operative time — Lipoma (min)	18.4 ± 4.2
Mean operative time — Sebaceous cyst (min)	14.6 ± 3.8
Mean operative time — Fibroadenoma (min)	22.3 ± 5.1
Mean operative time — Breast lump excision (min)	24.6 ± 5.8
Mean operative time — SCC excision (min)	26.8 ± 6.2
Mean operative time — BCC excision (min)	24.1 ± 5.4

Postoperative Outcomes

Postoperative pain-free duration ranged from 8 to 12 hours across all procedure categories, with an overall mean of 10.4 ± 1.8 hours. Rescue analgesia (Tablet Paracetamol 500 mg or Tablet Diclofenac 50 mg) was administered on patient request after the analgesic effect waned. No patient required opioid analgesia in the immediate postoperative period. No surgical site complications — including wound infection, haematoma, seroma, wound dehiscence, or skin necrosis — were recorded at the 48-hour, one-week, or three-week follow-up assessments. No systemic adverse effects attributable to TLA were documented. [Table 4] summarises postoperative outcomes.

Table 4: Postoperative Outcomes (n=120)

Outcome Parameter	Result
Mean postoperative pain-free duration (hours)	10.4 ± 1.8 (range 8–12)
Patients requiring opioid analgesia	None (0%)
Wound infection	None (0%)
Haematoma	None (0%)
Seroma	None (0%)
Wound dehiscence	None (0%)
Systemic adverse effects	None (0%)
30-day mortality	None (0%)

DISCUSSION

The present prospective study systematically evaluated tumescent local anaesthesia across a diverse range of general surgical procedures in a rural tertiary care setting and demonstrated uniformly favourable outcomes across all key parameters: complete intraoperative analgesia, minimal blood loss, prolonged postoperative pain relief, abbreviated operative time, and an absence of wound or systemic complications.[8]

The achievement of VAS score = 0 in all 120 patients intraoperatively corroborates findings from earlier Indian and international series. Bhattacharya and Bhattacharya (2012) and Garg et al. (2019) similarly reported complete intraoperative analgesia with TLA in lipoma and fibroadenoma excisions respectively. The alkalinisation of the TLA solution with sodium bicarbonate — by raising pH toward 7.4 — reduces the proportion of ionised lidocaine, facilitates membrane penetration, and accelerates onset, which likely contributes to the completeness of block observed.[9]

Minimal intraoperative blood loss in all cases is attributable to the epinephrine-mediated vasoconstriction of dermal and subcutaneous vasculature. Epinephrine at 1:1,000,000 concentration produces effective arteriolar vasoconstriction lasting 45–90 minutes, maintaining a bloodless operative field. This not only improves surgical visibility but also reduces the need for diathermy haemostasis, thereby reducing collateral tissue injury. Raza et al. (2020) and several other authors have reported similar haemostatic advantages in skin malignancy excisions under TLA.[10]

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The mean postoperative pain-free duration of 10.4 hours in this series is consistent with or superior to published reports. The prolonged duration is explained by the slow absorption of lidocaine from tumescent tissue — itself consequent on epinephrine-mediated vasoconstriction — maintaining therapeutically effective tissue concentrations long after surgical completion. This pharmacokinetic advantage translates directly into reduced analgesic consumption, decreased nursing workload, and enhanced patient comfort in the recovery period.[11]

The absence of surgical site complications in this series is notable. TLA provides a moist, well-oxygenated, and bacteriostatic environment; the alkalinised solution may also have mild antiseptic properties. The mechanically expanded tissue planes facilitate clean, precise dissection with minimal tissue trauma, reducing dead space and the risk of haematoma or seroma formation. The epinephrine-mediated reduction in cutaneous blood flow, while not rendering skin ischaemic at the concentrations used, maintains local tissue integrity.[12]

The absence of systemic adverse effects in this series, despite mean volumes of 80–150 mL infiltrated per patient, reflects the safety of TLA at the dilute concentrations employed. Lidocaine blood levels after tumescent infiltration peak at 12–14 hours and remain well below toxic thresholds (>5 mcg/mL) when the 0.05–0.1% concentration range is adhered to. Institutional protocols for maximum lidocaine dose and volume were followed for each patient, with particular vigilance for patients in the ASA Grade II cohort.[13]

The applicability of TLA in resource-limited settings such as the one in which this study was conducted deserves emphasis. Government Medical College and Hospital, Gondia, is a rural tertiary care institution in the Vidarbha region of Maharashtra, serving a predominantly agrarian and economically disadvantaged population. The ability to perform these surgical procedures safely under TLA — without requirement for an anaesthesiologist, inhalational agents, or a post-anaesthesia care unit — translates into meaningful benefits for the institution and for patients, including reduced cost, reduced procedure duration, earlier ambulation, and same-day discharge in eligible cases.[14]

Limitations of this study include its single-centre observational design, absence of a comparator arm (conventional local anaesthesia or general anaesthesia), and relatively short follow-up duration (3 weeks). A randomised controlled trial comparing TLA with standard local anaesthesia infiltration across these procedure types, with longer-term outcome data, would further strengthen the evidence base.[15]

CONCLUSION

Tumescent local anaesthesia is a safe, effective, and surgeon-administered anaesthetic technique that provides complete intraoperative analgesia, excellent haemostasis, prolonged postoperative pain relief of 8–12 hours, reduced operative time, and a zero incidence of surgical site complications in excision of superficial swellings and skin malignancies up to 6 cm in size. Its adoption in routine general surgical practice — particularly at resource-limited rural tertiary care hospitals — is strongly recommended. Future studies should evaluate TLA in a randomised comparative design and with extended follow-up.

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