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DOUBLE BLINDED COMPARATIVE STUDY OF BUPIVACAINE WITH AND WITHOUT DEXAMETHASONE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN SURGERY OF UPPER LIMB

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The aim of current study was to determine the prolongation of local anesthesia in brachial plexus through bupivacaine by the addition of dexamethasone. The study was conducted at Department of Anesthesiology, Khyber Teaching Hospital, Peshawar. 60 patients aged 18 to 60 years having undergone elective surgery on their upper extremities were included in this study. They were separated into two groups of almost equal size. Treatments for patients in Group-1 consisted of 1.5 mL of 0.5 percent bupivacaine and 8 mL of dexamethasone administered intravenously. Participants in Group-2 (the controls) received a 1.5 mL solution containing a 5 percent bupivacaine solution as well as a 9 percent normal saline solution. We compared the two groups to evaluate if there were any differences in the onset, duration, and intensity of postoperative analgesia induced by sensory and motor blocking between the two groups. For group-1 the onset of motor block was 3.8 ± 0.8 minutes and for group-2, it was 17.5 ± 2.3 minutes. Onset of sensory block for group-1 was 7.2 ± 1.5 minutes and for group-2, it was 15.6 ± 1.6 minutes. 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 addition of bupivacaine to dexamethasone significantly accelerates the onset of sensory and motor blockage in the patient. Similarly, dexamethasone adjuvant is completely safe and has no negative effects when used in the brachial plexus block.

Keywords: Anesthesia; Bupivacaine; Brachial Plexus; Dexamethasone; Upper Limb

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. Two drawbacks of brachial plexus block are the time it takes for it to begin functioning and the time it takes for you to feel comfortable once it has begun working. 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 priced, and has additional benefits such as antiemetic, anti-inflammatory, analgesic, and non-neurotoxic properties. The purpose of this study was to determine the effects of combining dexamethasone and bupivacaine on a brachial plexus block (sensory and motor) and postoperative analgesia.

MATERIAL & METHODS

In total, sixty patients participated in our study. The study was conducted at Department of Anaesthesiology, Khyber Teaching Hospital, Peshawar. The Institutional Ethical Committee approval was obtained. An extensive pre-anesthetic assessment was performed on all patients. This assessment included a detailed medical history and physical exam. A nil per oral diet was followed for the length of the night by all of the patients. A written informed consent from patients was obtained in their native language, which was then translated into English. Patients of the age range of 18 to 60 years were included in the study who were willing to give written consent, had no family history of bleeding issues or were not taking anticoagulant therapy and had no neurological impairments which had impact on the brachial plexus and its functions. The patients with pulmonary dysfunction, prior history of adverse effects to any anaesthetic drug and other diseases such as diabetes, hepatic and renal failure were excluded from the study.

The onset of anesthesia to commence in each of the major peripheral nerve distributions (ulnar, radial and medial nerve) after the administration of local anesthetic drug (bupivacaine) was measured. Sensory block was discovered by performing a pinprick using a blunt-end 27-gauge needle to determine its onset. Participants were given a pinprick to assess induction of sensory block at intervals of 0, 2, 5, 10, 15, 20, and 30 minutes. A variety of motor functions were tested 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 ulnar and radial nerve respectively. The median nerve blockade was determined when the patient was unable to oppose the thumb and index finger. Similarly, 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. The duration of motor block was determined by performing an examination every hour following surgery. Patients were encouraged to wiggle and raise their hands in order to determine whether or not their motor function had returned. This time period was recorded and was considered to be the end of the motor block. 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

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. Our study included 18 (29%) female and 42 (71%) male patients. 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. The onset of sensory and motor block is shown in Table 1. The durations of surgery, sensory and motor block are shown in Table 2. Our result showed that there was no significant difference between the duration of surgery under the anaesthesia in both study groups. However, we found a significant difference between duration of motor and sensory block between the two groups. The group of patients receiving bupivacaine with dexamethasone experienced prolong motor and sensory block than the patients only received bupivacaine. Similarly, the difference in duration of the analgesia produced in each group was statistically significant. The analgesia produced in group 1 patients was long lasting than the patients of group 2 receiving only bupivacaine (Table 2).

	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

	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

DISCUSSION

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 utilized 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, dexmedetomidine, 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.

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 utilized 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 percent bupivacaine and 2 percent 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 with 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 dexmedetomidine; nevertheless, our research indicated that dexamethasone treatment did not have any detrimental impacts [20].

CONCLUSION

The addition of bupivacaine to dexamethasone significantly accelerates the onset of sensory and motor blockage in the patient. However, large-scale study is required to elaborate the effects of addition of dexamethasone with bupivacaine in patients with comorbid diseases.

REFERENCES

1. Horlocker TT, Kopp SL, Wedel DJ. Millers anesthesia. vol. 1. Churchill livingstone Elsevier; 2015. p. 1721.
2. Swami SS, Ladi SD, Keniya VM, Rao R. Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. Indian J Anaesth. 2012;56(3):243–9. doi:10.4103/0019-5049.98767.
3. Chandni M, Soni CM, Parikh H. Comparison of the motor and sensory block by ropivacaine and bupivacaine in combination with lignocaine in supraclavicular block. Natl J Med Res. 2013;3(4):353–7.
4. Mcconachie I, Mcgeachie J, Barrie J. Regional anesthetic techniques. In: A Practice of Anesthesia. Wylie and Churchill-Davidsons;. p. 621.
5. Shrestha BR, Maharjan SK, Tabedar S. Supraclavicular Brachial Plexus Block with and without Dexamethasone - a Comparative Study. Kathmandu Univ Med J. 2003;1(3):158–60.
6. Pathak RG, Satkar AP, Khade RN. Supraclavicular brachial plexus block with and without dexamethasone - a comparative study. International Journal of Scientific and Research Publications. 2012;2(12):1–7.
7. Ma R, Wang X, Lu C, Li C, Cheng Y, Ding G, et al. Dexamethasone attenuated bupivacaine-induced neuron injury in vitro through a threonine–serine protein kinase B-dependent mechanism. Neurosci. 2010;167(2):329–42. doi:10.1016/j.neuroscience.2009.12.049.
8. Talukdar M, Begum H, Shoman MM, Khatun UHS. Anaesthetic and analgesic effects of adding dexamethasone to bupivacaine in supraclavicular brachial plexus block - a comparative study. J Bangladesh Coll Physicians Surg. 2013;31:11–7.
9. Islam SM, Hossain MH, Maruf AA. Effect of addition of dexamethasone to local Anaesthetics in supraclavicular Brachial plexus block. JAFMC Bangladesh. 2011;7:11–4.
10. Khobragade SM, Tadwalkar G, Patil T. Dexamethasone as an adjuvant to local anaesthetic in supra clavicular block -a comparative study. Paripex-Indian J Res. 2016;5(3).
11. Shaikh MR. Role of dexamethasone in supraclavicular brachial plexus block. J Dent Med Sci. 2013;1(12):1–7.
12. Arish BT, Babu DD, Lazarus SP, Chandar DD, Balasubramanian S, Kumar KS. Effect of dexamethasone as an adjuvant to local anesthetic in supraclavicular brachial plexus block. Int J Sci Stud. 2016;3(10):147–53.
13. Biradar PA, Kaimar P, Gopalakrishna K. Effect of dexamethasone added to lidocaine in supraclavicular brachial plexus block: A prospective, randomised, double-blind study. Indian J Anaesth. 2013;57(2):180. doi:10.4103/0019-5049.111850.
14. Devander E, Srikanth S. Supraclavicular Brachial plexus block using Lidocaine with Adrenaline and Dexamethasone as an adjunct- A study on 60 cases. Perspect Med Res. 2015;3(2):6–10.
15. Dhumane P, Shakir N. Supraclavicular Brachial Plexus Block with and without Dexamethasone as an Adjuvant to local anaesthetics: a Comparative Study. Int J Biomed Adv Res. 2016;7(9):456–9. doi:10.7439/ijbar.v7i9.3625.
16. Yadav V, Jain A, Dahiya A. Clinical Comparison Between 0.5% Bupivacaine and 0.5% Bupivacaine-Dexamethasone 8Mg Combination in Brachial Plexus Block by. 2015;4(12):348–51.
17. Kopacz DJ, Lacouture PG, Wu D, Nandy P, Swanton R, Landau C. The dose response and effects of dexamethasone on bupivacaine microcapsules for intercostal blockade (T9 to T11) in healthy volunteers. Anesth Analg. 2003;96:576–82.
18. Castillo J, Curley J, Hotz J, Uezono M, Tigner J, Chasin M, et al. Glucocorticoids Prolong Rat Sciatic Nerve Blockade In Vivo from Bupivacaine Microspheres. Anesthesiol. 1996;85(5):1157–66. doi:10.1097/00000542-199611000-00025.
19. Meitei AJ. Supraclavicular Brachial Plexus Block with and Without Dexamethasone as an Adjuvant to Bupivacaine-Lignocaine for Perioperative Analgesia in Patients Undergoing Upper Limb Surgery: A Comparative Study. IOSR J Dent Med Sci. 2016;15(10):24–7.
20. Agarwal S, Aggarwal R, Gupta P. Dexmedetomidine prolongs the effect of bupivacaine in supraclavicular brachial plexus block. J Anaesthesiol Clin Pharmacol. 2014;30(1):36–40. doi:10.4103/0970- 9185.125701.