To Study the Efficacy of Intravenous Dexamethasone in Prolonging the Duration of Spinal Anesthesia in Elective Cesarean Section

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Abstract

Background and Aims: Various additives have been evaluated for the purpose of enhancing quality of analgesia and prolonging duration of spinal anesthesia. This randomized, double-blind study was conducted to evaluate the efficacy of intravenous dexamethasone in spinal anesthesia. Methods: A total of sixty patients scheduled for lower segment cesarean section under spinal anesthesia were randomly allocated into two groups, group SD and group SN, including thirty patients each. All the patients received injection bupivacaine 0.5% heavy 10 mg through spinal anesthesia. Group SD received injection dexamethasone 8 mg intravenously, and group SN received injection normal saline (NS) 2 cc immediately after spinal anesthesia. Duration of sensory block, motor block, postoperative analgesia, visual analog pain scale (VAS) score, time of rescue analgesia, total analgesic requirement in the first 24 h, intra- and post-operative hemodynamics, and side effects if any were recorded. Whenever demanded rescue analgesia was given in the form of injection tramadol 100 mg. Results: The mean duration of sensory block (min) in group SD and group SN was 162.50 and 106.17, respectively which was highly significant. Similarly, time to the requirement of first rescue analgesia was prolonged in group SD (8.67 h) as compared to group SN (4.40 h). Significant changes were also seen in VAS score in postoperative period after 1 h of surgery in group SD and group SN. Duration of motor block, intra- and post-operative hemodynamic parameters were comparable in both the groups. No side effects were recorded in both the groups. Conclusion: We concluded that administration of dexamethasone 8 mg intravenously prolongs the duration of postoperative analgesia and sensory block in patients undergoing lower segment cesarean section under spinal anesthesia.

Keywords: Dexamethasone, postoperative analgesia, spinal anesthesia

INTRODUCTION

Spinal anesthesia technique is widely used for perioperative anesthesia and analgesia in cesarean section patient. It also has an important role in facilitating ambulatory anesthesia and reducing immediate postoperative pain. Inadequate pain relief results in delayed recovery and prolonging the hospital stay ultimately increasing health-care cost. Unwanted effects of anesthetic drugs which are used during general anesthesia, maternofetal transfer, stress of laryngoscopy, and tracheal intubation can be avoided with the use of regional anesthesia.[1] However, the duration of sensory block and analgesia is relatively short with single shot subarachnoid block. Hence, along with local anesthetic, adjuvants such as fentanyl, morphine, clonidine, ephedrine, pethidine, dexmedetomidine are used.[2] However, these may lead to certain side effects such as sedation, nausea, vomiting, pruritus, respiratory depression, hypotension, psychotomimetic effects, etc.[3] Hence, drugs having minimal side effects and prolonged analgesia is always looked for.

Dexamethasone is potent, selective glucocorticoid having minimal mineralocorticoid action.[4,5] Systemic
anti-inflammatory and immunosuppressive properties may be responsible for the prolongation of analgesia when administered intravenously. Various studies proved the efficacy of steroids for the prolongation of effects of regional nerve blocks.[6] We decided to conduct the present study to evaluate the effects of intravenous (IV) dexamethasone on subarachnoid block in patients posted for lower segment cesarean section.

The primary objective of our study was to evaluate the efficacy of IV dexamethasone in prolonging the duration of postoperative analgesia, to study the effect on spinal anesthesia (sensory and motor block), and to measure total tramadol requirement in first 24 h. Secondary outcomes include effects on hemodynamic and incidence of complications (postoperative nausea and vomiting [PONV], shivering, etc.).

**Methods**

After obtaining institutional ethical clearance and informed consent, sixty female patients aged between 25 and 30 years posted for elective cesarean section surgery, belonging to the American Society of Anesthesiologists (ASA) health status classes I and II were included in the study. Patients were randomly divided into two groups, group SD and SN, including thirty patients each. Patients having bleeding diathesis, severe hypovolemia, infection at the site of injection, fetal distress, severe preeclampsia, eclampsia, cord prolapse, patients on chronic steroid therapy, etc., were excluded from the study. Both groups received spinal anesthesia with 0.5% heavy bupivacaine 2 cc.

Thorough preanesthetic check-up of all patients including all routine investigations was done. The procedure was explained to the patients, and written informed consent was taken. After shifting the patient to operating theater, baseline values of heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), and oxygen saturation were recorded. After securing IV access, injection ondansetron 4 mg given intravenously. All patients received IV preload 10 mg/kg lactated ringers solution before subarachnoid block. With aseptic techniques, 26-gauge Quincke needle was inserted intrathecally at L3–L4 or L4–L5 interspace by midline approach with the patient in sitting position. After successful dural puncture anesthetic solution, injection bupivacaine 0.5% heavy 10 mg was injected. Patients were placed in the supine position once the drug was administered. Sensations were tested by the pinprick method with 23-gauge needle and quality of motor block was assessed using Bromage score. The level of D6 block was achieved in all patients. Visual analog pain scale (VAS) scores were explained to all patients preoperatively and were recorded for 24 h postoperatively. Patients were randomly divided using computer-generated random number table into two groups SD and SN. Group SD received injection dexamethasone 8 mg intravenously, and group SN received injection NS 2 cc immediately after spinal anesthesia.

Systolic and diastolic pressures were recorded 5 min before (baseline) and every 5 min for the first 20 min after subarachnoid block and there after every 5 min till the end of surgery. Duration of analgesia was recorded as the time from intrathecal injection to the time of the first complaint of pain or VAS score more than 4. No additional analgesia was administered unless patient complained of pain or when VAS score was more than 4, whichever occurred earlier. Whenever demanded rescue analgesia was given in the form of IV tramadol 100 mg. The time of rescue analgesia and total analgesic dose in the first 24 h was recorded.

Data were compiled systematically and Mann–Whitney U-test was used to analyze the data. \( P < 0.05 \) was considered statistically significant and \( P < 0.001 \) as highly significant.

**Statistical analysis**

Statistical analysis was conducted with Statistical Package for Social Sciences (SPSS version 19.0) (SPSS, Inc, Chicago IL, USA). To calculate the sample size, a power analysis of alpha = 0.05 and 0.09 showed that thirty patients per study group were needed. Parametric variables such as age, weight, HR, SpO\(_2\), SBP, DBP were analyzed with \( t \)-test while for nonparametric data (VAS), Mann–Whitney test was applied. A \( P < 0.05 \) was considered statistically significant.

**Results**

The study was conducted in sixty patients. In both the groups, patient’s demographic profiles were comparable with regard to age, weight, and ASA status [Figure 1].

In our study, mean duration of sensory block in SD group was 162.50 min, whereas in SN group, it was 106.17 which was statistically significant with \( P < 0.001 \) [Figure 2].

The mean duration of motor block in group SD and group SN was 169.5 and 163.17, respectively which was not statistically significant \( (P > 0.05) \) [Figure 3].

In addition, mean time to requirement of the first rescue analgesia was 8.67 h in group SD; whereas in group SN, it was 4.40 which was also of high statistical significant \( (P < 0.001) \).

Significant changes were also seen in VAS score in the postoperative period after 1 h of surgery in group SD and group SN [Table 1].

![Figure 1: Mean duration of sensory block (min)](image-url)
There was no significant difference seen in heart rate, SBP, DBP, oxygen saturation in both the groups throughout the study as compared to preoperative value.

**Discussion**

The results of the current study indicate that administration of dexamethasone (8 mg) intravenously in patients undergoing lower segment cesarean section under spinal anesthesia results in prolonging the duration of sensory block and postoperative analgesia without any complications. Multimodal analgesia is the most appropriate and feasible modality to render patient pain free.[7,8]

Postsurgical pain may be attributed to direct tissue damage, nerve injury, or inflammation.[9] Out of these, acute inflammation induced by tissue injury is considered to play an important role in the genesis of pain.[7,9] With varying rate of success, variety of additives ranging from opioids to alpha 2 agonists has been used either intrathecally or intravenously for the prolongation of regional blockade. Plethora of drugs, interventions, and techniques are available to deal with postoperative pain. Multimodal analgesia is the most appropriate and feasible modality to render patient pain free.[7,8] Dexamethasone, a high potency glucocorticoid, has also been used successfully for prolonging the action of local anesthetic drugs.[4,5]

When used perineurally dexamethasone causes vasoconstriction and slower the absorption local anesthetic drug and prolongs its action.[9] There are various studies reporting perineural use of dexamethasone in nerve block including epidural, femoral, brachial plexus, sciatic, facial, and dental blocks for the prolongation of both sensory and motor block.[8,10-14] IV use of dexamethasone also attenuates the need for analgesia in orofacial, laparoscopy, urethral, and orthopedic surgeries.[9,15-19] There are certain studies which illustrated that perineural and IV dexamethasone has equal efficacy. A study conducted by Abdelmonem and Rizk concluded that when dexamethasone, whether IV or local is added to bupivacaine in perianal block extend the postoperative analgesia.[17] Similar findings were also confirmed by Desmet *et al.*[9] Based on the results of above studies and the use of currently available dexamethasone (with preservative) intrathecally being questionable, we decided to use dexamethasone intravenously. The precise mechanism of action of dexamethasone is not known. After intracellular uptake, glucocorticoid activates cytoplasmic glucocorticoid receptors which bind to glucocorticoid response elements in the DNA. This leads to both decreased production of inflammatory proteins such as COX-2, iNOS, cytoplasmic PLA2, interlukins, inflammatory chemokines, etc., and increased production of anti-inflammatory proteins. Which results in reduction in edema, scar tissue formation, and suppression of immune response.[9,10]

Dose of dexamethasone also differs in different types of surgeries ranging from 4 mg to 16 mg. However, the optimal dose is still not defined. In a study conducted by Oliveria *et al.*, comparison is done on the basis of dose of dexamethasone by dividing into three groups, low dose (0.1 mg/kg), intermediate dose (0.1–0.2 mg/kg), and high dose (more than 0.2 mg/kg). They concluded that a dose of dexamethasone at 0.1 mg/kg is an effective adjuvant in multimodal strategies to reduce postoperative pain and opioid consumption.[5] The difference in dose of dexamethasone may be dependent on the extent of surgery and intensity of tissue damage and hence the
requirement.\[^{[10]}\] We found 8 mg dexamethasone to be sufficient in our study. The studies have been conducted with variations in the time of administration of drug. As the analgesic effect is seen when the peak level of the drug is achieved, studies in which dexamethasone was administered early showed better postoperative pain relief and reduced analgesia requirement.\[^{[10,15]}\] Bisgaard \textit{et al.} have shown decrease in postoperative pain in patients undergoing laparoscopic surgery where they had administered dexamethasone 90 min before skin incision.\[^{[15]}\] The reason being that the prominent effect of glucocorticoid is through an altered protein synthesis via gene transcription. Hence, the time of onset of drug is generally from 1 to 2 h. Hence, drug administered immediately before the incision does not suppress mediators of inflammation. In the present study, IV dexamethasone was administered immediately after spinal anesthesia.

In our study, VAS was significantly lower with dexamethasone group as compared to control group. We observed increase in the duration of postoperative analgesia and the first analgesic requirement was also prolonged. The total dose of tramadol consumption is reduced in the first 24 h after surgery. Prolongation of sensory blockade is also seen without delaying in motor blockade. These findings are in consistent with other studies where IV dexamethasone is proved better for postoperative pain relief.\[^{[9-11]}\]

Dexamethasone also has antiemetic action; proposed mechanism is the presence of glucocorticoid receptors on the central nuclei that are involved in control of nausea and vomiting, decrease in 5-HT turnover in central nervous system, or changes in permeability of blood-cerebrospinal fluid barrier to serum proteins.\[^{[20]}\] However, in contrast to above finding, our study has not shown any significant effect on PONV. Nortcliffe \textit{et al.} also observed similar outcome in cesarean section patients.\[^{[20]}\]

There are certain limitations to our study. We conducted this study only on ASA 1 and ASA 2 group of pregnant patients posted for lower segment caesarean section under spinal anesthesia. Second, we followed up the patients only till 24 h. The minimum therapeutic dose of IV dexamethasone capable of prolonging the duration of analgesia has not been evaluated. Hence, it is possible that dose used may have been more than the required. Nonetheless, in literature, it is studied that 8 mg is the most effective dose. It was found that single dose does not inhibit hypothalamic pituitary adrenal axis. In addition, there is no any adverse effect seen as impaired wound healing, increase blood sugar level, and gastrointestinal discomfort.\[^{[4]}\] Hence, it is unlikely that the patients in our study exhibited any delayed untoward effects.

**Conclusion**

Administration of injection dexamethasone 8 mg intravenously significantly prolongs the duration of postoperative analgesia and sensory block in patients undergoing lower segment cesarean section under spinal anesthesia.

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**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Kulenkampff D. Brachial plexus anaesthesia: Its indications, technique, and dangers. Ann Surg 1928;87:883-91.
2. Neal JM, Hebl JR, Gerancher JC, Hogan QH. Brachial plexus anesthesia: Essentials of our current understanding. Reg Anesth Pain Med 2002;27:402-28.
3. Patrick J. Technique of brachial plexus block anaesthesia. Br J Surg 1940;27:734.
4. Salerno A, Hermann R. Efficacy and safety of steroid use for postoperative pain relief. Update and review of the medical literature. J Bone Joint Surg Am 2006;88:1361-72.
5. De Oliveira GS Jr, Almeida MD, Benzon HT, McCarthy RJ. Perioperative single dose systemic dexamethasone for postoperative pain: A meta-analysis of randomized controlled trials. Anesthesiology 2011;115:575-88.
6. Hong YJ, Han SW, Kim WO, Kim EJ, Kil HK. Effect of dexamethasone in combination with caudal analgesia on postoperative pain control in day-case paediatric orchiopexy. Br J Anaesth 2010;105:506-10.
7. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade. Anesth Analg 2006;102:263-7.
8. Cummings KC 3rd, Napierkowski DE, Parra-Sanchez I, Kurz A, Dalton JE, Brems BJ, \textit{et al.} Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. Br J Anaesth 2011;107:446-53.
9. Desmet M, Braemns H, Reynvoet M, Plasschaert S, Van Cauwelaert J, Pottel H, \textit{et al.} I.V. and perineural dexamethasone are equivalent in increasing the analgesic duration of a single-shot interscalene block with ropivacaine for shoulder surgery: A prospective, randomized, placebo-controlled study. Br J Anaesth 2013;111:445-52.
10. Jain R, Dua CK. Comparative analgesic efficacy of different doses of dexamethasone during infraumbilical surgery: A Randomized controlled trial. Anesth Essays Res 2015;9:34-8.
11. Parveen S, Athaluri VV, Lakshmi BS. Effect of intravenous dexamethasone in prolonging the duration of supraclavicular brachial plexus block with 0.5% ropivacaine: A prospective, randomized, placebo controlled study. Int J Sci Study 2015;2:56-60. [DOI: 10.17354/ijss/2015/13].
12. Asad MV, Khan FA. Effect of a single bolus of dexamethasone on intraoperative and postoperative pain in unilateral inguinal hernia surgery. J Anaesthesiol Clin Pharmacol 2015;31:339-43.
13. Jehan MK, Abdel-Halim MD. The effect of preoperative single shot dose of epidural magnesium sulphate or dexamethasone as adjuvants to local anaesthesia. Ain Shams J Anaesthesiol 2011;4:3:83-91.
14. Thomas S, Beevi S. Epidural dexamethasone reduces postoperative pain and analgesic requirements. Can J Anaesth 2006;53:899-905.
15. Bisgaard T, Klarskov B, Kehlet H, Rosenberg J. Preoperative dexamethasone improves surgical outcome after laparoscopic cholecystectomy: A randomized double-blind placebo-controlled trial. Ann Surg 2003;238:651-60.
16. Baxendale BR, Vater M, Lavery KM. Dexamethasone reduces pain
and swelling following extraction of third molar teeth. Anaesthesia 1993;48:961-4.

17. Abdelmonem A, Rizk SN. Comparative study between intravenous and local dexamethasone as adjuvant to bupivacaine in perianal block. Egypt J Anaesth 2011;27:163-8.

18. Elhakim M, Ali NM, Rashed I, Riad MK, Refat M. Dexamethasone reduces postoperative vomiting and pain after pediatric tonsillectomy. Can J Anaesth 2003;50:392-7.

19. Bigat Z, Bozlug N, Hadimioglu N, Cete N, Coskulnifrat N, Ertok E. Does dexamethasone improve the quality of intravenous regional anesthesia and analgesia? A randomized, controlled clinical study. Anesth Analg 2006;102:605-9.

20. Nortcliffe SA, Shah J, Buggy DJ. Prevention of postoperative nausea and vomiting after spinal morphine for caesarean section: Comparison of cyclizine, dexamethasone and placebo. Br J Anaesth 2003;90:665-70.