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ORIGINAL PAPER

# Reduced painful facial infiltration with mixture of lignocaine–bupivacaine in comparison to individual agents

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**Abstract** The anecdotal use of lignocaine and bupivacaine mixture as local anaesthetics (LA) in minor surgical operations is increasingly popular, despite a lack of evidence to support this practice. The infiltration of LA is frequently identified as the most unpleasant aspect of the whole surgical procedure. This study compared the level of infiltration associated pain when 1% lignocaine, 0.25% bupivacaine and their 1:1 (*v*:*v*) mixture were used in patients undergoing minor facial procedure. A prospective, randomised study was carried out on patients undergoing minor facial procedure at the day surgery unit. The Visual Analogue Score (VAS) at the time of infiltration, injected volume and number of injections were recorded and analysed between groups. A total of 94 patients were recruited. The average volume of LA injected was 2.5± 1.9 ml and the average number of injections was 2.3±1.5. The lignocaine–bupivacaine mixture (VAS=3.1±0.4) was identified as the least painful agent ($p<0.05$), when compared to 1% lignocaine (VAS=4.6±0.4) and 0.25% bupivacaine (VAS=6.4±0.5). In this cohort, female patients consistently reported a lower VAS score for all groups, but this observation was not statistically significant ($p>0.05$) when compared to male patients. The mixture of lignocaine and bupivacaine was associated with less pain during skin infiltration when compared to individual agents. Thus, we recommend its use in facial surgical procedures involving LA as this practice allows us to improve patients comfort during their surgery.

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## Introduction

Local anaesthetics have been used as an adjunct to minor surgical procedures for more than a century. Lignocaine and bupivacaine were initially used in 1944 and 1963, respectively [1]. They are most commonly used agents in clinical practice today. Although used to obtund pain, the initial infiltration of local anaesthetic is often the most unpleasant aspect of minor surgical procedures. This has resulted in some patients declining future surgery involving local anaesthesia [2, 3].

The use of mixture of local anaesthetics for anaesthesia has become popular in recent years [1]. They are frequently used in an ad hoc manner in skin infiltration despite a lack of clinical trial to examine their advantages. Theoretically, it enables the combination of rapid onset of action of lignocaine with the slower but more prolonged activity of bupivacaine. This in turn should render this mixture less painful on skin infiltration. There have been many studies in the past that compared pain upon infiltration of lignocaine and bupivacaine. However, most of these studies involved the experience of healthy subjects in a controlled environment [4, 5]. Therefore, these studies have limited value when extrapolated to clinical practice. Clinical pain has an emotional component that is not present in experimental pain.

There was anecdotal evidence from our clinical experience to suggest that infiltration of a mixture of lignocaine and bupivacaine results in reduced infiltration associated pain. In order to determine the experience of real patients receiving these local anaesthetics, we prospectively evaluate

the pain experienced by patients during infiltration of these agents. A cohort of patients undergoing minor facial surgical procedures in our Plastic Surgical Day Ward was included. Our objective was to compare the level of pain on infiltration of 1:1 (*v*:*v*) mixture of 1% lignocaine and 0.25% bupivacaine with 1% lignocaine and 0.25% bupivacaine alone. We hypothesised that the use of a mixture of lignocaine and bupivacaine will result in decreased infiltration associated pain when compared to individual agents.

## Materials and methods

A prospective, randomized study of consenting patients in Plastic Surgical Day Ward in a university teaching hospital was carried out. Only patients scheduled to undergo a facial procedure were included to avoid surgical sites related differences in pain experienced. The patients were randomised to receive one of three local anaesthetics which included a 1:1 (*v*:*v*) mixture of 1% lignocaine (AstraZeneca), and 0.25% bupivacaine (AstraZeneca). The mixed solution was made up with 5 ml of 1% lignocaine and 5 ml of 0.25% bupivacaine. All the local anaesthetics used in this study have pre-mixed adrenaline composition of 1:200,000 as supplied by the manufacturer.

Informed consent was obtained from all patients prior to the procedures. They were blinded to the type of local anaesthetic used. The local anaesthetic was infiltrated into the subdermis using a 25G hypodermic needle at rate of 1.0 ml over 10 s. All three local anaesthetics were kept at room temperature before administration. There were no topical agents or sedation used during this study. Exclusion criteria included allergy to either local anaesthetics, and physical or cognitive impairment making VAS score unreliable.

Each patient was asked immediately after infiltration to complete a pain score using a ten-point linear visual analogue scale (VAS), where 0 = "no pain" and 10 = "worst pain". They were reminded to ignore the pain of needle insertion and to focus on the discomfort of the infiltration of local anaesthetic when completing their VAS pain score. The demographic data, the injected volume and the number of injections of each patient were recorded and analysed. The scheduled surgical procedure was carried out on each patient in accordance with our standard of care. All patients completed their assigned treatment without any additional anaesthesia.

Statistical analysis was performed using one-way ANOVA and Tukey's post-hoc test to compare the differences between the three groups using a statistical software (SPSS 15.0 for Windows). The use of parametric statistics specifically for VAS analysis has been previously validated [6]. Chi-square test was used for comparing categorical data. Data were expressed as mean±standard deviation unless otherwise stated. A $p$ value of $<0.05$ was considered statistically significant.

## Results

A total of 94 patients undergoing minor elective facial surgical procedure was recruited (Table 1). They included 54 (57.4%) males and 40 (42.6%) females. The mean age was 54.7±21.1 years (range 10 to 93 years). Children as young as 10 years were included because VAS pain scoring application has been shown to be reliable in this age group [5]. On average, a volume of less than 3 ml (mean=2.5±1.9; range 1–10 ml) of local anaesthetics was used. Most procedures had less than three injections (mean=2.3±1.5; range 1–8).

Seventy three (77.7%) patients experienced tolerable degrees of pain with a VAS pain score between 1 to 7 during local anaesthetic infiltration to the face. Three (3.2%) patients scored zero, one from each local anaesthetic group. Eighteen (19.1%) patients experienced severe pain (VAS score ≥8) with three (3.2%) patients scored 10. Two of the patients with a score of 10 received 1% lignocaine, and one received 0.25% bupivacaine.

There was a significant different in the pain level experienced between the three groups ($p<0.05$). The least painful agent was found to be the mixture, followed by 1%

**Table 1** Patient characteristics, volume of local anaesthetics and number of injections in each study groups

| | 1:1 (*v*:*v*) mixture 1% lignocaine–0.25% bupivacaine [*n*=32 (34%)] | 1% Lignocaine [*n*=35 (37.2%)] | 0.25% Bupivacaine [*n*=27 (28.7%)] | *p* value |
|---|---|---|---|---|
| Gender | | | | |
| Male | 19 (59.4%) | 18 (51.4%) | 17 (63%) | $p=0.64$ |
| Female | 13 (40.6%) | 17 (48.6%) | 10 (37%) | |
| Age (year) | 51.4±19.9 (21–89) | 53.2±22.7 (10–88) | 60.5±20.0 (26–93) | $p=0.224$ |
| Volume (ml) | 2.6±1.8 (1–7) | 2.7±2.0 (1–10) | 2.0±1.7 (1–8) | $p=0.286$ |
| Number of injection | 2.3±1.6 (1–8) | 2.4±1.7 (1–7) | 2.1±1.1 (1–5) | $p=0.684$ |
| VAS | 3.1±0.41 (0–9) | 4.6±0.38 (0–10) | 6.4±0.45 (0–10) | $p<0.05$ |

lignocaine. Bupivacaine (0.25%) was found to be the most painful agent in this cohort. Interestingly, the mean VAS pain score of female patients was lower than their male counterparts (Fig. 1). However, this difference was not statistically significant ($p>0.05$).

## Discussion

Skin infiltration of local anaesthetics is characteristically painful for the patients. The aetiology of local anaesthetic-induced pain is unknown [4]. Some authors have implicated local anaesthetic acidity or lipid solubility [1, 2, 7]. This observation was supported by several trials which confirmed that buffered local anaesthetics were less painful than their non-buffered counterparts [2, 8–10]. Other studies have described methods to minimize the pain in local anaesthetics' skin infiltration [3, 11]. However, none had evaluated the pain on skin infiltration when a mixture of a fast-acting and a slower, longer duration local anaesthetics agents was used.

Previously, there had been studies comparing the pain difference between lignocaine and bupivacaine on skin infiltration [4, 5, 12]. Morris et al. showed that 0.5% bupivacaine to be more painful than 1% lignocaine for skin infiltration [4]. Johnson also found bupivacaine to be more painful when he compared 0.25% bupivacaine to 0.5% lignocaine [12]. Their findings are consistent with our current study which showed that 0.25% bupivacaine to be more painful than 1% lignocaine.

The basis for mixing lignocaine and bupivacaine is to combine the more rapid onset of action of lignocaine with the higher potency and longer duration of action of bupivacaine. The mixture should therefore, theoretically offer significant clinical advantages owing to a combined faster onset, higher potency and longer duration of action. The findings of our study corroborate this theory. The mixture was significantly less painful than either lignocaine or bupivacaine used alone. This could be on account of the faster onset of 1% lignocaine and highly potent anaesthetic effect of 0.25% bupivacaine once infiltrated to provide a diffused front of anaesthetised areas for subsequent traumatic, tissue-splitting migration of remaining solutions.

Previous studies have matched severe pain to a VAS score of 8 or above [13]. Using this as standard, 76 (80.9%) of the 94 patients had tolerated skin infiltration for facial procedures well with a VAS score of less than 8. The mixture was superior with only two (2.1%) patients experienced severe pain (VAS score ≥8). In contrast, there were six (6.4%) and 10 (10.6%) patients reporting severe pain in the 1% lignocaine and 0.25% bupivacaine, respectively.

There were three patients who scored 10 in VAS. One patient was a 10-year-old boy who had excision of a naevus on his right cheek. It was felt, perhaps, that the pain experienced was significantly influenced by the anxiety that the boy experienced. Another two patients who scored 10 had 1×1 cm basal cell carcinoma excised adjacent to the alar area of the nose. It is possible in both cases that the thick skin at the alar of the nose was more painful than other regions on the face. Surprisingly, three patients (3.2%) experienced no pain with a VAS of 0 on local anaesthetic administration. Each patient was from one of the three groups of local anaesthetics employed. Two of those patients had 0.5×0.4 cm naevus excised from the chin and forehead, respectively. The other patient had 0.5×1 cm basal cell carcinoma excised from the temporal region. There was no obvious explanation for these patients

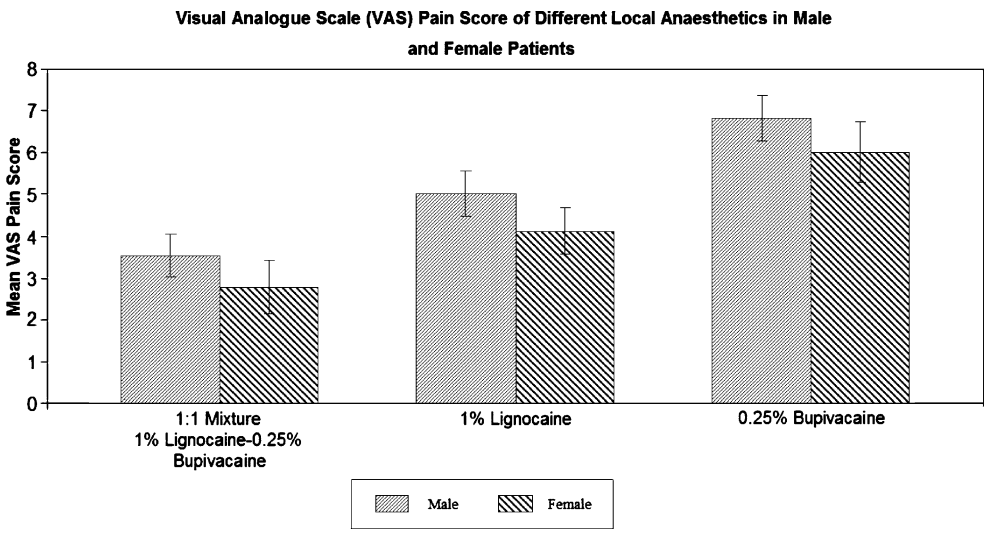


**Fig. 1** Gender was not a significant factor in pain experienced in skin infiltration among the three study groups. Mean VAS score for females were consistently lower than males but this did not reach statistical significance. The mean VAS score for females injected with the mixed agent was 2.77±0.63 versus 3.53±0.52 for males. Female patients scored 4.12±0.55 and 6.0±0.72 for 1% lignocaine and 0.25% bupivacaine, respectively, whereas male patients scored 5.0±0.54 and 6.82±0.55 on those respective groups

reporting no pain (VAS score = 0). However, it could be that the chin, forehead and temporal regions are less sensitive when compared to central facial areas such as the alar of the nose. It may also be due to false interpretation of the VAS pain scoring scale.

Thomson et al. had stated that ideally a single sex study should be performed to eliminate potential differences in male and female pain thresholds [14]. However, we did not find gender differences to be a factor on the level of pain experienced. Even though our male patients have consistently scored higher in VAS pain score compared to their female counterparts in all three study groups, this observation was not statistically significant.

The difficulty in many studies assessing pain in local anaesthetic infiltration is the difficulty in quantifying true pain itself as there is no objective measure of pain. We notice that the VAS pain score in our studies were higher for lignocaine and bupivacaine than those reported by Morris et al. This can be explained by the different setting in which these studies were conducted. Our study was carried out on real patients in clinical setting whereas theirs was in healthy volunteers. Patients' pain perception in clinical setting differs from those of healthy individuals. Factors such as anxiety or anticipation before surgery can significantly influence the pain perceived. These factors are not present in healthy individuals who volunteer to be the subjects of a study evaluating pain. In addition, using a single dimension such as intensity (VAS) alone will often fail to capture the many qualities of pain [15].

Through conducting this study on actual patients, we feel that it better represents both the physical and psychological components of pain experienced during anaesthetic infiltration. Therefore, we believe that our results are more relevant when extrapolated to clinical scenarios. The use of lignocaine and bupivacaine mixture offers reduced pain during infiltration that certainly provides us with another mean in which to improve patients' comfort. Therefore, we highly recommend its use in minor facial surgical procedures involving local anaesthetics.

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