Comparative evaluation of bupivacaine 0.25% with dexamethasone 2mg versus bupivacaine 0.25% alone in greater auricular nerve block for post-operative analgesia in mastoid surgery

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Background

Pain severity after ear surgery is usually at its worst during the first few hours after surgery. The greater auricular nerve is the major sensory branch of the cervical plexus and is readily amenable to blockade as it lies superficially passing over the sternocleidomastoid muscle. Dexamethasone as an adjuvant is known to prolong analgesia.

Aims and objectives

To compare the efficacy of combination of bupivacaine 0.25% (9.5ml) with dexamethasone 2mg (0.5ml) versus bupivacaine 0.25% (9.5ml) with normal saline (0.5ml) in greater auricular nerve block for duration of analgesia and requirement of rescue analgesia postoperatively.

Methodology

Prospective double blind randomised controlled trial. Fifty patients aged 18-65 years; American Society of Anaesthesiologists physical status I / II posted for mastoid surgery were randomly allocated into two groups. Both groups received routine general anaesthesia. Intra operatively, analgesia was maintained with boluses of intravenous fentanyl 25µg each if required. At the end of surgery, just before extubation the nerve was identified using anatomical landmarks and blocked blindly with the drugs chosen depending on the group. The patients were extubated after complete reversal of neuromuscular blockade.

Results

Demographic data and type of surgery were similar in both the groups. There was a significant difference for duration of analgesia between the two groups ($p<0.01$).

Conclusion

Dexamethasone as an adjuvant to bupivacaine in greater auricular nerve block significantly increases the duration of analgesia and reduces the need for postoperative analgesics without any complications.

Keywords: greater auricular nerve block; dexamethasone; regional analgesia; mastoid surgery.

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Introduction

Regional anaesthetic techniques score over systemic medication by abolishing primary hyperalgesia due to tissue damage thus blocking central sensitization which prevents secondary hyperalgesia altogether.[1] The greater auricular nerve block is one such simple technique known to provide analgesia in tympano-mastoid surgery. It is a known fact that the pain severity after ear surgery differs significantly from

patient to patient. Peripheral nerve blocks are known to reduce the need for peri-operative intravenous or oral analgesics and hence their adverse effects.

The greater auricular nerve (GAN) is a major sensory branch of the cervical plexus. The great auricular nerve provides sensory innervations for both surfaces of the external ear, areas above and on the posterior surface of the auricle and most of the skin covering the mastoid process and parotid gland.[1-3] The GAN is readily amenable to local anaesthetic blockade as it lies in a superficial location passing over the sternocleidomastoid muscle. Therefore, easier and considerable to block this nerve in mastoid surgeries for analgesia.[4-6]

We conducted this study to compare the efficacy of bupivacaine 0.25% (9.5ml) with dexamethasone 2mg (0.5ml) versus bupivacaine 0.25% (9.5ml) with normal saline (0.5ml) in greater auricular nerve block in post-operative pain control after mastoid operations. We also evaluated requirement of rescue analgesia postoperatively and complications of block, if any.

Methodology

Institutional Ethics Committee approval was obtained, and 50 patients were recruited for this prospective randomised double blind study. Registration of the study was done with clinical trials registry, India (CTRI/2018/02/011899). Patients between age group 18 to 60 years and BMI < 30kg/m^2 of either gender belonging to American Society of Anaesthesiologists physical status (ASA PS) 1 or 2 scheduled for mastoid surgery under general anaesthesia were enrolled. Exclusion criteria included patients with bleeding disorders or on anticoagulants, facial nerve palsy, infection, trauma, scar or sinuses at the site of block, known hypersensitivity to drugs, patients unable to comprehend Visual Analog Score (VAS) or psychiatric illness and unwillingness to participate in the study.

Written informed consent was taken and were randomly allocated to one of the two groups (Group D or Group S) with the aid of a computer-generated table of random numbers. Group allocation concealment was safeguarded using sequentially numbered, opaque sealed envelopes. In Group D: Patients received GAN block with bupivacaine 0.25%, 9.5ml + dexamethasone 2mg, 0.5ml. In Group S: Patients received GAN block with bupivacaine 0.25%, 9.5ml + normal saline 0.5ml.

Following patient identification, nil per oral status was confirmed and patient was wheeled into the theatre. Monitors were attached which included 5 electrode electrocardiography, non-invasive blood pressure and pulse oximeter. After noting baseline vital parameters intravenous line was secured with suitable gauge intravenous catheter and infusion of Ringer's lactate was started.

The anaesthetic technique was standardised for both the groups. Intravenous glycopyrrolate 0.2mg was given. General anaesthesia was induced after preoxygenation for 3 min with 100% oxygen, with fentanyl 1-2µg/kg and propofol 2-3mg/kg i.v. till the loss of response to verbal command. Plane of anaesthesia was deepened by switching on isoflurane. After confirmation of bag and mask ventilation vecuronium 0.1mg/kg i.v. was given and ventilation continued with 100% oxygen for 3 mins. Trachea was intubated with an appropriately sized single lumen cuffed portex endotracheal tube under direct vision. Anaesthesia was maintained with 50:50, air: oxygen and isoflurane with intermittent doses of vecuronium. Fluids and blood were given as per the requirement. Before the start of the surgery local infiltration with 2% lignocaine with adrenaline was administered by the surgeon at the site of incision. If pain response was still apparent even under cover of adequate analgesia and adequate depth of anaesthesia, fentanyl 25µg i.v. was given in boluses and was noted. Just before extubating the patient, head was turned to the opposite side of the operated ear. Mastoid process on the side of the operated ear was palpated and marked as a reference point. Under aseptic precautions, the puncture was done with 24G needle at the level of cricoid cartilage. The injection was performed over the lateral edge of sternocleidomastoid muscle. A subcutaneous wheal was raised by injection of 1 ml anaesthetic solution after negative aspiration test. The needle was then advanced towards mastoid process in the subcutaneous plane and anaesthetic solution was administered after negative aspiration test throughout the course of the nerve gradually withdrawing the needle. A discrete massage was then given towards mastoid process to support the diffusion of the

solution. Reversal of neuromuscular blockade was done with neostigmine 0.05mg /kg and glycopyrrolate 0.1 mg/kg i.v. and patients were extubated after the criteria of extubation were fulfilled. To assess the intensity of pain VAS was used. Follow up was done hourly for first 8 hours and two hourly for the next 16 hours (*Patients were followed up for 24 hours post procedure.) Parameters assessed were visual analogue score, requirement of rescue analgesic and any complications. At any point of time during the course of study, VAS of ≥4 was considered as the cut-off point. The time for analgesic was noted and the patient was administered diclofenac 75mg in 100ml normal saline i.v. stat when he/she complained of pain with VAS≥4. The respective unit was informed regarding the analgesic cover.

Sample size was determined based on the results of our pilot study, a difference of more than 8 hours between the two groups was considered significant. For 80% power at 5% level of significance, a minimum of 18 patients were required to be studied in each group. This was calculated using comparison of median duration between 'n' groups, where σ = 6.77h, d = 8 and inflation factor = 1.5 (ratio of standard deviation of median to mean). For authentication purpose, 'n' was taken to be 25 in each group. The tests that were performed to analyse the results were independent sample t test, Levene's test (equality of variances) and student t test (equality of means). The independent sample t test was employed for comparing the demographic data between the groups. Levene's test and t test again used for the outcome results obtained. P value was calculated for assessing the difference between the groups. SPSS version 20 for Windows was used for statistical analysis.

Results

A total of 50 patients were studied. The age, gender, American Society of Anaesthesiologists physical status of patients belonging to both the groups were comparable (Table 1).

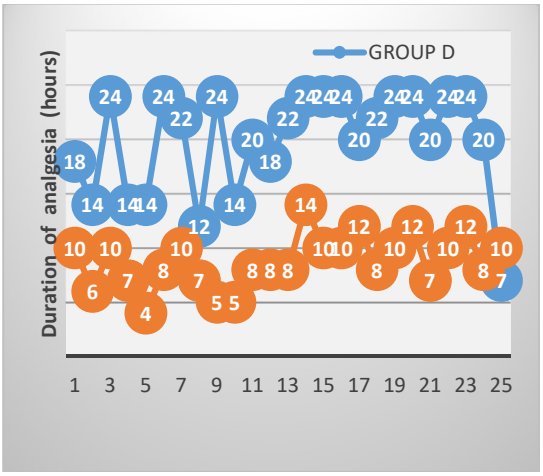
Maximum duration of analgesia obtained in Group D is ≥ 24hours whereas in Group S it was 14 hours (Graph 1). Total of 50 participants included. Once patient had VAS ≥ 4, rescue analgesic was given, and this time was taken as duration of analgesia.

Table 1: Demographic data

n=50	Group D	Group S
Age in years *	36.88±11.38	38.6±12.91
Gender (Male/Female)	14/11	11/14
ASA PS (1/2)	18/7	22/3

*p value of 0.62
Independent sample t test is used

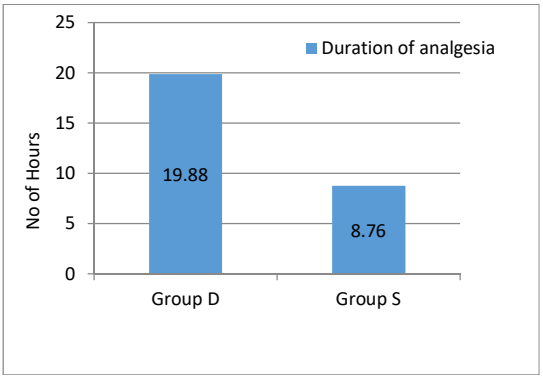
Graph 1: Duration of analgesia



X axis – serial number of patients considered
Y axis – duration of analgesia in hours

Graph 2 shows the mean value of duration of analgesia in Group D and Group S. Group D has a mean of 19.88±4.82 hours and Group S has 8.76±2.44 hours. Here equal variances were not assumed since p value was 0.004. Hence p < 0.01 which infers that significant difference exists between the two groups.

Graph 2: Mean value of duration of analgesia (in hours)



Discussion

Tympano-mastoid surgeries are one of the most commonly performed procedures. The mode of anaesthesia varies but most commonly it is done under general anaesthesia. However, the perception of pain is varied and subjective. Hence there is no novel or prescribed mode of analgesia in these surgeries. As it has always been propagated that regional techniques score over systemic analgesics, we have employed greater auricular nerve block for post-operative analgesia in these surgeries. Hence the side effects of systemic analgesics can be avoided.[4-6]

Addition of adjuvants to bupivacaine reduces the concentration of bupivacaine to achieve desire effect. We have utilised the same concept to increase the duration of analgesia along with reducing the required dose of bupivacaine and thus the untoward effects of bupivacaine. When dexamethasone is added as adjuvant to local anaesthetics, it acts synergistically with local anaesthetics to achieve a better quality and duration of analgesia, limiting the need for alternative analgesics – particularly opioids. Various theories have been put forward to explain the analgesic effect of corticosteroids. Stan et al suggested that steroids suppress the synthesis and secretion of various inflammatory mediators, which prolongs the period of analgesia (up to 48 hrs).[7] A direct effect on nerve membrane rather than an anti-inflammatory action has also been suggested.[8] On the other hand, steroids can induce a degree of vasoconstriction, which results in reducing local anaesthetic absorption, and they attach to the intracellular receptor to modulate nuclear transcription.[9] Attardi et al showed that dexamethasone acts on glucocorticoid receptors, which increase the activity of inhibitory potassium channels on nociceptive C-fibers.[10,11] Bupivacaine is cardiotoxic and also has a potential to cause cell damage.[12] This can be prevented by using adjuvants like dexamethasone. Hence dexamethasone is chosen as the adjuvant of choice in our study.

So, with this background, we planned our study to minimise the post-operative pain in mastoid surgery.We recruited 50 patients for our study and found that the mean duration of analgesia for group D was 19.88±4.82 hours whereas for group S was 8.76±2.44 hours (p=0.004), which was significant. Maximum duration of analgesia obtained in Group D was ≥ 24 hours whereas in Group S it was 14hours.

Our results are comparable with Vieira et al study, who performed ultrasound-guided interscalene brachial plexus blockade and studied the effects of dexamethasone with bupivacaine. They concluded that dexamethasone group extended median sensory and motor blockade compared with the control ($p<0.0001$). At 24 hours, dexamethasone group had lower median VAS scores as contrasted with control. At 48 hours, dexamethasone and control group had analogous median pain scores. Oxycodone equivalency and need for opioid was lesser in the dexamethasone group for the first 24 h, and alike subsequently as compared to the control group in their study.[13]

Results of our study are further supported by Sachdeva et al who found that the addition of 8 mg dexamethasone to 40 ml 0.2% ropivacaine for bilateral transversus abdominis plane (TAP) block resulted in a significant reduction of pain score over the first 24 hrs postoperatively, with prolongation of time to first analgesic, decreased requirement of postoperative opioids (tramadol), decreased incidence of vomiting, and produced better patient satisfaction in terms of pain relief.[11]

Another notable study by Williams BA et al gave us a different perspective about usage of dexamethasone. The use of high-dose adjuvants for nerve blocks was disregarded and especially with respect to dexamethasone, the dose of >2mg was not recommended.[14] They have also commented about the systemic absorption of dexamethasone and its unpleasant effects in patients with disorders like diabetes mellitus when used in higher concentration. In order to practice multimodal analgesia their suggestion was to use dexamethasone both perineurally as well as intravenously. But in our study, we employed only perineural usage.

Pehora C et al found that both intravenous as well as perineural dexamethasone was effective in prolonging the duration of analgesia, reduced post-operative pain and requirement of opioids.[15] Since the block was instituted by a single person, interpersonal variation was avoided in the study, this was the merit of our study.

Limitations of this study were due to the possibility of anaesthetising superficial cervical plexus which couldn't be ruled out since the technique was by classical method. However, the purpose of prolonged post-operative analgesia was fulfilled.

Conclusion

Dexamethasone as an adjuvant to bupivacaine in greater auricular nerve block significantly increases the duration of analgesia and reduces the need for post-operative analgesic requirement.

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