Original Research Article

A study to evaluate the efficacy of intrathecal dexmeditomedine in patients undergoing laparoscopic surgeries under conventional general anaesthesia

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ABSTRACT

Background and Aims: The advent of laparoscopic surgery has benefited the patient and surgeon; however creation of pneumoperitoneum for same has bearings during the perioperative period. These effects of pneumoperitoneum are associated with significant hemodynamic changes, increasing the morbidity of the patient. Dexmedetomidine, a new α2 agonist provides stable hemodynamic condition, good quality of intra operative analgesia and prolonged post-operative analgesia with minimal side effects.

Materials and Methods: A total of 74 patients of either sex, planned for laparoscopic cholecystectomy were included. The patients were randomly divided into two groups of 37 each. GROUP D received Injection Dexmedetomidine 5 mg (0.05ml) is diluted in 0.5ml of cerebrospinal fluid and injected intrathecally. A 5minutes interval is given for recording of post injection hemodynamic parameters prior to general anaesthesia. Patients will be premedicated with Injection glycopyrrolate 0.04 mg/kg, Injection midazolam 0.02 mg/kg and Injection Fentanyl 2 mg/kg intravenously. After adequate preoxygenation, conventional general anaesthesia will be given to the patients. GROUP ‘E’: Conventional general anaesthesia alone.

Measurements: Heart rate (HR), systolic blood pressure, diastolic blood pressure and mean arterial pressure (MAP), ETco2 were recorded preoperative, after study drug, after induction, after pneumoperitoneum at 5 min intervals, post pneumoperitoneum

Results: In group D, there was no statistically significant increase in HR and blood pressure after pneumoperitoneum at any time intervals and there was significant increase in time for first rescue analgesic, intraoperative fentanyl requirement, whereas in Group E, there was a statistical significant increase in MAP after pneumoperitoneum at 5, 10 and 15 min and HR during the whole pneumoperitoneum period.

Conclusion: Dexmedetomidine 5 µg given intrathecally improves the hemodynamic stability, decreased intraoperative requirement of fentanyl and the duration of postoperative analgesia and also provides an analgesic sparing effect in patients undergoing laparoscopic abdominal surgery.

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1. Introduction

Alpha (α)²- adrenoreceptor agonists have been used as adjuvant to anaesthetic agents in peri-operative period for its several beneficial actions.¹ Dexmedetomidine, a new α2 agonist provides stable hemodynamic condition, good quality of intra operative analgesia and prolonged post-operative analgesia with minimal side effects.² This effect

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process has also influenced the practice of anaesthesiology. Laparoscopic procedure is one among those which has the advantage of less pain, less trauma and shorter hospital stay in a cost-effective manner. However, laparoscopic surgeries are usually performed by insufflation of gases like carbon dioxide into the abdominal cavity. The creation of pneumoperitoneum along with change in patient positions result in marked pathophysiological alterations. The pneumoperitoneum causes stress hormone response leading to hemodynamic instability.

To overcome these alterations, spinal anaesthesia has been tried for laparoscopic as the sympathectomy would counteract for the hemodynamic changes. But the pneumoperitoneum for a longer duration in an awake patient with compromised position resulted in discomfort.

Regional anesthesia in combination with general anesthesia can reduce the surgical stress response, hemodynamic changes and the need for sedatives and analgesics with quicker recovery. Dexmedetomidine is now highly selective alpha 2 receptor agonist. It decreases the sympathetic outflow from CNS thereby reducing hemodynamic stress from the central nervous system thereby reducing the hemodynamic stress response and anaesthetic requirements in a laparoscopic surgery. It prolongs the duration of analgesia when given intrathecially. There is less literature with intrathecal dexmedetomidine in laparoscopic surgeries under general anaesthesia. Hence, we hereby make an attempt in this study presuming that the stress attenuating properties of dexmedetomidine would counter the hemodynamic instability created in a laparoscopic surgery.

2. Materials and Methods

Following approval of the Institutional Ethics Committee, the study was conducted in 90 patients over a period of 4 months. The patients were selected and divided into two groups of 45 each by using computer generated randomization table.

Group ‘D’: Intrathecal Dexmedetomidine 5μg (0.05ml) diluted to 0.5ml with cerebrospinal fluid followed by conventional general anaesthesia: 45

Group ‘E’: Conventional general anaesthesia alone: 45

Pre-anaesthetic examination including detailed history and systemic examination as well as airway examination was conducted prior to enrolment of the patient for the study. Informed written consent was obtained from the patients after explanation of the anaesthesia technique. All patients received premedication with Tablet Ranitidine 150mg and Tablet Anxit 0.5mg the night before surgery. The selected patients were kept fasting overnight for a period of 8 hours.

2.1. Anaesthetic procedure

On shifting the patient to the operation theatre, an 18 gauge intravenous line was secured on to either of the upper limbs. Monitors including electrocardiogram, non-invasive blood pressure monitor and pulse oximeter was connected to the patient. Baseline hemodynamic parameters were measured.

Under aseptic precautions, a lumbar puncture was performed in the patients allotted to group D, in the left lateral position using 25 gauge Quincke type spinal needle at the L3-L4 inter vertebral space by midline approach to get a free flowing, clear cerebrospinal fluid.

Injection Dexmedetomidine 5μg (0.05ml) was diluted in 0.5ml of cerebrospinal fluid to total volume of 1ml and injected intrathecally. The patients were made supine immediately. At 5 minutes interval was given for recording of post injection hemodynamic parameters prior to general anaesthesia. Patients were premedicated with Injection glycopyrrolate 0.04 mg/kg, Injection midazolam 0.02 mg/kg and Injection Fentanyl 2μg/kg intravenously. After adequate preoxygenation, conventional general anaesthesia was given to the patients. Whereas the patients allotted to group C received conventional general anesthesia alone after adequate premedication and preoxygenation. The volatile inhalational agent was used in lowest possible concentration necessary to keep the mean arterial pressure and heart rate within 20 percentage of baseline and at the same time maintaining bispectral index between 40 and 60. At the end of the procedure, residual neuromuscular blockade was adequately reversed and extubated after adequate recovery.

Duration of surgery and quantity of volatile inhalational agent consumed was recorded at the end of surgery. Patients were shifted to post-operative ward and monitored for heart rate, blood pressure and oxygen saturation. Level of pain and sedation was assessed using Visual Analogue scale and Ramsay sedation scores respectively. Time to the first rescue analgesic was noted and rescue analgesia was given with Injection Paracetamol 1 gram intravenous infusion over 15 minutes. Post-operative nausea and vomiting was treated using Injection Ondansetron 0.08mg/kg intravenously.

2.2. Statistical analysis

Data was entered in Microsoft Excel and was exported into SPSS version 24.0. Data was analyzed by descriptive statistics. Student’s t test was used to compare the significant difference between two means. Chi - square or Fisher’s exact probability test was used for association of qualitative variables. p < 0.05 is considered statistically significant.

3. Results

There were no significant differences among groups in demographic data, clinical characteristics and duration of surgery (P > 0.05) (Table 1).
Table 1:

| Variable                | Group D (Intrathecal Dexmeditomedine 5μg given)(n=37) Mean(SD) | Control(n=37) Mean (SD) |
|-------------------------|---------------------------------------------------------------|-------------------------|
| Age(in years)           | 39(10.44)                                                     | 40.27(10.07)            |
| Weight(in kgs)          | 60.86(6.98)                                                   | 63.57(6.24)             |
| Height(in kgs)          | 154.54(3.66)                                                  | 156.03(3.97)            |
| Male/Female             | 9/28                                                          | 16/21                   |
| ASA I/II                | 27/10                                                         | 27/10                   |
| Duration of surgery(hour)| 0.71(0.38)                                                    | 0.57(0.21)              |

Table 2: Heart rate (Induction)

| Heart rate | Group D (Intrathecal Dexmeditomedine 5μg given)(N=37) Mean(SD) | Control(n=37) Mean(SD) | t-value | p-value |
|------------|-----------------------------------------------------------------|-------------------------|---------|---------|
| 5 minutes  | 87.51(16.11)                                                    | 80.32(9.39)             | 2.345   | 0.022*  |
| 10 minutes | 88.08(14.05)                                                   | 85.59(9.0)              | 0.907   | 0.368   |
| 15 minutes | 89.78(12.94)                                                   | 94.92(10.96)            | -1.842  | 0.070   |
| 20 minutes | 95.73(13.44)                                                   | 105.62(13.98)           | -3.09   | 0.003** |
| 25 minutes | 90.84(8.89)                                                    | 112.27(12.26)           | -8.61   | 0.001** |
| 30 minutes | 86.97(15.44)                                                   | 116.81(13.87)           | -8.74   | 0.001** |
| 35 minutes | 91.70(13.57)                                                   | 120.08(14.29)           | -8.76   | 0.001** |
| 40 minutes | 91.29(12.86)                                                   | 119.65(13.54)           | -9.10   | 0.001** |

*significant
**highly significant

Table 3: Heart rate (Insufflation time)

| Heart rate | Group D (Intrathecal Dexmeditomedine 5μg given)(n=37) Mean(SD) | Control(n=37) Mean(SD) | t-value | p-value |
|------------|-----------------------------------------------------------------|-------------------------|---------|---------|
| 1 minute   | 91.49(16.64)                                                    | 93.84(10.19)            | -7.33   | 0.466   |
| 2 minutes  | 92.43(15.62)                                                   | 103.19(12.78)           | -3.241  | 0.002** |
| 3 minutes  | 93.76(18.56)                                                   | 112.68(12.91)           | -5.091  | 0.001** |
| 4 minutes  | 94.19(19.38)                                                   | 119.27(9.97)            | -7.00   | 0.001** |
| 5 minutes  | 95.49(17.38)                                                   | 112.16(9.47)            | -8.199  | 0.001** |
| 10 minutes | 94.68(16.44)                                                   | 123.03(11.87)           | -8.505  | 0.001** |
| 15 minutes | 93.95(12.94)                                                   | 120.27(13.08)           | -8.704  | 0.001** |
| 20 minutes | 89.49(10.28)                                                   | 113.46(11.73)           | -9.348  | 0.001** |

*significant
**highly significant

Table 4: SBP (Induction)

| SBP        | Group D (Intrathecal Dexmeditomedine 5μg given)(n=37) Mean(SD) | Control(n=37) Mean(SD) | t-value | p-value |
|------------|-----------------------------------------------------------------|-------------------------|---------|---------|
| 5 minute   | 111.70(12.94)                                                   | 124.08(17.70)           | -3.41   | 0.001** |
| 10 minutes | 113.32(12.42)                                                   | 128.30(11.91)           | -5.29   | 0.001** |
| 15 minutes | 115.35(19.210)                                                  | 140.43(8.04)            | -7.32   | 0.001** |
| 20 minutes | 121.05(16.29)                                                   | 146.0(9.74)             | -7.99   | 0.001** |
| 25 minutes | 122.81(12.62)                                                   | 157.86(12.99)           | -11.77  | 0.001** |
| 30 minutes | 130.43(15.59)                                                   | 163.65(12.66)           | -10.06  | 0.001** |
| 35 minutes | 129.84(10.75)                                                   | 168.0(13.57)            | -13.41  | 0.001** |
| 40 minutes | 131.29(11.53)                                                   | 168.11(17.77)           | -10.36  | 0.001** |

**highly significant
### Table 5: SBP (Insufflation time)

|                | Group D (Intrathecal Dexmeditomedine 5µg Given) (n=37) Mean(SD) | Control(n=37) Mean(SD) | t-value | p-value |
|----------------|-----------------------------------------------------------------|-------------------------|---------|---------|
|                | Mean(SD)                                                        |                         |         |         |
| 1 minute       | 124.08(19.52)                                                   | 143.97(16.16)           | -4.77   | 0.001** |
| 2 minutes      | 130.35(24.04)                                                   | 150.43(17.86)           | -4.08   | 0.001** |
| 3 minutes      | 132.89(22.42)                                                   | 158.14(14.86)           | -5.71   | 0.001** |
| 4 minutes      | 132.19(17.37)                                                   | 164.03(12.04)           | -8.54   | 0.001** |
| 5 minutes      | 133.08(17.18)                                                   | 168.76(12.85)           | -10.11  | 0.001** |
| 10 minutes     | 120.73(11.67)                                                   | 171.84(14.90)           | -13.86  | 0.001** |
| 15 minutes     | 126.76(10.81)                                                   | 165.35(15.59)           | -12.37  | 0.001** |
| 20 minutes     | 125.78(11.51)                                                   | 153.38(13.44)           | -9.49   | 0.001** |

** highly significant

### Table 6: DBP (Induction)

|                | Group D (Intrathecal Dexmeditomedine 5µg Given)(n=37) Mean(SD) | Control(n=37) Mean(SD) | t-value | p-value |
|----------------|-----------------------------------------------------------------|-------------------------|---------|---------|
|                | Mean(SD)                                                        |                         |         |         |
| 5 minute       | 73.59(8.69)                                                     | 77.57(8.97)             | -1.93   | 0.057   |
| 10 minutes     | 71.05(9.35)                                                     | 76.92(7.25)             | -3.02   | 0.004** |
| 15 minutes     | 74.62(14.67)                                                    | 82.86(2.84)             | -3.35   | 0.001** |
| 20 minutes     | 82.03(13.15)                                                    | 84.73(3.31)             | -1.20   | 0.234   |
| 25 minutes     | 81.24(8.36)                                                     | 89.92(10.09)            | -4.03   | 0.001** |
| 30 minutes     | 82.27(8.39)                                                     | 90.11(7.91)             | -4.13   | 0.001** |
| 35 minutes     | 84.38(7.51)                                                     | 89.95(5.34)             | -3.68   | 0.001** |
| 40 minutes     | 84.66(7.004)                                                    | 89.46(4.72)             | -3.43   | 0.001** |

** highly significant

### Table 7: DBP (Insufflation time)

|                | Group D (Intrathecal Dexmeditomedine 5µg Given)(n=37) Mean(SD) | Control(n=37) Mean(SD) | t-value | p-value |
|----------------|-----------------------------------------------------------------|-------------------------|---------|---------|
|                | Mean(SD)                                                        |                         |         |         |
| 1 minute       | 82.73(11.99)                                                    | 84.86(11.24)            | -0.79   | 0.432   |
| 2 minutes      | 87.73(15.82)                                                    | 86.05(8.55)             | -0.57   | 0.573   |
| 3 minutes      | 87.89(12.61)                                                    | 88.05(8.18)             | -0.07   | 0.948   |
| 4 minutes      | 86.59(10.74)                                                    | 89.08(8.16)             | -1.121  | 0.266   |
| 5 minutes      | 85.76(9.46)                                                     | 90.92(7.66)             | -2.58   | 0.012*  |
| 10 minutes     | 85.22(6.19)                                                     | 90.62(3.53)             | -4.61   | 0.001** |
| 15 minutes     | 81.62(5.49)                                                     | 89.03(2.89)             | -7.26   | 0.001** |
| 20 minutes     | 81.19(5.36)                                                     | 86.08(2.38)             | -5.07   | 0.001** |

* significant

** highly significant

### Table 8: Mean Arterial Pressure (Induction)

|                | Group D (Intrathecal Dexmeditomedine 5µg Given)(n=37) Mean(SD) | Control(n=37) Mean(SD) | t-value | p-value |
|----------------|-----------------------------------------------------------------|-------------------------|---------|---------|
|                | Mean(SD)                                                        |                         |         |         |
| 5 minute       | 85.97(9.92)                                                     | 90.49(5.63)             | -2.35   | 0.022   |
| 10 minutes     | 84.69(10.62)                                                    | 94.57(9.45)             | -4.19   | 0.001** |
| 15 minutes     | 88.19(16.56)                                                    | 102.08(3.77)            | -4.97   | 0.001** |
| 20 minutes     | 95.06(14.04)                                                    | 105.03(4.64)            | -4.09   | 0.001** |
| 25 minutes     | 94.22(9.74)                                                     | 112.62(10.49)           | -7.76   | 0.001** |
| 30 minutes     | 97.72(10.19)                                                    | 114.54(8.33)            | -7.73   | 0.001** |
| 35 minutes     | 99.58(9.11)                                                     | 116.08(7.39)            | -8.51   | 0.001** |
| 40 minutes     | 100(8.80)                                                       | 115.32(7.82)            | -7.77   | 0.001** |
| 45 minutes     | 96.18(9.54)                                                     | 98.57(35.19)            | -0.35   | 0.73    |

** highly significant
Table 9: Mean Arterial Pressure (Insufflation time)

| Mean Arterial Pressure | Group D (Intrathecal Dexmedetomidine 5 µg given)(n=37) | Control(n=37) Mean(SD) | t-value |
|------------------------|--------------------------------------------------------|------------------------|---------|
| 1 minute               | 94.81(11.87)                                           | 105.29(12.61)          | -3.01   | 0.001 |
| 2 minutes              | 98.83(14.96)                                           | 102.38(27.37)          | -0.68   | 0.496 |
| 3 minutes              | 101.33(13.44)                                          | 111.86(10.88)          | -3.62   | 0.001 |
| 4 minutes              | 99.72(11.47)                                           | 114.66(8.08)           | -6.33   | 0.001 |
| 5 minutes              | 100.97(10.60)                                          | 110.68(27.85)          | -1.96   | 0.054 |
| 10 minutes             | 100.28(7.86)                                           | 117.46(4.15)           | -11.47  | 0.001**|
| 15 minutes             | 95.89(5.73)                                            | 115.17(5.12)           | -14.94  | 0.001**|
| 20 minutes             | 96.11(5.88)                                            | 102.97(25.43)          | -1.58   | 0.119 |

*significant
**highly significant

Regarding hemodynamic variables measured during the intraoperative period, there was a significant reduction in pulse rate during induction starting at 20 minutes until 40 minutes in the group D [Table 2] and there was significant reduction in pulse rate during insufflation time starting at 2 mins to 20 mins in group D in comparison to the control group (P <0.05)[Table 3]. Systolic blood pressure showed a significant reduction during induction starting at 5 minutes until 40 minutes in group in comparison to the control group (P < 0.05)[Table 4]. Systolic blood pressure showed a significant reduction during insufflation starting at 5 minutes until 40 minutes in group in comparison to the control group [P < 0.05][Table 5]. There was a significant reduction in diastolic blood pressure during insufflation starting at 10 minutes until 40 minutes in group D in comparison to the control group (P < 0.05)[Table 6]. Mean arterial pressure showed a significant reduction during induction starting at 10 minutes until 40 minutes in group in comparison to the control group (P < 0.05)[Table 7]. There was decrease in consumption of inhalational agents in dexmedetomidine group. There were no significant differences between groups in hemodynamic variables measured during the postoperative period.

4. Discussion

In a study conducted by Vinith K Srivastava et al, in 2015, a total of 60 patients were included. The patients were divided into three groups of 30 each. Group D received intravenous dexmedetomidine, group E received intravenous esmolol, group C received normal saline. They observed that in group D, there was no significant increase in HR and BP after pneumoperitoneum at any time intervals. Hence, Dexmedetomidine is more effective than esmolol for attenuating hemodynamic response to pneumoperitoneum in laparoscopic surgeries.10

In a Randomised, double blinded study conducted by Ashraf Amin Mohammed et al in 2012, 90 patients were randomly assigned to receive intrathecally either 0.5% bupivacaine with 5 µg dexmedetomidine alone or dexmedetomidine with fentanyl along with bupivacaine. They found that dexmedetomidine given intrathecally improves the quality and the duration of post-operative analgesia and also provides analgesic sparing effect in patients undergoing major surgeries.3

In a study done by Rajini Gupta et al in 2011, 60 patients classified in American Society of Anaesthesiologists classes I and II scheduled for lower abdominal surgeries were studied. Patients were randomly allocated to receive Bupivacaine plus dexmedetomidine and bupivacaine plus fentanyl. They observed that Patients in dexmedetomidine. Group had a significantly longer sensory motor block than fentanyl group. Hence dexmedetomidine maintains hemodynamic stability, and reduced demand for rescue analgesics.11

In our study, we have compared between 2 groups, one group received 5 micrograms of intrathecal dexmedetomidine in addition to general anaesthesia in patients undergoing laparoscopic surgeries and the other group received only conventional general anaesthesia. We found that the hemodynamic variables like heart rate, SBP, DBP and MAP were more stable in group D compared to group E during induction, intubation and creation of pneumoperitonium as well as decreases the requirement of rescue analgesics. Hence we can conclude that use of intrathecal dexmedetomidine will decrease the hemodynamic response to intubation, insufflation. It will also decrease the requirement of intra operative opioid consumption and post-operative rescue analgesia.

5. Conclusion

Dexmedetomidine 5 µg given intrathecally improves the hemodynamic stability, decreased intraoperative require-
ment of fentanyl, inhalational agents and the duration of postoperative analgesia and also provides an analgesic sparing effect in patients undergoing laparoscopic abdominal surgeries.

6. Source of Funding
None.

7. Conflict of Interest
None.

References
1. Patel CR, Smitha R, Madhu S. The Effect of dexmedetomidine continuous infusion as an adjuvant to general anaesthesia on sevoflurane requirements: A study based on entropy analysis. *J Anaesth Clin Pharmacol*. 2013;29(3):318–22.
2. El-lakany SAAMH. Intrathecal dexmedetomidine: Useful or not? *J Anesth Clin Res*. 2013;04(09):351.
3. Mohammed AA, Fares M, Mohammed K, A S. Efficacy of intrathecally administered Dexmedetomidine versus dexmedetomidie with fentanyl in patients undergoing major abdominal cancer surgery. *Pin Physician*. 2012;15:339–48.
4. Kavanagh BP, Hedenstierna G. Respiratory physiology and pathophysiology. In: Miller RD, editor. Miller’s Anesthesia. 8th ed. vol. 1. Churchill Livingstone Elsevier Inc; 2015. p. 470–1.
5. Gutt CN, Oniu T, Mehrabi A, Schemmer P, Kashfi A, Kraus T, et al. Circulatory and Respiratory Complications of Carbon Dioxide Insufflation. *Dig Surg*. 2004;21:95–105.
6. Mazdisnian F, Palmieri A, Hakakha B, Hakakha M, Cambridge C, Lauria B. Office microlaparoscopy for female sterilization under local anesthesia. A cost and clinical analysis. *J Reprod Med*. 2002;47:97–100.
7. Elsharkawy H, Naguib MA. Centrally acting non opioid analgesics. In: Flood P, Rathmell JP, Shafer S, editors. Stoelting’s pharmacology and physiology in anesthetic practice. 5th ed. New Delhi: Wolters Kluwer; 2016. p. 257–58.
8. Ansermino M, Basu R, Vandebeek C, Montgomery C. Nonopioid additives to local anaesthetics for caudal blockade in children: a systematic review. *Pediatr Anesth*. 2003;13:561–73.
9. Constant I, Gall O, Gouyet L, Chauvin M, Murat I. Addition of clonidine or fentanyl to local anaesthetics prolongs the duration of surgical analgesia after single shot caudal block in children. *Br J Anaesth*. 1998;80:294–8.
10. Srivastava VK, Nagle V, Kedia S. Comparative evaluation of dexmedetomidine and esmolol on hemodynamic responses during laparoscopic cholecystectomy. *J Clin Diagn Res*. 2015;9(3):1–05.
11. Gupta R, Verma R, Kushwaha JK. A comparative study of intrathecaldexmedetomidine and fentanyl as adjuvants to bupivacaine. *J Anaesth Clin Pharmacol*. 2011;27(3):339–43.

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