# Minimizing the Hurdle of Pain During Administration of Local Anesthesia Using Bupivacaine in Large Operative Field

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## Abstract

**Objective:** To study use of our technique and anesthetic solution in minimizing the discomfort and pain of administration of anesthetic solution without complications.

**Material and Methods:** This study was conducted in Prime Care Hospital from June 2022- June 2023. In this case series, we present 100 cases who underwent minor plastic surgery and general surgical procedures using our anesthetic ZA solution containing 0.5% bupivacaine (20 cc) , 1 % xylocaine (20cc) , NAHCO3 (3 cc) and epinephrine (1 cc) diluted in 250 cc Normal Saline. We injected solution in the sub-cutaneous plane with four quadrant fan shape technique via spinal needle (26G). We noted the information acquire from the patients on questionnaire form about the pain score during administration of solution along with validation from the patient for continuation of this technique on other patients along with length of analgesia.

**Results:** Among 100 patients, 65 were males and 35 were females. Our minimum calculated pain score during administration was 1 maximum was 5, mean was 3, per operatively was 0 , post operatively was 0,remained 0 upto 8 hours after operation. Our calculated duration of action was 9 hours and maximum duration was 14 hours after which patient was given oral pain killers. It is further noted that the pain tolerance was more in age group 25-35 years and less among age group 15-25 years patients. Acceptability of procedure was 87%. No complications were noted throughout the procedure.

**Conclusion:** Our anesthetic solution is cost effective, patient friendly , provides long duration of anesthesia with minimizing need of multiple pricks and re-adminstration. Hence, reducing pain experience along with validation from the patient . it requires minimum experience , equipment with high success rate.


**Keywords:** pain during multiple pricks, minor surgeries, Xylocaine, Bupivacaine, NAHCO3, Adrenalin

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## Introduction

Surgery has entered in the new era after the invention of local anesthesia .Since then, medical professionals, researchers have long been engaged in efforts to invent new anesthetic drugs or to increase the duration of action of local anesthetics to reduce the pain during administration local anesthesia. Procaine was invented by Alfred Einhorn in 1905. The Swedish chemists' Nils Löfgren and Bengt Lundqvist invented lidocaine in 1943. Bupivacaine was discovered in 1957.[1]

Lidocaine is a fast-acting local anesthetic with a time of onset of between 1 and 5 min and a rather short duration of action of 1–2 h.[2] Whereas, Bupivacaine has a slower onset of 10–15 min but a longer duration of up to 8 h.[2] In combination, they can provide fast, long-lasting regional pain blocking.[2] Local Anesthesia reversibly inhibit nerve transmission by binding voltage-gated sodium channel in the nerve plasma membrane.[3] In the effort to minimize pain because of local anaes

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thesia use, several strategies have been employed to achieve this objective, including the development of extended-release local anesthetics,[4] the implementation of physical tour-niquet techniques,[5] the concurrent administration of supplementary medications such as analgesics or vaso-constrictor drugs,[6,7] the invention of mechanical devices for continuous or intermittent delivery of local anesthe-tics,[8] administration of local anesthesia in surgical wounds after stitches[9] and the utilization of pharmaceutical drug delivery systems.[10] The term "wide-awake" denotes that the surgical procedure on the hand is executed with the patient being fully conscious.

Procedure selection criteria for local anesthesia include minor, quick procedures not demanding the patient to stay overnight with no need for the person to be unconscious. Injection technique is an important factor in achieving nearly pain-free experience for patients and ensuring effective anesthesia in the field. The superficial skin has the highest concentration of nerve endings, which branch repeatedly from larger nerve fibrils in the deeper dermis and subcutaneous fat.[11-12] Use of fine guage needle, limited use of same needle, perpendicular injection technique, slow pulsatile injection and initial deeper of injection are some of the recommendations to reduce the pain of anesthesia administration[13]. Topical anesthetic application, such as EMLA (Eutectic mixture of local anesthetics:lidocaine 2.5%-prilocaine 2.5%) cream applied 60 to 120 minutes prior to intra lesional anesthetic injection has been found in multiple studies to attenuate injection pain.[14]

In this study we share our experience and results regarding the use of our technique and anesthetic solution, a mixture of 0.5% bupivacaine (20 cc), 1 %xylocaine (20cc), $NAHCO_3$ (3 cc) and epinephrine (1 cc) diluted in 250 cc Normal Saline in variety of plastic surgical and other surgical day case procedures with long duration of analgesia minimizing the discomfort and pain of administration of anesthetic solution without complications. We named our solution as Zameer anesthetic solution (ZA solution).

## Material and Methods

This case series of 100 patients was conducted in the department of plastic surgery in Prime Care Hospital, a private setup. Patients were selected and planned for variety of plastic surgical and other surgical procedures during the period of June 2022-June 2023. After the taking approval for ethical committee No Ref: PCH/1029. Detailed history and examination, all patients were informed about on going research. Informed consent were taken.

Patients selected for procedures were made sure to be fit in general health. Procedures performed were selected on criteria of being a day case, not needing general or spinal anesthesia. Thorough histories were taken regarding comorbidity, previous surgical procedures and allergic history to any specific drug. Selected patients undergoing procedures via our ZA solution administrating technique were counseled and offered informed consent with prior information regarding conversion of local anesthesia to general anesthesia or regional anesthesia, if needed.

Patients were positioned supine. Intravenous catheters were secured and intravenous Ringer lactate fluid was attached. Cardiac monitor and Pulse oximeter were attached. Emergency and anti-anaphylactic drugs were prepared. NSAIDs and acetaminophen were kept standby. Antibiotic was administrated. An anesthetist was on board ,if there is need of conversion from local anesthesia to regional or general anesthesia. Surgical site was prepared with Povidine-Iodine solution and standard protocol of sterilization was followed.

ZA Solution was administrated via our fan shaped administrating technique, in which we marked surgical field with gentian violet staying 6cm away from the boarder of main surgcial field along with 4 points marked at corner of the surgical field and 2 in the middle of surgical filed dividing the surgical field into 4 quadrants. ZA solution administration started at first given marked six points from proximal to distal along with the length of limb in a perpendicular pulsatile method without aspiration till the site become tumescent and elevated from the surrounding skin. 20 minutes were given for action of onset of the ZA solution. Then we administrated ZA solution in four quadrants through above mentioned six points with single prick without withdrawing spinal needle from the entry point, in fan shaped method again 15 mintues were given to the marked surgical field to let the solution become fully anesthesied the field. Patients were asked about pain according to numeric pain score (shown in table 1) at the end of administration and recommendation from the patient about the administration of this technique, on other patients. During the procedure patient was asked about the pain every 2 hourly per operative, post operative period till the pain starts on a questionnaire which is filled by doctor at

**Table 1:**

| Rating | Pain Level |
|---|---|
| 0 | No Pain |
| 1–3 | Mild Pain (nagging, annoying, interfering little with ADLs) |
| 4–6 | Moderate Pain (interferes significantly with ADLs) |
| 7–10 | Severe Pain (disabling; unable to perform ADLs) |

time of administration per operative, post operative up till 2 hour after which patient was discharged on oral antibiotics and analgesic with instruction, how to fill the questionnaire form till pain starts and return the form on first postoperative visit.

## Results

The mean age of patients selected in this study was 25 years ( range 20-35 years ) with 65 males (65% ) and 35 (35%) females. Procedures done with this technique are listed in Table 1. All patients well tolerated surgery, remained vitally stable and were discharged as day case. 87 patients recommended this technique to be used on other patients (Chart 1). Effects of our ZA solution lasted around 9 -14 hours. Our average pain score during administration was 2 to 4 mean 3, per operatively was 0 and post operatively was 0 (Table 2). Pain score at 4,6,8,10,12 and 14 hours were 0,0,0,1,2,3 respectively) (Chart 2). No procedure was converted to spinal or general anesthesia. No patient showed hypersensitivity reaction to our ZA solution.

**Table 1:** *Name of procedures performed with their no*

| Sr. No | Procedure Name | Number of procedure done |
|---|---|---|
| 1 | large lipoma | 4 |
| 2 | scar revision | 6 |
| 3 | hair transplant | 7 |
| 4 | release of burn contractures on hand | 6 |
| 5 | multiple tendon repair | 14 |
| 6 | release of dupuytren's contracture | 4 |
| 7 | STSG | 7 |
| 8 | FTSG | 16 |
| 9 | Fat Grafting | 4 |
| 10 | Liposuction | 6 |
| 11 | Small flap coverage | 4 |
| 12 | Carpal tunnel syndrome | 3 |
| 13 | Gynecomastia | 6 |
| 14 | Breast Lump exision | 3 |
| 15 | Sebacoeus Cyst | 10 |

**Table 2:** *Pain score measurement in females and males*

| Pain Score during administration | Number of Female Age Range 15-35y | Number of Male Age Range 15-35y |
|---|---|---|
| 1 | 6 | 17 |
| 2 | 11 | 18 |
| 3 | 14 | 21 |
| 4 | 2 | 6 |
| 5 | 2 | 3 |
| 6 | 0 | 0 |
| 7 | 0 | 0 |
| 8 | 0 | 0 |
| 9 | 0 | 0 |
| 10 | 0 | 0 |

**Chart 1:** *Validation Chart*

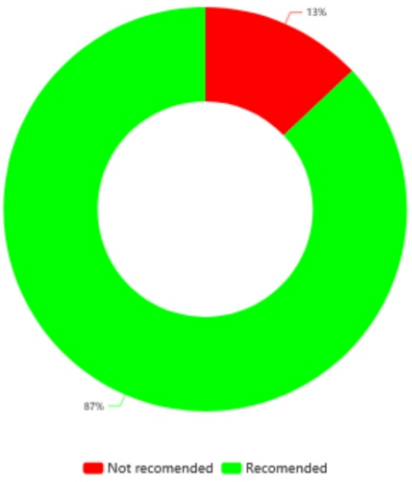
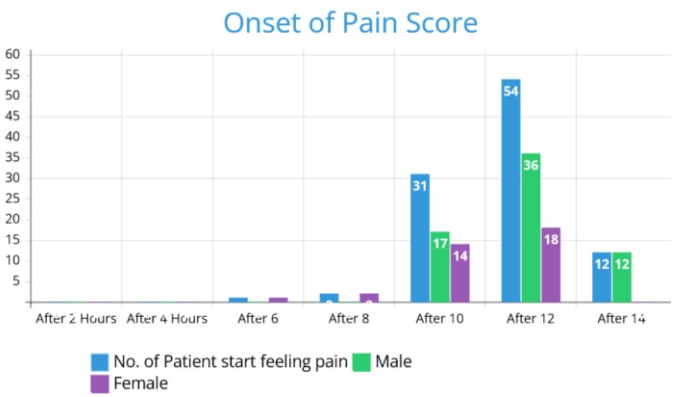



**Chart 2:** *Onset of pain score.*




## Discussion

Nowadays many methods and techniques are being practiced to reduce per operative and post operative pain. Newer and better anesthetic drugs are being administrated. Wide awake surgeries alternatives are appealing to individuals who appreciate the concepts of abstaining from preoperative testing, avoiding tourniquet-induced discomfort, minimizing hospital stay durati-

on for surgi-cal procedures, maintaining the opportunity to commu-nicate with their surgeon throughout the operation, and eliminating the need for sedation that may impair cog-nitive clarity upon returning home post-surgery.[14,15]

Tumescent Solution contain Xylocain but not Bupivacain which does not provide longer period of pain control. WALANT technique is, now a days trend in hand surgery especially tendon transfer. In this technique we consider our ZA solution and technique would be more beneficial as it will provide pain relief for longer period and avoid re-administration of local anesthesia during long surgery. Our ZA solution is a mixture of 0.5% Bupivacaine (20 cc), 1 % Xylocaine (20cc), $NAHCO_3$ (3cc) and epinephrine (1 cc) diluted in 250 cc Normal Saline. Despite the use of bupivacaine as long acting anesthetic drug, adverse effects like hypersensitivity and cardio toxicity hold a fear in surgeons heart, that prevents its common use. Using a safe prescribed dose of 2.5mg/kg , offers a safe practice for bupivacain. Xylocain with epinephrine offers a dose of 7mg/kg, acting as a fast acting anesthetic drug. Epinephrine allows vasoconstriction thus a blood less surgery. NAHCO3 acts as a buffer allowing to minimize the pain of local anesthetic during its administration. We use tumescent technique while administrating in subcutaneous tissue around surgical field thats provide us a great benefit of administration of drug without calibrating dosage of our mixture as our mixture is very diluted. We offer a dilution of 250 ml normal saline, eliminating the risk of over dose of any, used drug. Patient always receive safe dosage as we prepared mixture in prescribed safe dosage and contained epinephrine that causes peripheral vasoconstriction hence decreased its systemic absorption. Moreover systemic absorption is also hampered because of hydro-static pressure of Tumescent technique which causes pressure on the nearby vasculature and collapse them. Most of the local surgical procedures usually are well away from major vessels, so that our solution can easily be utilized for skin and subcutaneous tissue surgery. Our technique is not applicable over fingers and appendages however ZA solution can be used in traditional way of regional blocks. Our mixture can be used in all types of surgical procedure among other specialties as well, limited to skin and subcutaneous tissue.

It's a well known fact that pricking with fine gauge needle causes less pain and to avoid the repeated pricking the needle must be long enough to anesthetize a significant area, for which, we used 26G Spinal needle which can be easily maneuvered without retrieving from the entry site avoiding re pricking hence decreasing pain. The cost of spinal needle is a twice as compared to other needle but the difference is of less than 1$ . It is also very helpful in administrating solution in fan shape directions easily with another hand in large area. Its is also proven that perpendicular slow pulsatile administration of injection, and initial deeper injection helps in significant reduction of pain during administration of local anesthesia.[16] Among other benefits our technique of dividing surgical site into four quadrant and staying 6cm away from target surgical site during administration of our solution, provide good analgesia and vasoconstriction as it blocks the sensory nerve and cause vasoconstriction in a $6cm^2$ area. In tumor surgery and dirty wound hydro static effect also cause collapse of vessels along with adrenaline effect of vasoconstriction which in turn stops seedling of tumor and spread of infection in nearby or distant area. Our ZA solution along with our administration technique proved an essential factor in minimizing the pain in local anesthesia injection. The induction time required to do a surgery with our technique is about 10-15 minutes, which is comparable to regional or general anesthesia i.e. 10-15 minutes.[17] Our data showed that our technique with ZA solution resulted in low pain score. Average pain score during administration was means 3. None of the patient needed I/V analgesic. Intravenous access is not mandatory. We felt no use of any monitoring equipment, as all our patients remained vitally stable. As shown by our study, surgeons can operate in remote and impoverished areas, even with limited infrastructure. The preoperative phase is reduced, as patients have the flexibility to arrive just 30 minutes before the scheduled start time. A preoperative workup is not mandatory for except viral markers for safety of surgeons ,staff and theatre. The number of procedure cancellations and delays is minimized as there is no requirement for preoperative clearance from an anesthesiologist. Also use of ZA solution eliminates the need to apply tourniquet per operatively excluding the tourniquet complications and offering blood less surgery. Patient remains awake, pain free, can safely discharge as a day case and safely drive back to reach their destination.

## Conclusion

We conclude that our ZA solution containing bupivacaine and solution administrating technique is safe cost effective, patient and poor system friendly.

It gives liberty to perform long surgery without re administration and can be practice without need of monitoring equipment.

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**Conflict of Interest** *None*

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## Authors Contribution

**ZAM:** Conceptualization of Project
**AR:** Data Collection
**AA:** Literature Search
**HA:** Statistical Analysis
**GAN:** Drafting, Revision
**IA:** Writing of Manuscript