

Comparing Dexamethasone and Dexmedetomidine as Adjuvants for Tap Block After Abdominal Hysterectomy Under Spinal Anaesthesia

Vasanth Kumar J¹, Rachana S Kori²

¹Associate Professor, ²Post Graduate Student, Department of Anaesthesiology, Bangalore Medical College and Research Institute, Bengaluru, Karnataka 560002, India.

Abstract

Background and Aim: Ultrasound guided transversus abdominis plane (TAP) block is a safe, effective analgesic technique for lower abdominal surgeries. This study is designed to compare dexamethasone and dexmedetomidine as adjuvants for TAP block in patients undergoing abdominal hysterectomy under spinal anaesthesia.

Materials and methods: After ethics committee approval and informed written consent, 30 Patients were allocated into 2 groups each by randomized double-blind design using a computer generated randomization posted for abdominal hysterectomy under spinal anaesthesia. Group D1 received Inj Bupivacaine 0.25% 20ml + Inj Dexamethasone 4mg + 1ml normal saline in TAP Block on each side. Group D2 received Inj Bupivacaine 0.25% 20ml + Dexmedetomidine 25mcg+ 1ml normal saline in TAP Block on each side at the end of surgery under ultrasound guidance. Assessment parameters included hemodynamic, post operative VAS score, duration of post operative analgesia, total dose of post operative rescue analgesia and side effects.

Results: There was no significant difference in Heart rate and Mean arterial blood pressure in both the groups. In the first 8 hr post operative VAS score was lower in GROUP D1 compared to GROUP D2 ($p < 0.05$). Duration of post operative analgesia was longer in GROUP D1 compared to GROUP D2 ($p < 0.05$). Total dose of post operative rescue analgesia consumption in 24hrs was lower in GROUP D1 than in GROUP D2 ($p < 0.05$). No significant side effects were noted.

Conclusion: Dexamethasone as an adjuvant to bupivacaine in TAP block has prolonged postoperative analgesia and has reduced requirement of rescue analgesia than dexmedetomidine following abdominal hysterectomy under spinal anaesthesia.

Keywords: Dexamethasone; Dexmedetomidine; Post operative analgesia; Transversus abdominis plane block.

How to cite this article:

Vasanth Kumar J, Rachana S Kori / Comparing Dexamethasone and Dexmedetomidine as Adjuvants for Tap Block After Abdominal Hysterectomy Under Spinal Anaesthesia. Indian J Anesth Analg. 2021;8(1):117-122.

Introduction

Hysterectomy is a frequent surgery performed in women, due to the substantial incision and soft-

tissue undermining associated with this operation, it could result in moderate to severe postoperative pain which affects multiple systems and induces physiological, immunological, and psychological

Corresponding Author: Rachana S Kori, Post Graduate Student, Department of Anaesthesiology, Bangalore Medical College and Research Institute, Bengaluru, Karnataka 560002, India.

E-mail: rachana.kori@gmail.com

Received on 03.12.20, **Accepted on** 23.01.2021.

changes.¹ Successful management of postoperative pain can have an impact on a patient's quality of life. Neuraxial block has many advantages over general anaesthesia like easier to perform, rapid onset of action and good muscle relaxation. One of the main disadvantage is its limited duration of action and hence lack of postoperative analgesia.²

Traditionally NSAIDs (non steroidal anti inflammatory drugs) or opioids used for post operative analgesia, however the use of systemic analgesics is confined for short period of time and associated with frequent side effects, including gastrointestinal problems, kidney dysfunction, nausea and vomiting, and reduced bowel mobility.³

There are different modalities to reduce the post-operative pain of lower abdominal surgery, including systemic analgesia with non-steroid anti-inflammatory drugs (NSAIDs), opioids, intravenous patient controlled analgesia and regional analgesic techniques like port-site local anesthetic infiltration, patient controlled epidural analgesia, Transversus Abdominis plane block.

Transversus Abdominis Plane⁴ containing the thoraco-lumbar nerves originating from T6 to L1 lies between the internal oblique and transversus abdominis. Dexamethasone, tramadol, buprenorphine, clonidine, dexmedetomidine have been used as adjuvants⁵ for transverses abdominis plane block for postoperative analgesia for lower abdominal surgeries.

Dexmedetomidine⁶, alpha-2(α_2) adrenergic receptor (AR) agonist has been the focus of interest due to sedative, analgesic, and haemodynamic stabilizing properties and prolonged postoperative analgesia with minimal side effects. Site of action of dexmedetomidine are prejunctional and postjunctional α_2 receptors present in the dorsal horn of the spinal cord. Activation of presynaptic receptors reduces neurotransmitter release, whereas postjunctional receptor activation results in hyperpolarization and reduction of pulse transmission. It has a relatively high ratio of α_2/α_1 activity (1620:1) and lack respiratory depression, making it a safe adjuvant.

Dexamethasone⁷ is also used as an adjuvant. Steroid induces vasoconstriction, which decreases the absorption of local anaesthetic solution. Alternatively, dexamethasone blocks nociceptive impulse transmission along unmyelinated C-fibers through its anti-inflammatory and/or immunosuppressive effect.⁸ After intracellular uptake, glucocorticoids activate cytoplasmic receptors that bind to their response elements

in DNA. Hence decreasing the production of inflammatory proteins (eg, cyclooxygenase-2, inducible nitric oxide synthase, cytoplasmic phospholipase A2, interleukins, and inflammatory chemokines) and increasing the production of anti-inflammatory proteins (lipocortin-1 receptor antagonist).

This study is designed to compare dexmedetomidine and dexamethasone as an adjuvant for Transversus abdominis plane block after abdominal hysterectomy under spinal anaesthesia.

Materials and Methods

After approval from the institutional ethical committee and a written informed consent, a prospective randomised double blinded study was conducted in 60 patients, belonging to ASA Classes I or II, aged between 18- 60years, weighing 50-80kg posted for elective abdominal hysterectomy under spinal anaesthesia.

Exclusion criteria included patient's refusal, allergy to study drug, contraindication to spinal anaesthesia, those who required general anaesthesia for surgery, morbid obesity, or chronic analgesic user, patients with cardiac dysarrhythmia, patients using adrenergic receptor blockers, calcium channel blockers and with height less than 140cm.

Patients were allocated into 2 groups in a controlled, randomized double-blind design using a computer generated randomization list to receive either 20ml of 0.25% bupivacaine with dexamethasone 4mg (1ml) making total volume of 22ml using normal saline (GROUP D1) or 20ml of 0.25% bupivacaine with dexmedetomidine 25mcg (0.25ml) making total volume of 22ml using normal saline (GROUP D2).

All patients were evaluated preoperatively on the previous day of surgery. Procedure and the use of visual analogue scale (VAS) for pain was explained to the patient. Tablet alprazolam 0.5mg was given night before surgery. On the day of surgery, an 18G intravenous line was secured. On arrival in the operating room, patient was preloaded with lactated Ringer's solution @15ml/kg. Monitors like automated non invasive blood pressure (NIBP), pulse oxymetry, an electrocardiogram was connected to the patient in operation theatre and base line parameters like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) were noted. These patients did not receive any intravenous analgesics

or sedatives during the surgery. Under all aseptic precautions, spinal anesthesia was administered with 0.5% bupivacaine 2.8ml intrathecally.

After spinal anaesthesia patient was positioned in supine position and supplemented with oxygen (4L/min) through face mask and surgery was allowed to proceed after confirming the attainment of sensory blockade of T6. Intra operative monitoring of HR, SBP, DBP, MAP was done as usual. Intraoperative hypotension i.e systolic blood pressure (SBP) <90mm of Hg or <20% of the baseline whichever appeared first was treated with ephedrine (3mg aliquots) as and when necessary. Bradycardia was treated with atropine 0.02mg/kg if heart rate (HR) decreased to <60/min.

At the end of surgery, TAP block was administered under ultrasound guidance by in plane technique using Sonosite Nano Maxx USG Machine in both the groups with doses as described above. Success of the block was confirmed by the distribution of local anesthetic as a hypoechoic enlargement on ultrasonography.

Pain was assessed postoperatively at 0hr (at the time when patient is shifted to Post anaesthesia care unit-PACU) 2, 4, 8, 12 and 24 hours using a VAS score. At any time during post operative period if the VAS score is equal to or more than 4, rescue analgesia of tramadol 50mg was administered intravenously and time of administration noted. The total consumption of rescue analgesia in first 24hr was recorded. Any side effects (nausea or vomiting) were recorded.

Statistical analysis

Statistical analysis was done using the statistical software system, SPSS

version 18.0 (SPSS Inc., Chicago, IL, USA). Student's t test was used for numerical data. Categorical data were analyzed by Chi square test or Fisher's exact test as appropriate. Results were expressed as mean \pm standard deviation, number or percentage (%). Results were considered statistically significant if $P < 0.05$.

Pain was assessed post operatively at 0hr (at the time when patient is shifted to Post anaesthesia care unit-PACU) 2, 4, 8, 12 and 24 hours using a VAS score. At any time during post operative period if the VAS score is equal to or more than 4, rescue analgesia of tramadol 50mg was administered intravenously and time of administration noted. The total consumption of rescue analgesia in first 24hr was recorded. Any side effects (nausea or vomiting) were recorded (Fig. 3)

Results

The mean age in GROUP D1 was 45.9 \pm 4.6 and in GROUP D2 was 46.2 \pm 4.3. The mean body weight in GROUP D1 was 58.5 \pm 6.2 and in GROUP D2 was 59.5 \pm 5.3. The demographic data of the patients in both groups were comparable. (Fig. 1,2)

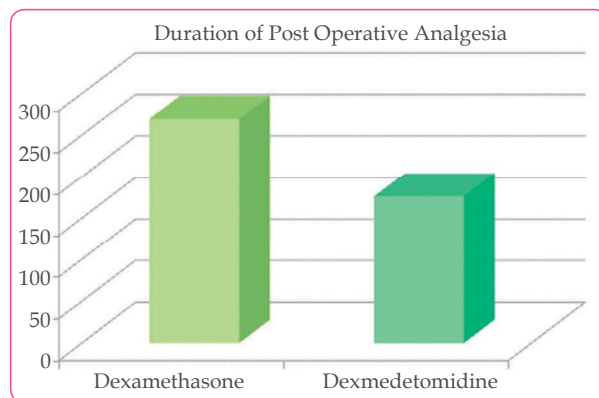


Fig.1: Duration of Post Operative Analgesia.

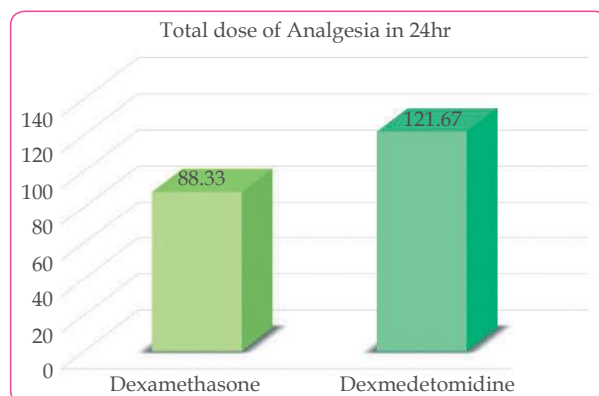


Fig.2: Total dose of Analgesia in 24hr.

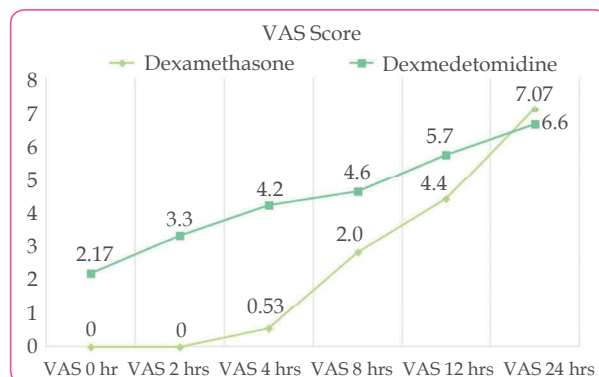


Fig.3: VAS Score.

The duration of post operative analgesia was longer in GROUP D1 than in GROUP D2 (269 \pm 79 vs 176 \pm 92, $p < 0.05$). The total dose of consumption of rescue analgesia was lower in GROUP D2 THAN IN GROUP D1 (86.33 vs 121.67, $p < 0.05$). GROUP

D1 experienced lower post operative pain scores than GROUP D2 especially in first 8hrs ($p < 0.05$). Hemodynamic parameters were comparable between the two groups. No significant side effects were noted within the patients.

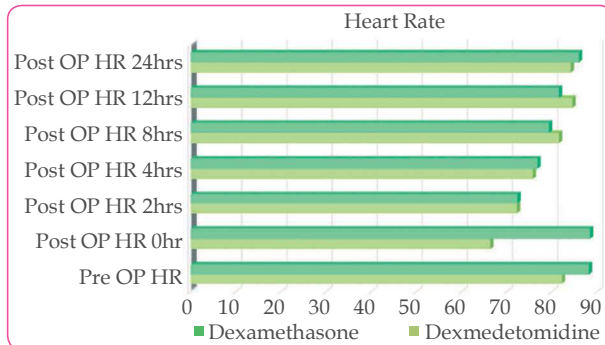


Fig. 4: Heart Rate.

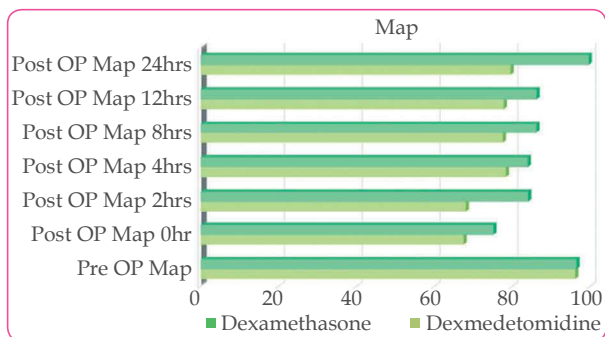


Fig. 5: Map.

Discussion

Abdominal hysterectomy is usually associated with considerable pain during the postoperative period, which may affect multiple systems and induce physiological, immunological, and psychological changes.

Adequate postoperative analgesia causes reduction in the postoperative stress response and postoperative morbidity and in certain types of surgeries postoperative analgesia does yield an improved surgical outcome.⁹⁻¹¹ Other benefits of effective regional analgesic techniques include reduced pain intensity, decrease in the incidence of side effects from analgesics and improved patient comfort.¹²

TAP block as a regional analgesic technique for postoperative analgesia is gaining popularity; it may play a role in major abdominal surgeries. Adjuvants are used to intensify the quality and increase the duration of local anesthetics in different regional block techniques.

A randomised study conducted by G. Niraj, et

al., 2009¹³ on 52 adult patients undergoing open appendectomy under general anaesthesia, a right-sided ultrasound guided TAP block with 20ml of bupivacaine 0.5% was given for post operative analgesia and results were significantly reduced post operative morphine consumption in the first 24 hour.

Deshpande JP et al.,¹⁴ studied the analgesic efficacy of dexamethasone (4mg) added to ropivacaine in transversus abdominis plane block for transabdominal hysterectomy under subarachnoid block. Addition of dexamethasone to ropivacaine TAP block prolonged the postoperative analgesia and reduced post operative analgesic requirement following abdominal hysterectomy under spinal anesthesia. Corticosteroid induces analgesic action by their anti inflammatory or immunosuppressive effects.^{15,16} Analgesic action of steroid is by modulation of nuclear transcription.¹⁶ In addition, steroids potentiate the action of local anesthetic through modulation of the function of the K⁺ channels in excitable cells and also by vasoconstriction which decreases the absorption of the drug.¹⁷ Corticosteroids are also found to have analgesic effect due to their systemic effects.¹⁸ A recent in vivo animal safety models show no adverse event levels and potential neuroprotection and antihyperalgesic effects with clinically relevant dosing of perineural dexamethasone to bupivacaine.^{19,20} Many studies have recommended the use of dexamethasone to potentiate analgesia and anesthesia of local anesthetic agents administered through various routes.

Dexmedetomidine, a strong and highly selective α_2 -adrenoceptor agonist, when added to local anesthetics, it could enhance the analgesic efficacy of local anesthetics.

A study conducted by Rai P et al.,²¹ studied the effect of addition of dexmedetomidine (0.5mcg/kg) to ropivacaine (0.25% 20ml) in transversus abdominis plane block on postoperative pain in lower segment caesarean section under spinal anaesthesia. The time for first analgesic dose was longer in dexmedetomidine group. VAS score was found to be lower in all post-operative points for the first 6 hrs in dexmedetomidine group. Hence the authors concluded the addition of dexmedetomidine to ropivacaine in TAP block helps achieve better analgesia and decreases the total dose of analgesics required post-operatively without any major side-effects.

Another study conducted by Ramya Parameswari A et al.,²² to compare the efficacy of 20ml of bupivacaine (0.25%) with 0.5 μ g/kg of

Dexmedetomidine and 20ml Bupivacaine (0.25%) alone for TAP block for Post-operative Analgesia in Patients Undergoing Elective Caesarean Section under spinal anaesthesia. The addition of dexmedetomidine to bupivacaine in TAP block prolonged the duration of post operative analgesia.

In our study, post operative analgesia with the addition of dexamethasone (GROUP D1) or dexmedetomidine (GROUP D2) to bupivacaine in TAP block was compared. The average VAS score in patients who received TAP with dexamethasone was significantly lower than those who received dexmedetomidine. Further, the duration of analgesia was 269 minutes longer in the first group who received dexamethasone TAP. The total dose of rescue analgesic requirement was lower in group D1 compared to GROUP D2. There were no significant side effects in both the groups.

The limitation of the present study is that the extent of block under spinal anaesthesia could not be assessed which can be vital in assessing successful block.

Conclusion

Addition of dexamethasone to bupivacaine in TAP block prolonged the duration of postoperative analgesia and reduced the analgesic requirements compared to addition of dexmedetomidine following open abdominal hysterectomy without any major side effects. We recommend the routine use of a dexamethasone as an adjuvant to bupivacaine in TAP block as part of multimodal analgesic regimen after abdominal hysterectomy to enhance the recovery process and render patient pain free.

References

- Holte K, Kehlet H. Effect of postoperative epidural analgesia on surgical outcome. *Minerva Anesthesiol* 2002; 68(4):157-61.
- Kehlet H, Rung GW, Callesen T. Postoperative opioid analgesia: time for a reconsideration?. *J Clin Anesth* 1996; 8(6):441-445.
- David LB. Spinal, epidural and caudal anesthesia. In: Miller RD, editor. *Miller's Anaesthesia*. 7th ed. Vol. 2. Philadelphia: Churchill Livingstone; 2010. p. 1611-38.
- Rozen WM, Tran TM, Ashton MW, Barrington MJ, Ivanusic JJ, Taylor GI. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clinical Anatomy: The Official Journal of the American Association of Clinical Anatomists and the British Association of Clinical Anatomists*. 2008 May;21(4):325-33.
- McDonnell JG, O'Donnell BD, Farrell T, Gough N, Tuite D, Power C, Laffey JG. Transversus abdominis plane block: a cadaveric and radiological evaluation. *Regional anesthesia and pain medicine*. 2007 Sep 1;32(5):399-404.
- Grewal A. Dexmedetomidine: new avenues. *Journal of anaesthesiology, clinical pharmacology*. 2011 Jul;27(3):297.
- Albrecht E, Kern C, Kirkham KR. A systematic review and meta-analysis of perineural dexamethasone for peripheral nerve blocks. *Anaesthesia*. 2015 Jan;70(1):71-83.
- Johansson A, Hao J, Sjölund B. Local corticosteroid application blocks transmission in normal nociceptive C-fibres. *Acta Anaesthesiologica Scandinavica*. 1990 Jul;34(5):335-8.
- Kehlet H. Surgical stress: the role of pain and analgesia. *Br J Anaesth*. 1989;63:189-95.
- Capdevila X, Barthelet Y, Biboulet P, Ryckwaert Y, Rubenovitch J, d'Athis F. Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery. *Anesthesiology*. 1999;91:8-15.
- Kehlet H, Holte K. Effect of postoperative analgesia on surgical outcome. *Br J Anaesth* 2001;87:62-72.
- Bonnet F, Marret E. Influence of anaesthetic and analgesic techniques on outcome after surgery. *Br J Anaesth*. 2005;95:52-8.
- Niraj G, Searle A, Mathews M, Misra V, Baban M, Kiani S, Wong M. Analgesic efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing open appendectomy. *British Journal of Anaesthesia*. 2009 Jun 26;103(4):601-5.
- Deshpande JP, Ghodki PS, Sardesai SP. The analgesic efficacy of dexamethasone added to ropivacaine in transversus abdominis plane block for transabdominal hysterectomy under subarachnoid block. *Anesthesia, essays and researches*. 2017 Apr;11(2):499.
- McCormack K. The spinal actions of nonsteroidal anti-inflammatory drugs and the dissociation between their anti-inflammatory and analgesic effects. *Drugs* 1994;47 Suppl 5:28-45.
- Ahlgren SC, Wang JF, Levine JD. C-fiber mechanical stimulus-response functions are different in inflammatory versus neuropathic hyperalgesia in the rat. *Neuroscience* 1997;76:285-90.
- Naghypour B, Aghamohamadi D, Azarfarin R, Mirinazhad M, Bilehjani E, Abbasali D, et al. Dexamethasone added to bupivacaine prolongs duration of epidural analgesia. *Middle East J Anaesthesiol* 2013;22:53-7.
- Pennington AJ, Kelly JS, Antoni FA. Selective

- enhancement of an A type potassium current by dexamethasone in a corticotroph cell line. *J Neuroendocrinol* 1994;6:305-15.
19. Williams BA, Butt MT, Zeller JR, Coffee S, Pippi MA. Multimodal perineural analgesia with combined Bupivacaine-clonidine-buprenorphine-dexamethasone: Safe in vivo and chemically compatible in solution. *Pain Med* 2015;16:186-98.
 20. An K, Elkassabany NM, Liu J. Dexamethasone as adjuvant to bupivacaine prolongs the duration of thermal antinociception and prevents bupivacaine-induced rebound hyperalgesia via regional mechanism in a mouse sciatic nerve block model. *PLoS One*. 2015 Apr 9;10(4):e0123459.
 21. Rai P, Singh D, Singh SK, Malviya D, Bagwans MC. Effect of addition of dexmedetomidine to ropivacaine in transversus abdominis plane block on postoperative pain in lower segment caesarean section: A randomized controlled trial. *J Dent Med Sci*. 2016;15:122-5.
 22. Parameswari AR, Udayakumar P. Comparison of efficacy of bupivacaine with dexmedetomidine versus bupivacaine alone for transversus abdominis plane block for post-operative analgesia in patients undergoing elective caesarean section. *The Journal of Obstetrics and Gynecology of India*. 2018 Apr 1;68(2):98-103.

