# A Comparative Study of Levobupivacaine with Fentanyl and Levobupivacaine with Dexmedetomidine in Thoracic Epidural Block for Laparoscopic Cholecystectomy

**Aditya Kumar Kejriwal[1], Malti Agrawal[2], Gopalkrishan[3], L.S. Kang[4], Karandeep Singh[1], Anand Yadav[1], Rajeev Kumar[5], Sarfaraz Ahmad[6], Rampal Singh[5]**

**ABSTRACT**

**Introduction:** Laparoscopic cholecystectomy has traditionally been performed under general anesthesia, epidural anesthesia has emerged as a more suitable alternative for the minimally invasive laparoscopic cholecystectomy with minimal complications. We conducted a clinical study comparing levobupivacaine with fentanyl and a combination of levobupivacaine with dexmedetomidine in thoracic epidural anesthesia for laparoscopic cholecystectomy as sole anaesthetic.

**Material and Methods:** After taking approval from Institutional Ethical Committee, 60 adult patients of ASA grade I and II were divided into two groups; group A where levobupivacaine 0.5% (2mg/kg) with 1.5µg/kg fentanyl was given and in group B levobupivacaine 0.5% (2mg/kg) with 0.5 µg/kg of dexmedetomidine. Thoracic epidural was given at the $T_{10}$ -$T_{11}$ interspace to obtain a sensory block of $T_4$ -$L_2$ dermatome which was judged every minute by pin prick method till complete sensory block was established. Hemodynamic

**Result:** Onset of action was fast and duration of action was longer in group A patients. Also fall in blood pressure and heart rate was greater in group B patients.Less incidence of shoulder pain was found in group A patients. Oxygen saturation ($Spo_2$) was comparable in both the groups and no respiratory distress was seen. More post-operative analgesia was required in group B. Also no complications were seen postoperatively in both the groups.

**Conclusion:** Levobupivacaine with fentanyl provides better anesthesia andhaemodynamic stability than levobupivacaine with dexmedetomidine in thoracic epidural for laproscopic-cholecystectomy.

**Keywords:** Dexmedetomidine, Fentanyl, Thoracic epidural anesthesia, Laparoscopic cholecystectomy.

## INTRODUCTION

Laparoscopic cholecystectomy has traditionally been performed under general anesthesia, epidural anesthesia has emerged as a more suitable alternative for the minimally invasive laparoscopic cholecystectomy with minimal complications. We conducted a clinical study comparing levobupivacaine with fentanyl and a combination of levobupivacaine with dexmedetomidine in thoracic epidural anesthesia as sole anaesthetic for laparoscopic cholecystectomy.[1,2]

Regional anesthetic approaches such as segmental low thoracic epidural anesthesia in laparoscopic cholecystectomy has many advantages over lumbar spinal anesthesia land helps in avoiding urinary retention with early ambulation and possibility of day care surgery setting. Also the level of block achieved by a spinal anesthetic isbelow desired level required to perform laparoscopic surgery in s many cases, it is because the drug accumulates in the sacral region due to lumbar lordosis. Also, volume of cerebrospinal fluid variesfrom patient to patient making the level of block unpredictable, with a block level above T4desirable for laparoscopic cholecystectomy, but may cause significant cardiac depression.[3]

Contrary to this, in epidural anesthesia, the titration of block level is easier, and therefore it is preferable even in patients with medical conditions such as cardiac disease and obstructive airway disease which depend on active expiration for maintaining lung ventilation, where a slower onset of sympathetic block and minimized muscle weakness are desirable.[4]

During epidural patient is required to be relaxed and cooperative, Low intra-abdominal pressure (IAP) is required to reduce shoulder pain and ventillation disturbances. Patient is on spontaneous ventillation and is able to adjust his breathing and respiration during surgery.

Levobupivacaine is the isolated S (-) isomer of bupivacaine and is less cardiotoxic. Addition of Fentanyl or dexmedetomidine decreases the dose requirement of levobupivacaine, so eliminating the side effects of larger doses of levobupivacaine and improves the quality of block. Fentanyl is an opioid which acts on µ-1 opioid receptors (widely distributed in CNS and other tissues) producing supraspinal analgesia, The µ-receptors exist mostlypresynaptically in the periaqueductal gray region, and in the superficial dorsal horn of the spinal cord (specifically the substantiagelatinosa of Rolando).

While dexmedetomidine is an alpha 2 agonist that produces analgesia via a non- opioid mechanism providing better

[1]JR-3, [2]Professor and Head of the Department, [3]Assistant Professor, [4]Professor, [5]Associate Professor, [6]Senior Resident, Department of Anesthesia, Rohilkhand Medical College and Hospital, Bareilly, Uttar pradesh, India.

**Corresponding author:** Dr. Aditya Kumar Kejriwal, Room no.-12, PG Boys Hostel, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India.

**How to cite this article:** Aditya Kumar Kejriwal, Malti Agrawal, Gopalkrishan, L.S. Kang, Karandeep Singh, Anand Yadav, Rajeev Kumar, Sarfaraz Ahmad, Rampal Singh. A comparative study of levobupivacaine with fentanyl and levobupivacaine with dexmedetomidine in thoracic epidural block for laparoscopic cholecystectomy. International Journal of Contemporary Medical Research 2016;3 (2):319-323.

analgesia and helps in sparing of doses and side effects of levobupivacaine. The $\alpha_2$-adrenergic receptor is classically located on vascular prejunctionalterminals where dexmedetomidine inhibits the release of norepinephrine (noradrenaline) in the form of negative feedback. Dexmedetomidine is a highly selective $\alpha_2$ Adrenergic agonist with an affinity of eight times greater than clonidine. The aim of the proposed study was to establish the role of fentanyl and dexmedetomidine as a adjuvant to epidural levobupivacaine and to study their beneficial clinical effects. Objectives of the research were to compare and determine the onset of sensory analgesia and duration of post- operative analgesia in patients undergoing laparoscopic cholecystectomy under thoracic epidural anesthesia with 0.5% (2mg/kg) levobupivacaine with 1.5µg/kg fentanyl and 0.5% (2mg/kg) levobupivacaine with 0.5µg/kg dexmedetomidine, to study the hemodynamic responses of the drug during surgery, to detect any complication or side effects as a result of these drug and to study the need of intra-operative and post-operative analgesic drug (rescue analgesia) within 24hr after block and to judge muscle relaxation during surgery.

## MATERIAL AND METHODS

After obtaining approval of ethical committee and written informed consent, 60 ASA physical status I and status II patients aged 18–60 years, of both sexes, scheduled for laparoscopic cholecystectomy under epidural anesthesia were included in this study. Exclusion criteria were presence of chronic obstructive pulmonary disease, severe anemia, heart disease, morbid obesity, deranged liver function test, patient on anticoagulant therapy, renal diseases and endocrine diseases.

Preanesthetic check up was done a day before surgery, relevant investigations were done and informed written consent was taken. Patient were asked to remain nil per oral 8 hrs before surgery. Patient werepremedicated with tablet alprazolam 0.5 mg and tab ranitidine 150mg in the night before surgery.

In OT a good IV access was secured and preloading done with 500ml lactated ringer's solution and a monitor was attached for monitoring ECG, HR, NIBP, SPO2, temperature, respiratory rate. Doses of the were given drug according to the body weight. Patient were made to sit with their elbows resting on their thighs on a bedside table. Flexion of the spine was done and midline approach was used for epidural.

After proper positioning and under strict aseptic precautions local infiltration with 2ml of 2% lignocaine with adrenaline 1:200, 000 was done at T10-T11 intervertebral space. Epidural block was given with 18 G gauge Tuohy's needle (by the loss of resistance method with 10ml L.O.R Syringe). A test dose of 3ml of 2% lignocaine hydrochloride solution containing 1:200, 000 adrenaline was injected and there after patients in group I received 2mg/kg 0.5% L-bupavicaine and 1.5 µgm/kg of fentanyl and patients in group II received 2mg/kg 0.5% L-bupavicaine and 0.5 µgm/kg of dexmedetomidine. The drugs were prepared by an anesthetist who was not aware of the procedure. Onset of action and level of sensory block was judged by pin prick method. The two groups were monitored intraoperatively for heart rate, non-invasive blood pressure and arterial O2 saturation (SpO2). Hypotension was defined as systolic bloodpressure<90 mmHg or >20% decrease in baseline values and was treated by fluids and vasopressors (mephentermine 6mg). Bradycardia was defined as heart rate <50/min and was treated by0.6 mg of atropine injection. Intraoperative nausea, vomiting, pruritus, sedation or any other side effects were recorded.

## STATISTICAL ANALYSIS

At the end of the study the data was compiled systematically and analyzed using statistical package for social sciences (SPSS) software. Chi-square test was used to compare the proportional data. Mean differences were compared using students *T*-test and a *P* value < 0.05 showed a significant intergroup difference.

## RESULTS

There was no statistically significant difference between the two groups in any of the demographic data. At baseline, mean heart rate, diastolic blood pressure, systolic blood pressures were comparable between the two group and were in normal ranges.

Mean heart rates of two groups were comparable throughout the procedure and did not show a statistically significant difference (p>0.05). Mean diastolic blood pressures of two groups were comparable throughout the procedure and did not show a statistically significant difference at all time intervals (p>0.05). Mean systolic blood pressures of two groups were comparable throughout the study (p>0.05). In both the groups at all follow up intervals mean heart rate, systolic blood pressures and diastolic blood pressures were significantly lower as compared to baseline (p<0.05).

Mean onset time of sensory block was 4.02±1.14 minutes in Group I and 8.45±2.56 minutes in Group II, thus showing a statistically faster onset of block in Group I (p<0.05). Mean

| Hemodynamic Variables | Group I (n=30) | | Group II (n=30) | | Statistical significance | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | 't' | 'p' |
| Heart Rate (per min) | 92.6 | 14.48 | 90.6 | 14.24 | 0.44 | 0.6621 |
| Diastolic BP (mm Hg) | 78.2 | 10.12 | 76.6 | 11.69 | 0.463 | 0.6462 |
| Systolic BP (mm Hg) | 126.2 | 17.12 | 126.55 | 18.72 | 0.062 | 0.9511 |
| It was found that all the above hemodynamic variables (heart rate, diastolic BP and Systolic BP) of Group I and II were statistically comparable. | | | | | | |

**Table-1:** Inter Group Comparison of Baseline HemodynamicVariables

| Time Interval | Group I | | Group II | | Statistical Significance | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | 't' | 'p' |
| Baseline | 92.6 | 14.48 | 90.6 | 14.24 | 0.44 | 0.6621 |
| 5 min | 90.5 | 15.97 | 88.2 | 13.12 | 1.502 | 0.137 |
| 10 min | 85.9 | 15.35 | 83.7 | 14.27 | 0.082 | 0.9351 |
| 15 min | 82.4 | 17.64 | 78.45 | 20.54 | 1.137 | 0.259 |
| 20 min | 83.5 | 16.19 | 80.85 | 18.29 | 0.222 | 0.8246 |
| 25 min | 79.7 | 15.69 | 76.65 | 17.61 | 0.905 | 0.368 |
| 30 min | 80.6 | 16.22 | 77.8 | 17.77 | 0.911 | 0.365 |
| 35 min | 78.3 | 16.89 | 75.65 | 16.95 | 1.2 | 0.2344 |
| 40 min | 74.3 | 13.54 | 72.1 | 12.74 | 1.622 | 0.1095 |
| 45 min | 76.7 | 10.65 | 73.23 | 11.17 | 1.927 | 0.0852 |
| 50 min | 78.6 | 11.24 | 76.85 | 10.17 | 1.1623 | 0.1127 |
| 55 min | 83 | 14.05 | 80.75 | 15.9 | 1.161 | 0.2536 |
| 60 min | 76.2 | 7.1 | 74.5 | 4.94 | 1.913 | 0.0653 |
| Heart rates were comparable in both the groups at any of the above time intervals. | | | | | | |

**Table** 2: Inter Group Comparison of Heart Rate (per minute) at different time intervals

| Time Interval | Group I | | Group II | | Statistical Significance | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | 't' | 'p' |
| Baseline | 126.2 | 17.12 | 126.55 | 18.72 | 0.062 | 0.9511 |
| 5 min | 115.8 | 19.97 | 114.75 | 20.91 | 1.302 | 0.127 |
| 10 min | 106.9 | 18.52 | 108.45 | 18.06 | 0.078 | 0.9421 |
| 15 min | 114.7 | 23.33 | 115.7 | 16.12 | 1.184 | 0.2123 |
| 20 min | 114.7 | 18.19 | 121.3 | 26.86 | 0.346 | 0.8642 |
| 25 min | 115.4 | 17.26 | 115.05 | 16 | 0.905 | 0.368 |
| 30 min | 111.6 | 17.58 | 117.25 | 13.73 | 0.911 | 0.365 |
| 35 min | 112.4 | 15.01 | 110.15 | 12.7 | 1.1623 | 0.1127 |
| 40 min | 110.1 | 17.01 | 108.78 | 12.21 | 1.161 | 0.2536 |
| 45 min | 113.8 | 14.48 | 110.46 | 10.11 | 1.67 | 0.1008 |
| 50 min | 107.9 | 10.6 | 110 | 6.68 | 0.389 | 0.7174 |
| 55 min | 107.9 | 4.6 | 106 | 4.32 | 0.819 | 0.4186 |
| 60 min | 113.2 | 1.84 | 102 | 1.41 | 0.303 | 0.764 |
| Systolic blood pressures were comparable in both the groups at any of the above time intervals. | | | | | | |

**Table-3:** Inter Group Comparison of Systolic Blood Pressure (mm Hg) at different time intervals

| Time Interval | Group I | | Group II | | Statistical Significance | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | 't' | 'p' |
| Baseline | 78.2 | 10.12 | 76.6 | 11.69 | 0.463 | 0.6462 |
| 5 min | 72 | 11.86 | 71.05 | 13.95 | 1.532 | 0.127 |
| 10 min | 65 | 13.96 | 65.75 | 11.8 | 0.092 | 0.9151 |
| 15 min | 71.2 | 14.01 | 72.2 | 15.75 | 1.147 | 0.2492 |
| 20 min | 73.9 | 12.73 | 75.6 | 16.78 | 0.252 | 0.8231 |
| 25 min | 73 | 12.84 | 71.6 | 13.61 | 0.806 | 0.388 |
| 30 min | 71.5 | 13.98 | 74.35 | 10.08 | 0.962 | 0.3858 |
| 35 min | 72.1 | 11.45 | 70.5 | 11.32 | 1.1623 | 0.1127 |
| 40 min | 69.1 | 12.31 | 68.15 | 8.82 | 1.181 | 0.2432 |
| 45 min | 72.6 | 10.97 | 70.46 | 6.23 | 1.913 | 0.0653 |
| 50 min | 69.6 | 10.78 | 70.01 | 5.99 | 0.389 | 0.7174 |
| 55 min | 68.1 | 8.24 | 66.75 | 3.77 | 1.924 | 0.0945 |
| 60 min | 64.9 | 8.25 | 62.5 | 9.19 | 1.813 | 0.0753 |
| Diastolic blood pressures were comparable in both the groups at any of the above time intervals. | | | | | | |

**Table-4:** Inter Group Comparison of Diastolic Blood Pressure (mm Hg) at different time intervals

duration of sensory block was 6.5±0.78 hours in Group I and 5.74±1.53 hours in Group II, thus showing a longer duration of block in group II ($p<0.05$).

Vasopressor requirement was significantly higher in Group II (62.5%) as compared to Group I (40%) ($p<0.05$). Ketamine requirement for shoulder pain was significantly higher in Group II (35%) patients as compared to Group I (20%) ($p<0.05$). Also atropine requirement was significantly higher in Group II (5%) as compared to nil in Group I ($p<0.05$).

Muscle relaxation was judged as fair by the surgeon in most of the cases at the end of surgery. None of the patient complained of vomiting, headache and pruritis postoperatively. Also, Group I had significantly lower rescue analgesic need as compared to Group II ($p<0.05$).

## DISCUSSION

Laparoscopic cholecystectomy (LC) has traditionally been performed under general anesthesia, epidural anesthesia has lower postoperative mortality and fewer complications than general anesthesia, so epidural anesthesia seems more suit-

able for the minimally invasive laparoscopic cholecystectomy.[1]

Zahoor MU, Masroor R and Khurshid T*et al.* compared the postoperative pain relief and vomiting and the length of hospital stay in patients undergoing open cholecystectomy under general anesthesia versus those receiving thoracic epidural anesthesia and concluded that the use of intra-operative epidural anesthesia combined with postoperative epidural analgesia was found to be associated with reduction in the postoperative pain and vomiting in patients undergoing open cholecystectomy.[2]

Epidural anesthesia is found to be safe for laparoscopic cholecystectomy as the respiratory control mechanism remains intact and the patients is able to adjust their minute ventilation. So, the respiratory changes are pronounced in awake patients under regional anesthesia and patient is able to maintain an unchanged end tidal carbon dioxide levels.[3]

Neuraxial blockade has been employed routinely in patients with s co-morbid conditions when intra-abdominal pressure is kept low and the patient tilt is to a lesser degree during surgical procedure.[4] Shoulder pain occurs due to diaphragmatic irritation from carbon dioxide used to createpneumoperitoneum and is incompletely alleviated with epidural anesthesia alone. Extensive sensory block from T4 to L2 is needed for the laparoscopic procedure.[4,5]

Usually, Bupivacaine is used to produce epidural thoracic block for laparoscopic cholecystectomy procedures.[5] Levobupivacaine is relatively safer and has been reported to have equivalent efficacy. Use of $\alpha_2$ agonists like clonidine, dexmedetomidineand opioids like fentanyl as adjuvant increases the analgesic efficacy of spinal and epidural anesthesia, it increases the pharmacokinetics of the main anesthetic agents used and helps in early achievement and maintainance of block over a reasonable period of time.[5-9]

With this background two anesthetic adjuvant drugs *i.e.* dexmedetomidineand fentanyl, were evaluated for their performance in epidural thoracic block with levobupivacaine for conducting laparoscopic cholecystectomy.

For this purpose a double-blinded prospective randomized controlled study was carried out in which a total of 60 patients belonging to ASA grade 1 or 2 undergoing laparoscopic cholecystectomy procedure were enrolled and were randomly allocated to one of the two groups. A total of 30 patients in Group I received epidural anesthesia with 0.5% (2 mg/kg) levobupivacaine with 1.5 µg/kg fentanyl while remaining 30 patients in Group II received epidural anesthesia with 0.5% (2 mg/kg) levobupivacaine with 0.5 µg/kg dexmedetomidine.

At baseline both the groups were comparable hemodynamically. Throughout the procedure, statistically no significant difference between two groups was observed with respect to hemodynamic parameters. In both the groups, throughout the procedure, mean heart rate and blood pressure levels were either significantly lower or comparable to the baseline levels.[6-10]

In both the groups most of the times hypotensive effect of anesthetic agents was observed. Both the combinations showed an average decline of 20-30% in the hemodynamic parameters as compared to baseline readings.

Sedation and muscle relaxation were adequate in both the groups. Bajwa et al showed in their study that dexmedetomidine was a better adjuvant than clonidine in epidural anesthesia for patient comfort, superior sedative and anxiolytic properties, intra-operative and postoperative analgesia.[9]

Mean onset time of sensory block was 4.02±1.14 minutes and mean duration of sensory block was 6.5±0.78 hours in Group I although Gupta A, Gupta K and Gupta PK etal in their study with ropivacaineand fentanyl for thoracic epidural anesthesia for laparoscopic cholecystectomy found mean onset time of sensory block to be 15 minutes;this may be because 0.75% ropivacaine was used instead of 0.5% levobupivacaine and as we know that ropivacaine is less potent than levobupivacaine and a fixed dose of 50µg fentanyl was used.[6,11]

Mean onset time of sensory block was 8.45±2.56 minutes and mean duration of sensory block was 5.74±1.53 hours in Group II, Kamal etal in their study used levobupivacine with dexmedetomidine for thoracic epidural anesthesia for major abdominal surgeries found that mean onset of sensory block as 12.6±5.9 minutes and mean regression time of sensory block was 390±87.6 mins, which did not match our results, the reason may be the dose dependent effect of the drugs.[7]

In present study, Group I had significantly lower rescue analgesic need as compared to Group II, thus showing that levobupivacaine in combination with fentanyl provided a better analgesic effect as compared to levobupivacaine in combination with dexmedetomidine.

Erol DD, Yilmaz S and PolatC*et al.* compared the use of intravenous and thoracic epidural analgesia in patients undergoing general anesthesia with sevoflurane for laparoscopic cholecystectomy in the early postoperative period and concluded that thoracic epidural anesthesia using fentanyl reduced postoperative pain in patients.[12]

Use of thoracic epidural anesthesia for laparoscopic cholecystectomy is a safer and satisfactory alternative technique in many cases. Addition of dexmedetomidine to levobupivacaine improves the quality of blockand prevents hemodynamic perturbations caused by pneumoperitoneum and reduce the incidence of shoulder pain.[5,9] Ketamine was used for alleviating shoulder pain in 8 patients in group Iand 12 patients in group II at a fixed dose of 25mg. Incidence of shoulder pain is proportional to the magnitude of intraabdominal pressure.[4-6,9,11]

The thoracic epidural anesthesia with 0.75% ropivacaine and fentanyl for elective laparoscopic cholecystectomy is efficacious and has preserved ventilation and hemodynamic changes within physiological limits during pneumoperitoneum with minimal treatable side effects.[6]

Although levobupivacaine is free from any cardiotoxic effects and has a similar safety profile, but hypotensive effect in both the groups was due to blockade of sympathetic system. Maintenance of blood pressure lower than the baseline is a preventive measure in laparoscopic cholecystectomy cases in order to tackle with the surgical stress response.

However, hypotensive episodes were of considerable significance in both the groups.

## CONCLUSION

Thoracic epidural anesthesia for laparoscopic cholecystectomy is a satisfactory alternative technique in selected cases. Addition of anesthetic adjuvant drugs like fentanyl or dexmedetomidine to levobupivacaine not only produces better qualitative anesthetic conditions but also prolongs the duration of analgesia. Both these drugs not only prevent hemodynamic perturbations produced by pneumoperitoneum but also decreases the incidence of shoulder pain.

In our study we found fentanyl along with levobupivacaine to produce shorter onset and longer duration of analgesia than with levobupivacaine with dexmedetomidine. Also the need for vasopressors, atropine and post-operative analgesia were significantly less with fentanyl group. Not only this hemodynamic perturbations produced by pneumoperitoneum and the incidence of shoulder pain were also significantly less with levobupivacine and fentanyl group.

Also, further studies with smaller doses of adjuvant dexmedetomidine are recommended for ensuring better clinical safety and reduced vasopressor and atropine use.

## REFERENCES


1. Ji Hyun Lee, Jin Huh, Duk Kyung Kim, JeaRyoungGil, Sung Won Min, and Sun Sook Han. Laparoscopic cholecystectomy under epidural anesthesia: a clinical feasibility study. Korean J Anesthesiol. 2010;59:383-388.
2. Zahoor MU, Masroor R, Khurshid T, Azhar R, Yasin MMA. Thoracic Epidural Anaesthesia for Open Cholecystectomy. J. Coll. Phys. Surg. Pak. 2011; 21: 654-658.
3. Raju N Pusapati, Sivashanmugam T. and Murugesan RS Respiratory Changes During Spinal Anaesthesia for Gynaecological Laparoscopic Surgery JOACP 10/2010; 26:475-9.
4. Sarli L, Costi R, Sansebastiano G, Trivelli M, Roncoroni L. Prospective randomized trial of low-pressure pneumoperitoneum for reduction of shoulder tip pain following laparoscopy. Br J Surg 2000;87:1161-5.
5. AgrawalM, Verma A.P and Kang L.S. Thoracic epidural anesthesia for laparoscopic cholecystectomy using either bupivacaine or a mixture of bupivacaine and clonidine: A comparative clinical study. Anesth Essays Res. 2013;7:44–48.
6. Gupta A, Gupta K, Gupta PK, Agarwal N, Rastogi B. Efficacy of thoracic epidural anesthesia for laparoscopic cholecystectomy. Anesth Essays Res 2011;5:138-41.
7. Kamal MM and Talaat SM. Comparative study of epidural morphine and epidural dexmedetomidine used as adjuvant to levobupivacaine in major abdominal surgery. Egyptian Journal of Anaesthesia 2014;30:137–141.
8. Jaakola ML, Salonen M, Lehtinen R, Scheinin H. The analgesic action of dexmedetomidine--a novel alpha 2-adrenoceptor agonist--in healthy volunteers. Pain 1991;46:281-5.
9. S Bajwa, V Arora, J Kaur, A Singh, and S. S. Parmar, Comparative evaluation of dexmedetomidine and fentanyl for epidural analgesia in lower limb orthopedic surgeries. Saudi J Anaesth. 2011;5:365–370.
10. Dexmedetomidine:Bhana N, Goa KL and McClellan KJ.Drugs. 2000;59:263-8;269-70.
11. Casati A, Putzu M. Bupivacaine, levobupivacaine and ropivacaine: are they clinically different? Best Pract Res ClinAnaesthesiol. 2005;19:247-68.
12. Erol DD, Yilmaz S, Polat C, Arikan Y. Efficacy of thoracic epidural analgesia for laparoscopic cholecystectomy. Pub med Adv Ther. 2008;25:45-52


**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 07-12-2015; **Published online**: 28-12-2015