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ORIGINAL ARTICLE

Double Blinded Comparative Study Of Bupivacaine With And Without Dexamethasone In Supraclavicular Brachial Plexus Block In Surgery Of Upper Limb

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ABSTRACT

Background: Through the use of bupivacaine-induced brachial plexus blocking, it is possible to achieve high levels of anaesthesia and analgesia for surgical procedures. When dexamethasone was given to bupivacaine as an additive, the anaesthesia and analgesia lasted significantly longer in the patients who participated in the study.
Aim: To study sensory and motor blockade, as well as the duration of postoperative analgesia and the duration of postoperative pain relief.
Methods: We were able to enrol 60 patients in the experiment after they were approved by the Institutional Ethical Committee and provided written informed consent to participate. ASA I and II patients, ranging in age from 18 to 60 years old, who had undergone elective surgery on their upper extremities were included in this study. They were separated into two groups of almost equal size..
Results: The mean age in group 1 was 42.6 years with 13.6 SD whereas in group 2 mean age was 37.8 years with 12.5 SD. In group 1 mean weight was 61.7 kgs with 5.9 SD whereas in group 2 the mean weight was 58.2 kgs with 4.8 SD. The descriptive analysis of group 1 and group 2 showed that the mean pulse rate with SD was 83 ± 6.5 and 84 ± 7.2 respectively. While the systolic BP was recorded as 122 and 126 for groups 1 and 2 the standard deviation in this case was 7.8 and 6.4 respectively. Diastolic blood pressure for group 1 was 75 ± 8.2 SD and for group 2 it was recorded as 78 ± 7.9 SD. The analysis of SPO2 for group 1 was 97.3 ± 1.4 SD while group 2 showed 97.5 ± 1.1 SD as mean and SD values. For group 1 the onset of motor block (minutes) was 3.8 ± 0.8 SD and for group 2 it was 17.5 ± 2.3 SD. Onset of sensory block (minute) for group 1 was 7.2 ± 1.5 SD and for group it was 15.6 ± 1.6 SD.
Conclusion: The addition of 15 millilitres of 0.5% bupivacaine to 15 millilitres of dexamethasone significantly accelerates the onset of sensory and motor blockage in the patient. It has been demonstrated to significantly increase the duration of sensory and motor blockage as well as analgesia. It has been demonstrated that dexamethasone adjuvant is completely safe and has no negative effects when used in the brachial plexus block.
Keywords: Double blinded study, upper limb, supraclavicular brachial plexus

INTRODUCTION

Pneumatic nerve blocks have a variety of applications, including anaesthesia, surgical analgesia, and the diagnosis and treatment of chronic pain disorders, to name a few examples. When performed successfully, peripheral nerve blockade provides anaesthesia practitioners with more options for providing high-quality anaesthetic care. The appropriate selection of anaesthesia and sedation can allow these procedures to be performed on patients of any age or gender[1]. Peripheral nerve blocks are significantly safer than general anaesthesia and have a number of distinct advantages over spinal anaesthesia. The use of peripheral nerve blocks for intraoperative anaesthesia has proven to be quite beneficial in recent years. An additional benefit of this treatment is that it allows analgesia to be maintained for a longer period of time without causing any harmful systemic side effects during the postoperative phase[2].

As a bonus, they have the fewest amount of side effects associated with prolonged postoperative analgesia. In elderly patients, the use of this technique reduces the risk of aspiration due to intact pharyngeal and laryngeal reflexes. It also improves postoperative pain control without the use of excessive sedation and allows patients to be discharged from the hospital sooner following surgery[3].

Because of their high success rate and capacity to offer long-lasting postoperative analgesia, brachial plexus blocks are among the most thoroughly researched peripheral nerve blocks. A plus is that the sympathetic block established is ideal for arm or hand re-implantation surgery as well as the construction of an intravascular shunt that dialysis patients can use to their advantage when undergoing treatment[4]. The success of the brachial plexus block is dependent on the integrity of the tubular fascia sheath that covers the brachial plexus branches. It is also conceivable to predict that the entire branch plexus will be blocked if only a single branch is recognised using paraesthesia or a nerve stimulator, and a high enough volume of anaesthetic is administered into the patient[4].

The supraclavicular approach is the most commonly used technique for doing brachial plexus block. The brachial plexus is narrowed into a small region near the end of its journey across the first rib as it reaches the second rib. Therefore, it is reasonable to expect that the block will include all three trunks. In continuous catheter block procedures, the risk of systemic toxicity increases as the dose or volume of local anaesthetics is increased or as the procedure is prolonged. It is for this reason that researchers have always looked for an adjuvant to the localised block of medications that can increase the duration of analgesia while causing the least amount of side effects. Since the 1950s, dexamethasone has been used in the treatment of peripheral nerve block as an adjunct to local anaesthesia[5,6].

An increase in the duration of a nerve block may be possible in some situations with the use of steroids. It is believed that, rather than inhibiting the transmission of nociceptive myelinated c-fibers, it reduces the ectopic firing of adjacent neurons. In our trial, we selected dexamethasone because it has been shown to significantly increase anaesthesia and analgesic duration by up to 50%. In addition, it has been found that dexamethasone is completely risk-free and can guard against the neurotoxicity of bupivacaine injections, and that there are no known adverse effects[7]. It has previously been stated that the analgesic effects of corticosteroids are not attributable to systemic absorption, but rather to local action[8]. Researchers used a non-particulate steroid called dexamethasone to investigate the effects of dexamethasone on several aspects of supraclavicular brachial plexus block symptoms. Dexamethasone is widely available, reasonably

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priced, and has additional benefits such as antiemetic, anti-inflammatory, analgesic, and non-neurotoxic properties

The objective of the study was to study sensory and motor blockade, as well as the duration of postoperative analgesia and the duration of postoperative pain relief. To study sensory and motor blockade, as well as the duration of postoperative analgesia and the duration of postoperative pain relief. They used supraclavicular brachial plexus blocks to achieve their results. They then compared the results of their experiments.

MATERIALS AND METHODS

The Institutional Ethical Committee gave their approval to our research efforts. To conduct the study, it was required to get written informed consent from patients in their native language, which was then translated into English for the objectives of the research. In total, sixty patients participated in our study.

Inclusion criteria: In our investigation, we only took into consideration patients who met the following criteria.

The age range of 18 to 70 years is defined as follows: The American Society of Anesthesiologists has granted us accreditation at levels 1 and 2. Underarm surgery for conditions such as acromegaly is performed in some cases (both elective and emergency)

Exclusion criteria: Patients had to meet certain requirements in order to be eligible to take part in our study.

1. This block was not accepted because there was no unanimous consent from all parties.
2. For the second time, the American Society of Anesthesiology's grades 3 and 4 have been recognised.
3. If you have a family history of bleeding issues, you should consult your doctor.
4. People who are taking anticoagulant drugs rank fourth on the list of dangers.
5. Significant amount of pulmonary dysfunction
6. Neurological impairments have an impact on the brachial plexus and its function.
7. Patients who have previously experienced an adverse reaction to local anaesthetics are more prone to have complications.
8. It is possible to get infection at the site where the block is administered.
9. A few of the nine conditions to avoid are diabetes, hepatic or renal failure, peptic ulcer disease, and type 2 diabetes (as they are contraindications to the use of steroid

Consent from patients was obtained in their native language, which was then translated into English once it had been approved by the hospital ethics committee. Because of our inclusion criteria, we were able to enrol a total of sixty people in our research. An extensive pre-anesthetic assessment was performed on all patients. This assessment included a detailed medical history and physical exam, in addition to an evaluation of the entire body. A significant amount of preliminary work has already been completed (Haemoglobin percent , complete blood counts, bleeding time, clotting time, random blood sugar, serum urea, serum creatinine, if age above 45yrs then ECG). A nil per oral diet was followed for the length of the night by all of the patients. Because randomization could not be completed at the start of the experiment, subjects were selected in a different manner than usual. When it comes to brachial plexus block, survial clavicular block is one of the most commonly performed treatments. Specifically, it is performed at the trunk level on a tiny part of the body in which the sensory, motor, and sympathetic innervation of the upper limb is concentrically focused.

When local anaesthetic was given, the time it took for analgesia to commence in each of the major peripheral nerve distributions, such as the ulnar, medial, and radial nerves, as well as the musculocutaneous nerve, was measured. Sensory block could be discovered by performing a pinprick using a blunt-end 27-gauge needle to determine its onset. Participants were given a pinprick to assess their immune system at intervals of 0, 2, 5, 10, 15, 20, and 30 minutes. The pinprick test was used to measure sensory obstruction, and the results were recorded.

It was regarded the beginning of motor blockage when a patient was unable to move his or her finger or lift his or her hand after receiving local anaesthetic injection. Researchers tested a variety of motor functions to determine whether or not Motor Block had begun after 10 or 20 minutes, including flexion at the elbow and wrist extension, which are controlled by the radial nerve; opposition between the thumb and index finger; and the thumb's ulnar nerve and ulnar artery, which are both controlled by the median nerve; all of which are controlled by the median nerve.

Duration of Analgesia: If the patient did not complain of pain or discomfort during the procedure, or if sedation was not required, the anaesthesia was rated good or adequate. Following surgery, the patient's postoperative condition was continuously monitored in the recovery room as well as on the postoperative ward. Following that, the analgesia duration was recorded every half-hour for the next ten hours using the "visual analogue scale for pain," and then every hour for the following 24 hours. It has been demonstrated that the analgesic efficacy of the medication was exhausted in patients who complained of the most acute pain (a Visual Analogue Score of 8-10). The patient was administered the rescue analgesic (I.M Diclofenac 1-1.5mg/kg) in order to alleviate his or her suffering. The duration of a motor block was determined by performing an examination every hour following surgery to see how long it would last. Patients were encouraged to wiggle and raise their hands in order to determine whether or not their motor function had returned.

Statistical analysis: The data was analysed using the SPSS 22 version of software, which was then imported into an Excel spreadsheet for further analysis. To illustrate categorical information, data in the form of frequencies and proportions were employed to illustrate the information. The chi-square test was employed to determine whether or not there was a statistically significant difference. For the purpose of displaying continuous data, the mean and standard deviation were calculated. Statistical significance was determined by using independent t tests to determine whether or not the results were statistically significant. Researchers can determine whether or whether two independent data points, such as those obtained before and after drug therapy, are statistically significant by combining them. For the purposes of this study, a p value less than 0.05 was considered statistically significant.

RESULTS

Table 1: The mean age in group 1 was 42.6 years with 13.6 SD whereas in group 2 mean age was 37.8 years with 12.5 SD. In group 1 mean weight was 61.7 kgs with 5.9 SD whereas in group 2 the mean weight was 58.2 kgs with 4.8 SD.

	Group 1	**Group 2**
Age (years)	42.6 ±13.6 SD	37.8 ±12.5 SD
Weight (kg)	61.7 ±5.9 SD	58.2 ± 4.8 SD

Fig. 1: Gender distribution

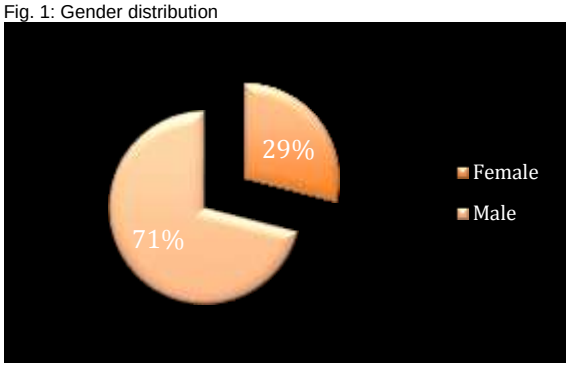


Table 2: The descriptive analysis of group 1 and group 2 showed that the mean pulse rate with SD was 83 ± 6.5 and 84 ± 7.2 respectively. While the systolic BP was recorded as 122 and 126 for groups 1 and 2 the standard deviation in this case was 7.8 and 6.4 respectively. Diastolic blood pressure for group 1 was75 ± 8.2 SD and for group 2 it was recorded as 78 ± 7.9 SD. The analysis of SPO2 for group 1 was 97.3±1.4 SD while group 2 showed 97.5±1.1 SD as mean and SD values.

	Group 1	**Group 2**
Pulse Rate	83 ± 6.5 SD	84 ± 7.2 SD
Systolic Blood Pressure	122 ± 7.8 SD	126 ± 6.4 SD
Diastolic Pressure	75 ± 8.2 SD	78 ± 7.9 SD
SPO2	97.3 ± 1.4 SD	97.5 ± 1.1 SD

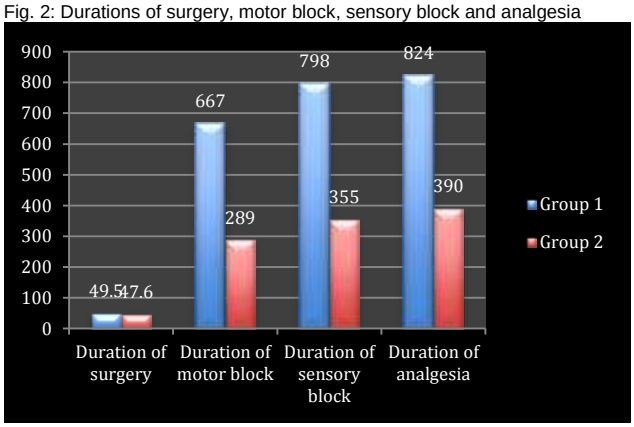
Table 3: For group 1 the onset of motor block (minutes) was 3.8 ± 0.8 SD and for group 2 it was 17.5±2.3SD. Onset of sensory block (minute) for group 1 was 7.2±1.5 SD and for group it was 15.6 ± 1.6 SD.

	Group 1	Group 2
Onset of motor block (min)	3.8 ± 0.8 SD	17.5 ± 2.3 SD
Onset of sensory block (min)	7.2 ± 1.5 SD	15.6 ± 1.6 SD

Table 4: Duration of surgery for group 1 was 49.5 minutes with 18.8 as SD whereas for group 2 it was 47.6 minutes with 15.9 as SD value. The p value for surgery duration was 0.445. Duration of motor block for group 1 was 667 minutes with 85 as SD value and for group 2 it was 289 minutes with 56 as SD value and <0.01 as p value. For group 1 and 2 the duration of sensory block in minutes was 798 ± 13.5 and 355 ± 12.9 as mean and SD respectively and <0.01 as p value. Duration of analgesia for group 1 was 824 minutes as mean and 13.8 as SD whereas for group 2 it was 390 minutes as mean and 44 as SD value. The value of p for this factor was <0.01. The p values show that the test analysis is significant statistically.

	Group 1	Group 2	P value
Duration of Surgery (min)	49.5 ± 18.8 SD	47.6 ± 15.9 SD	0.445
Duration of Motor Block (min)	667 ± 85 SD	289 ± 56 SD	<0.01
Duration of Sensory Block (min)	798 ± 13.5 SD	355 ± 12.9 SD	<0.01
Duration of Analgesia (min)	824 ± 13.8 SD	390 ± 44 SD	<0.01

Fig. 2: Durations of surgery, motor block, sensory block and analgesia



DISCUSSION

In our investigation, the mean age in group 1 was 42.6 years with a standard deviation of 13.6 years, whereas the mean age in group 2 was 37.8 years with a standard deviation of 12.5 years. In group 1, the mean weight was 61.7 kg with a standard deviation of 5.9 kg, whereas in group 2, the mean weight was 58.2 kg with a standard deviation of 4.8 kg. The descriptive analysis revealed that the mean pulse rate with SD for groups 1 and 2 was 83 6.5 and 84 7.2, respectively. While the systolic blood pressure was measured at 122 and 126 for groups 1 and 2, the standard deviation was 7.8 and 6.4 for these groups. Diastolic blood pressure was 75 8.2 SD in group 1 and 78 7.9 SD in group 2. SPO2 analysis revealed mean and SD values of 97.3 1.4 SD for group 1, and 97.5 1.1 SD for group 2. The onset of motor block (minutes) was 3.8 0.8 SD for group 1, and 17.5 2.3 SD for group 2. Sensory block onset (minute) was 7.2 1.5 SD for group 1 and 15.6 1.6 SD for group 2. The duration of surgery for group 1 was 49.5 minutes with a standard deviation of 18.8, whereas for group 2, it was 47.6 minutes with a standard deviation of 15.9. The p value for the length of surgery was 0.445. The duration of the motor block was 667 minutes with an SD of 85, and 289 minutes with an SD of 56 and a p value of 0.01. The mean and SD of the length of sensory block in minutes for groups 1 and 2 were 798 13.5 and 355 12.9 minutes, respectively, with a p value of 0.01. The duration of analgesia was 824 minutes on average and 13.8 minutes on SD in group 1, but it was 390 minutes on average and 44 minutes on SD in group 2.

Surrounding the supraclavicular brachial plexus block, which is a common and frequently used regional nerve block treatment for upper extremity surgery, is used to provide preoperative and postoperative analgesia as well as anaesthesia and pain relief. During general anaesthesia, the brachial plexus block is utilised to protect patients from the hazards associated with surgery while they are under anaesthesia. However, when local anaesthetics are employed to block the supraclavicular brachial plexus alone, the duration of postoperative analgesia is significantly shortened. However, analgesia and motor blockage are likely to continue for a short period of time following the treatment if bupivacaine and lignocaine are used in conjunction during surgery. In addition to fentanyl, clonidine, neostigmine, midazolam, buprenorphine, dexmeditomidine, and butorphanol were used as adjuvants with local anaesthesia to induce a rapid, dense, and persistent block of the brachial plexus. Fentanyl was the most commonly used adjuvant with local anaesthesia, followed by clonidine, neostigmine, mid However, in some cases, the findings are equivocal or are associated with serious side effects, as is the case with this study. Because of their considerable anti-inflammatory characteristics, glucocorticoids have been demonstrated in some studies to be effective in extending analgesia.

The supraclavicular method to brachial plexus block will be used in this investigation. In the upper extremities, the supraclavicular brachial plexus block is a popular and very effective regional nerve block that is used to give analgesia and anaesthesia during surgical procedures involving the arms and hands. A short period of time is required to create a thick and predictable anaesthetic for the entire upper extremity to be operated on. It is the most efficient block for the entire upper extremity, and it is performed at the "division" level of the brachial plexus, which is the most superficial level of the plexus.

We utilised lignocaine in conjunction with Adrenaline because it has a rapid onset of action and because bupivacaine has a longer duration of action than lignocaine. We utilised dexamethasone in our study because it has the ability to increase anaesthesia and analgesic duration by up to 50%, which is significant. Because of its non-particulate nature, dexamethasone was chosen as a local anaesthetic adjuvant due to its availability, cost effectiveness, anti-emetic effects, anti-inflammatory characteristics, analgesic properties, and lack of neurotoxicity. The drug's effects on many characteristics were investigated using a supraclavicular brachial plexus block, and the results revealed that it was not neurotoxic. As a result of our research, we have discovered that adding dexamethasone to a topical anaesthetic speeds the onset of sensory and motor blockage. Islam S M[9] Siddharth et al[10] came to the same conclusion as we did, stating that the same amount of 0.5% bupivacaine and 2% lignocain in combination with dexamethasone was utilised in their trial and that they reached the same conclusion as we did. A statistically significant difference between the two groups was not found in the commencement of sensory and motor blockage, according to Shaikh M R[11] and Arish BT[12]. Dexamethasone-induced sensory and motor blockage that manifests itself early may be due to the synergistic action of dexamethasone in combination with local anaesthetic medications, according to the study's authors. While our conclusion of the study is supported by a number of investigations, including those conducted by Biradar, [13] E Devander, [14] Dhumane, and [15] Vaibhav Yadav[16]. It is possible that local nerve fibre activity, rather than systemic activity, is responsible for the block prolonging effect, rather than the other way around. [17] If steroids have an effect on potassium channel activity in excitable cells, it is possible that they will bind to their intracellular receptors and regulate nuclear transcription as a result of this effect. [13,18] In addition to increasing the danger of postoperative damage, maintaining motor blockade for an extended amount of time makes it more difficult to assess whether a medicine has caused neurotoxicity or whether a nerve lesion sustained during surgery has resulted in neurodegeneration. It was also found that administering dexamethasone prolonged postoperative analgesia and reduced the need for rescue anaesthesia, both of which were considered beneficial results after the procedure. The researchers were able to put their findings into numerical form thanks to the VAS rating. In contrast to our study, which used 8mg of dexamethasone, Metei AJ et al. [19] showed that 4mg of dexamethasone produced identical effects. Contrary to popular opinion, the findings were relatively consistent across all of the studies. One study by a group of twenty researchers, including Agarwal, looked into how dexmedetomidine added to bupivacaine altered the effects of an upper brachial plexus block performed with and without dexmedetomidine. They discovered that there were no changes in the outcomes. According to our study, which used dexamethasone + 2% lignocaine with adrenaline in conjunction with bupivacaine and found that sensory blocking began even more quickly

than in the other trial, this could be due to the fact that our study found that sensory blocking began even more quickly than in the other trial. It has been demonstrated that one patient experienced bradycardia after receiving dexmeditomidine; nevertheless, our research indicated that dexamethasone treatment did not have any detrimental impacts.

In addition, patients were examined for signs and symptoms such as pneumonia, hemothorax, and Horner's syndrome, as well as for a phrenic nerve block, which could last up to 24 hours during and after surgery. No statistically significant differences were discovered in the heart rates, blood pressure readings, and oxygen saturation levels before and after surgery when we compared the two groups. (The p-value is more than 0.05, indicating statistical significance.) Aside from pneumothorax and hemothorax, there were no additional block-related disorders such as horner's syndrome or phrenic nerve palsy that were seen. During this investigation, there was no evidence of the manufacturing of a neurotoxic substance. Another study found that some patients experienced difficulties such as Horner's syndrome, dyspnea, and chronic nerve palsy up to 2 weeks and 6 months following Brachial Plexus Block[21], with symptoms lasting up to 6 months in some cases. According to the findings of Shaikh M R's research, Horner's syndrome has a 42% occurrence rate[11]. As a corticosteroid, some individuals are concerned about the safety of using dexamethasone in a nerve sheath because of the way it works. Corticosteroid-mediated neurotoxicity has been linked to the presence of the preservative benzyl alcohol in steroid preparations, and the presence of insoluble steroid particle matter in intravenous preparations, according to recent research findings[22]. There are no particles present in the steroid Dexamethasone Sodium Phosphate, which is used to treat acne (DSP). Neither polyethylene glycol nor benzyl alcohol are contained within this product[22]. Experimental studies on animals have revealed that local corticosteroids administered into peripheral nerves had no long-term effect on the structure, electrical characteristics, or function of the nerves[23]. An experimental paradigm using the rat sciatic nerve revealed that dexamethasone injections delivered extra fascicularly and intra fascicularly resulted in no or only minor peripheral nerve injury, respectively[24].

CONCLUSION

The addition of 15 millilitres of 0.5% bupivacaine to 15 millilitres of dexamethasone significantly accelerates the onset of sensory and motor blockage in the patient. It has been demonstrated to significantly increase the duration of sensory and motor blockage as well as analgesia. It has been demonstrated that dexamethasone adjuvant is completely safe and has no negative effects when used in the brachial plexus block.

Conflict of interest: Nil

Limitations of our Study

1. A ultrasonography guided nerve block was not performed at our clinic at the time due to a lack of availability of the technology.
2. The effect of dexamethasone on glucose homeostasis during wound healing was not investigated in this study.
3. Our study did not include a measurement of sedation level in participants. As a result, it's possible that dexamethasone will have no effect on the sedation score when administered. This approach will be particularly useful in high-risk individuals who do not require sedation during the procedure.
4. There was no longer-term follow-up available due to the short time span, therefore it was impossible to assess whether dexamethasone-induced delayed neurotoxicity had occurred.

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