

A comparative study in the post-operative spine surgeries: Epidural ropivacaine with dexmedetomidine and ropivacaine with clonidine for post-operative analgesia

Address for correspondence:

Dr. MS Saravana Babu,
No. 16, Bye Pass Road,
Subramaniya Nagar,
Tiruttani - 631 209,
Tamil Nadu, India.
E-mail: saravanababu4u@
gmail.com

**MS Saravana Babu, Anil Kumar Verma, Apurva Agarwal, Chitra MS Tyagi,
Manoj Upadhyay, Shivshenkar Tripathi**

Department of Anaesthesiology and Critical Care Medicine, G.S.V.M. Medical College, Kanpur,
Uttar Pradesh, India

ABSTRACT

Background: Anaesthesia for spine surgeries is not only concerned with relieving pain during surgeries but also during the post-operative period. A prospective randomised study was carried out to evaluate the efficacy of epidural route and to compare the efficacy and clinical profile of dexmedetomidine and clonidine as an adjuvant to ropivacaine, in epidural analgesia with special emphasis on their quality of analgesia and the ability to provide the smooth post-operative course. **Methods:** A total of 60 subjects, 33 were men and 27 were women between the age of 18 and 65 years of American Society of Anaesthesiologists (ASA) I/II class who underwent spine surgeries were randomly allocated into two groups, ropivacaine + dexmedetomidine (RD) and ropivacaine + clonidine (RC), comprising 30 patients each. Group RD received 20 ml of 0.2% ropivacaine and 1 µg/kg of dexmedetomidine while group RC received 20 ml of 0.2% ropivacaine and 2 µg/kg of clonidine through the epidural catheter. Onset of analgesia, time of peak effect, duration of analgesia, cardiorespiratory parameters, side-effects and need of rescue intravenous (IV) analgesics were observed. **Results:** The demographic profile and ASA class were comparable between the groups. None of the patients needed rescue analgesics in either group. Group RD had early onset, early peak effect, prolonged duration and stable cardiorespiratory parameters when compared with group RC. The side-effects profile was also comparable with a little higher incidence of nausea and dry mouth in both groups. **Conclusion:** Epidural route provided acceptable analgesia in spine surgeries and avoided the need of IV analgesics in either group. Dexmedetomidine is a better neuraxial adjuvant compared with clonidine for providing early onset and prolonged post-operative analgesia and stable cardiorespiratory parameters.

Key words: Anaesthesia technique, clonidine, dexmedetomidine, epidural analgesia, ropivacaine, spine surgeries

Access this article online

Website: www.ijaweb.org

DOI: 10.4103/0019-5049.118563

Quick response code



INTRODUCTION

Relieving post-operative pain of spine surgeries has become an indispensable component in anaesthesiology. Various methods have been tried for the management of post-operative pain in spine surgeries out of which epidural techniques are becoming most promising.^[1] α_2 adrenergic agonists

have both analgesic and sedative properties when used as an adjuvant in regional anaesthesia.^[2] Dexmedetomidine is a highly selective α_2 adrenergic agonist with receptor affinity 8 times greater than clonidine.^[3] While no head to head comparison of dose equivalence of epidural dexmedetomidine and clonidine has been done, the observation of various studies have stated that the dose of clonidine is

How to cite this article: Saravana Babu MS, Verma AK, Agarwal A, Tyagi CM, Upadhyay M, Tripathi S. A comparative study in the post-operative spine surgeries: Epidural ropivacaine with dexmedetomidine and ropivacaine with clonidine for post-operative analgesia. Indian J Anaesth 2013;57:371-6.

1-2 times higher than dexmedetomidine when used in epidural route.^[4] The degree of pain relief increases with the addition of alpha agonist to epidural local anaesthetics because of their analgesic properties and augmentation of local anaesthetic effects.^[5] The stable haemodynamics and the decreased oxygen demand due to enhanced sympathoadrenal stability make them very useful pharmacologic agents.^[6] Since only few studies have been published with epidural route for post-operative analgesia in spine surgeries, we planned a double-blind, prospective, randomised clinically controlled study at our institute to study the efficacy of epidural analgesia and compare the efficacy and safety of both alpha agonists through epidural route for post-operative analgesia after spine surgeries.

METHODS

After obtaining permission from the appropriate authority of the institute (302/E-3/07/PG. dated 15/05/2012) and written consent from patients, 60 patients of American Society of Anaesthesiologists (ASA) class I and II between the age of 18 and 65 years who underwent lower thoracic (below T8) and lumbosacral spine surgeries (laminectomy \pm discectomy for PIVD (Prolapse of intervertebral disc), excision of space occupying lesions, correction of vertebral deformities such as scoliosis, spondylolisthesis, benign spinal tumours, fracture fixation of the spine and vertebral bodies) were enrolled for the study. Patients with cardiac disease (heart blocks, significant bradyarrhythmias, left ventricular failure), haematological disease, bleeding or coagulation test abnormalities, psychiatric diseases, history of drug abuse and allergy to local anaesthetics, upper thoracic (above T8) and cervical spine surgeries, tubercular spine and any permanent neurological disorders were excluded from the study. Patients were given ranitidine 150 mg tablet a night before and on the morning before surgery. In the operation theatre, an intravenous (IV) access was secured and all non-invasive monitoring devices (non-invasive blood pressure (NIBP), electrocardiograph leads, pulse oxymeter, axillary temperature probe) were attached and the baseline cardiorespiratory parameters were recorded. All cases of spine surgery were conducted under general anaesthesia with the patient in lateral position. After completion of the surgical procedure and before closure of the surgical wound, an 18 gauge epidural catheter was placed under direct vision in the epidural space through a separate skin puncture

in the interspinous space above the incision (about 2.5 cm above the main surgical incision in the midline of the spine) with 16 gauge Touhy's needle. The catheter was positioned up to 7 cm from skin entry directing downwards in the epidural space under direct vision to avoid maldistribution of the drug. The catheter was then anchored in place on the back of the patient using an adhesive tape. After closing and dressing the surgical wound, patient made supine from lateral surgical position and extubated after adequate reversal. Patients were shifted to post-operative room and monitored. Once the patient in the post-operative room was noted to have pain (visual analogue scale (VAS) of >4), the study started. A test dose of 3 ml lignocaine with adrenaline (1:200,000) was injected and the patients were randomly allocated to one of the following two groups in a double-blinded fashion based on a computer-generated code: Group 1 (ropivacaine + dexmedetomidine (RD) group) ($n=30$): Received ropivacaine 0.2% 20ml plus dexmedetomidine 1 mcg/kg. Group 2 (ropivacaine + clonidine (RC) group) ($n=30$): Received ropivacaine 0.2% 20 ml plus clonidine 2 mcg/kg. After administering the drug, the following parameters were noted by the independent observer. (1) The pain score, by using VAS every 2 min for 30 min and then every 30 min until the need for next epidural top up. (2) Onset of analgesia (fall of VAS <4 after epidural drug). (3) Peak level of analgesia (achieving VAS score 0). (4) Duration of analgesia (starting from epidural drug administration to once the patient asks for additional epidural analgesia with VAS >4). (5) Monitoring of vital parameters such as NIBP, pulse rate, respiratory rate every 30 min. (6) Side-effects such as nausea, vomiting, respiratory depression, motor blockade (Bromage scale >1), deep sedation (Ramsay sedation scale >3), shivering and hypotension and (7) requirement for IV rescue analgesics (injection diclofenac). Once the patient asked for additional epidural analgesia (VAS >4) for pain relief during the observation period, the study ended and the above mentioned parameters were noted. The monitoring devices used in the observation period were NIBP, pulse oxymetry, VAS scale and continuous electrocardiogram. Hypotension (defined as systolic arterial pressure falling more than 20% from the pre-operative level) was treated with injection mephenteramine 3-6 mg IV bolus and heart rate <50 beats/min was treated with 0.01 mg/kg of injection atropine. Post-operative maintenance IV fluids were given as per body weight. Nausea and vomiting were

treated with 0.1 mg/kg of IV ondansetron. Shivering was treated with injection tramadol 50 mg IV.

Statistical analysis

Sample size was selected on the basis of cross-over pilot study of 10 patients in both groups to detect a projected difference of 35% between the two groups for the duration of analgesia for Type I error (α) of 0.05 and power of the study 0.8. At the end of the study, all data were compiled systematically and analysed using unpaired Student *t*-test and Chi-square test. Statistical Package for Social Science (IBM Software Group, Chicago, IL 60606, USA.) version 20.0 for Windows was used to compare the continuous variables between the two groups. Data are expressed as mean \pm SD. Value of $P < 0.05$ is considered significant and $P < 0.0001$ as highly significant.

RESULTS

The demographic profile of the patients in both groups was comparable with regards to age, weight and height. The distribution as per ASA class was similar and comparable in both the groups [Table 1].

Addition of dexmedetomidine to ropivacaine as an adjuvant resulted in an earlier onset (7.33 \pm 1.76 min) of analgesia as compared to the addition of clonidine (8.40 \pm 1.61 min). Dexmedetomidine not only provided early onset, but also helped in achieving the peak analgesic level (VAS = 0) in a shorter period (11.66 \pm 2.05 min) compared with clonidine (13.20 \pm 2.90 min). The duration of analgesia also prolonged in dexmedetomidine group (407.00 \pm 47.06 min) compared to clonidine group (345.01 \pm 35.02). All these analgesic characteristics are statistically significant values on comparison ($P < 0.05$) [Table 2]. The need for IV rescue analgesics in both groups was nil throughout the study period [Table 2].

Comparative incidence of various side-effects in both groups was observed in the post-injection period. The incidence of dry mouth and sedation were similar in both groups and also statistically non-significant. The incidence of other side-effects such as nausea, vomiting, headache and shivering were comparable in both groups and found to be statistically non-significant ($P > 0.05$). None of the patient showed respiratory depression or motor block in either group.

In both groups, the VAS score followed a decreasing trend from 0 to 15 min of post-injection. From 15 to

Table 1: The demographic profile of patients of both groups

Demographic characteristics	RD group (mean \pm SD)	RC group (mean \pm SD)	P value
Age (years)	47.86 \pm 8.14	48.90 \pm 7.14	0.6033
Weight (kg)	60.26 \pm 5.77	59.1 \pm 4.943	0.4041
Height (cm)	158.86 \pm 5.55	160.12 \pm 5.97	0.5628
ASA PS (I/II)	25/5	23/7	0.7468

ASA PS – American society of anaesthesiologists physical status; RD – Ropivacaine+dexmedetomidine; RC – Ropivacaine+clonidine; SD – Standard deviation

Table 2: Comparison of analgesic characteristics in both the groups

Analgesic characteristics	Group RD (n=30)	Group RC (n=30)	P value
Onset of analgesia (min)*	7.33 \pm 1.76	8.40 \pm 1.61	0.0176
Time of peak onset of analgesia (min)**	11.66 \pm 2.05	13.20 \pm 2.90	0.0221
Duration of analgesia (min)***	407.00 \pm 47.06	345.01 \pm 35.02	<0.0001
Need of IV rescue analgesics (injection diclofenac IV)	Nil	Nil	-

*Onset of analgesia (fall of VAS to < 4 after epidural drug), **Peak level of analgesia (achieving VAS score 0), ***Duration of analgesia (starting from epidural drug administration to once the patient asks for additional epidural analgesia with VAS > 4). RD – Ropivacaine+dexmedetomidine; RC – Ropivacaine+clonidine; IV – Intravenous

240 min (4 h), the VAS score was stable and this period was totally pain free. After 240 min (4 h), the VAS score showed an increasing trend. All the patients of either groups asked for additional epidural drug when the average VAS score was > 4 . However, the mean VAS score was higher in the clonidine group at each time interval and also the RC group needed epidural top up earlier than dexmedetomidine RD group [Figure 1].

There was no significant difference of heart rate and mean arterial blood pressure ($P > 0.05$) in both the groups at the time of administration of drugs, but it started to decrease as evident at 30 min post-injection, there was a fall in both groups. There was a decreasing trend of heart rate and mean arterial pressure post-injection in both groups and this decrease was significant in the RC group compared with RD group ($P < 0.05$) but none of the patient showed bradycardia or hypotension at any time.

There was a decrease in mean respiratory rate in both the groups after giving the drug and the difference between the groups was statistically not significant ($P > 0.05$) at different time intervals. None of the patient showed respiratory depression (< 10 /min) at any time.

DISCUSSION

The main aim of post-operative pain relief is to provide subjective comfort, in addition to inhibiting nociceptive

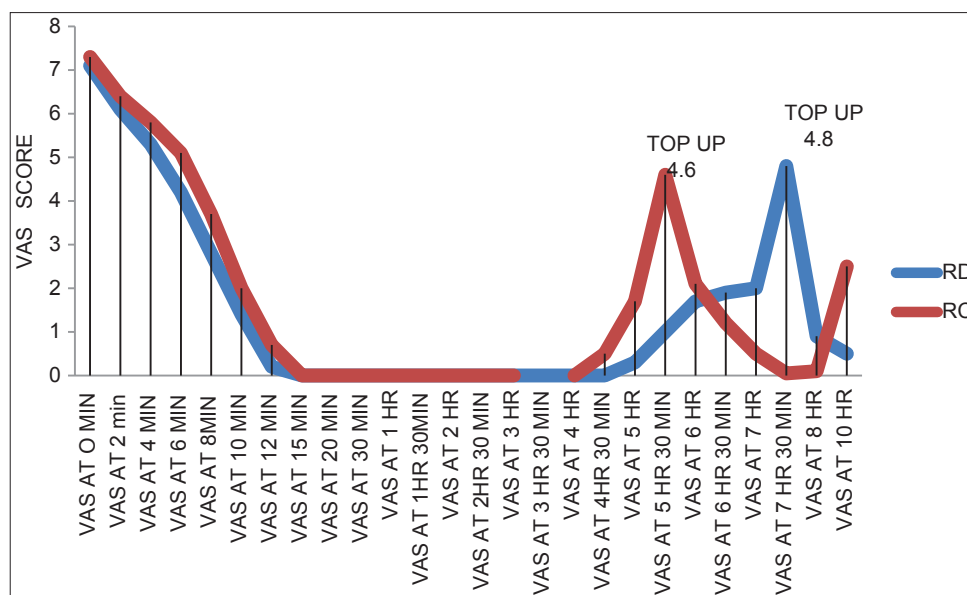


Figure 1: Visual analogue scale score observation between the two groups at different intervals

impulses caused by trauma and to blunt autonomic as well as somatic reflexes to pain. Subsequently, this might enhance restoration of function by allowing the patient to breathe, cough and to be easily ambulant. Giving epidural analgesia for post-operative spine surgeries is a newer technique and challenging one for pain relief because inserting an epidural catheter in the surgical site has lot of controversies and drawbacks; however, we overcame these issues and got good results.^[1,2,7,8] The surgical incision for the spine surgeries involved the nerve supply area of not more than nine spinal segments and less than six spinal segments. The instrumentation of the epidural space soon after surgery requires a larger amount of drug than the usual. So taking into account, drug of 20 ml (2 ml/segment) will be sufficient to give adequate analgesia. A test dose of 20 ml was taken in all cases to keep the drug amount constant since the study involved the spine pathology below T8 (14 segments).^[1,7]

In our study, VAS score was used to evaluate the efficacy of epidural route. Since the study begins in the post-operative period, the residual effects of general anaesthesia drugs make the perception of mild pain (VAS<4) to differ among patients as most patients tolerate minimal pain in the post-operative period due to residual analgesia and hypnosis. We started the study with VAS>4 based on previous studies where post-operative epidural analgesia was given for VAS>4.^[9] There was a significant change/decrease in VAS score at 6 min in both groups but the decrease was greater in RD group and at 10 min post-injection of the

drug there was a further decrease in VAS score in both groups and became insignificant. In both groups, there was increasing trend of mean VAS score after 5 and 7 h post-injection of the drug, which showed a fall in mean VAS score after epidural top up in both groups. However, still mean VAS scores were higher in RC group in comparison to RD group at different time intervals although statistically not significant [Figure 1]. This shows that although epidural route provided good mode of analgesia in both the groups, dexmedetomidine improved the epidural efficacy.^[4,5,10,11]

None of the patients of both groups needed rescue IV analgesics (injection diclofenac) throughout the study period. This shows that epidural route provided effective analgesia in all the patients of both groups.^[1,2,7] Since the epidural catheters were placed under direct vision in the epidural space during the perioperative period, chances of epidural failure were not seen.^[1,7]

Although epidural route of analgesia increases the possibility of hemodynamic instability, the cardio-respiratory parameters remained stable throughout the study period, which reaffirms the established effects of α_2 agonists in providing a haemodynamically stable post-operative analgesia.^[12] A slight decrease in heart rate and mean arterial pressure was observed in both the groups, it never fell down to more than 20% of the baseline values.^[13] Furthermore, the use of low concentration of ropivacaine (0.2%) decreased the chances of hypotension.

The use of neuraxial opioids was associated with a few side-effects, so various options including α_2 agonists are being extensively evaluated as an alternative with emphasis on opioid-related side-effects such as respiratory depression, nausea, urinary retention and pruritus.^[14,15] The use of alpha-2 agonists for regional neural blockade in combination with local anaesthetic results in increased duration of sensory blockade with no difference in onset time.^[11,13] Epidural administration of these drugs is associated with sedation, analgesia, anxiolysis, hypnosis and sympatholysis. The faster onset of action, rapid establishment of both sensory and motor blockade, prolonged duration of analgesia in the post-operative period, dose-sparing action of local anaesthetics and stable cardiovascular parameters make these agents a very effective adjuvant in regional anaesthesia.^[10,16-18] However, dexmedetomidine has early onset of analgesia than clonidine as an adjuvant.^[4] Addition of either 1 $\mu\text{g}/\text{kg}$ dexmedetomidine or 2 $\mu\text{g}/\text{kg}$ clonidine as adjuvant to epidural ropivacaine prolonged the duration of analgesia. Duration of block was prolonged in RD group than in RC group, in our study.^[4,11,19] These properties of dexmedetomidine are mostly due to their increased affinity to α_2 receptors (8 times more than clonidine). This affinity is when the drug is used in IV route. The affinity for epidural route is not known.^[3,20,21]

The side-effect profiles of both these drugs are quite favourable as none of the patient in either groups had profound deep sedation (sedation score >3) or respiratory depression.^[13] Light sedation (sedation score ≤ 3) was found in both groups in almost equal proportions, but none of the patients had profound deep sedation (sedation score >3) in both groups. None of the patients in the study developed motor blockade, respiratory depression.^[11] This can be attributed to lower concentrations of ropivacaine and the α_2 agonists properties of sedation with no respiratory depression.

The limitation of the study is that it was conducted on patients of lumbosacral and lower thoracic spine surgeries (below T8) to avoid much differences in the perception of pain because the perception of post-operative pain will certainly differ depending on the level of spine, affecting breathing pattern of the patient. We were not able to include the patients of upper thoracic and cervical spine surgeries.

Results of our study provides strength and adds evidence to the studies that showed epidural analgesic

regimens significantly reduced post-operative pain in spine surgeries and the requirement for supplementary parenteral analgesics was minimal^[7,8] and the use of alpha agonists in epidural route significantly reduced the demand for opioids and reduced the post-operative nausea with few side-effects.^[2]

Placing an epidural catheter at the surgical site may increase the chances of infection in the epidural space.^[22] The surgeons may not prefer epidural analgesia after spine surgeries due to the fear of infections. These controversies can be managed by maintaining strict aseptic precautions while putting an epidural catheter and administering the drug through the catheter. Proper antibiotics and dressing care in the post-operative period can also reduce the risk of infection.^[23]

Research studies on epidural catheter related infections in spine surgeries should be carried out in the future, so that the fear of infections among the surgeons and patients can be alleviated. Studies comparing the efficacy of epidural analgesia between cervicothoracic and lumbosacral spines should be carried out, so that epidural analgesia can be safely used in spine surgeries of all levels.

CONCLUSION

It can be concluded from the study the epidural route provided adequate analgesia in spine surgeries in terms of VAS score and overall patient satisfaction and it avoided the need of IV analgesics in both groups. Dexmedetomidine is a better neuraxial adjuvant to ropivacaine when compared to clonidine for providing early onset and prolonged post-operative analgesia and stable cardiorespiratory parameters.

REFERENCES

1. Taenzer AH, Clark C. Efficacy of postoperative epidural analgesia in adolescent scoliosis surgery: A meta-analysis. *Paediatr Anaesth* 2010;20:135-43.
2. Farmery AD, Wilson-MacDonald J. The analgesic effect of epidural clonidine after spinal surgery: A randomized placebo-controlled trial. *Anesth Analg* 2009;108:631-4.
3. Aryan HE, Box KW, Ibrahim D, Desiraju U, Ames CP. Safety and efficacy of dexmedetomidine in neurosurgical patients. *Brain Inj* 2006;20:791-8.
4. Bajwa SJ, Bajwa SK, Kaur J, Singh G, Arora V, Gupta S, et al. Dexmedetomidine and clonidine in epidural anaesthesia: A comparative evaluation. *Indian J Anaesth* 2011;55:116-21.
5. Coskuner I, Tekin M, Kati I, Yagmur C, Elcicek K. Effects of dexmedetomidine on the duration of anaesthesia and wakefulness in bupivacaine epidural block. *Eur J Anaesthesiol* 2007;24:535-40.
6. Kalajdzija M, Cero I, Prnjavorac B, Ljuca S. Influence of clonidine on the hemodynamic stability and stress response

- in the course of surgery on general anesthesia. *Med Arh* 2011;65:210-2.
7. Kumar RJ, Menon KV, Ranjith TC. Use of epidural analgesia for pain management after major spinal surgery. *J Orthop Surg (Hong Kong)* 2003;11:67-72.
 8. Rehtine GR, Love LC. The postoperative laminectomy pain control using bupivacaine and epidural morphine. *Br J Anaesth* 2005;95:59-68.
 9. Gupta R, Kaur S, Singh S, Aujla KS. A comparison of epidural butorphanol and tramadol for postoperative analgesia using CSEA technique. *J Anaesthesiol Clin Pharmacol* 2011;27:35-8.
 10. Selim MF, Elnabity AM, Hasan AM. Comparative evaluation of epidural bupivacaine-dexmedetomidine and bupivacaine-fentanyl on Doppler velocimetry of uterine and umbilical arteries during labor. *J Prenat Med* 2012;6:47-54.
 11. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, *et al.* Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. *Acta Anaesthesiol Scand* 2006;50:222-7.
 12. Pichot C, Longrois D, Ghignone M, Quintin L. Dexmedetomidine and clonidine: A review of their pharmacodynamics to define their role for sedation in intensive care patients. *Ann Fr Anesth Reanim* 2012;31:876-96.
 13. El-Hennawy AM, Abd-Elwahab AM, Abd-Elmaksoud AM, El-Ozairy HS, Boulis SR. Addition of clonidine or dexmedetomidine to bupivacaine prolongs caudal analgesia in children. *Br J Anaesth* 2009;103:268-74.
 14. Mohamed AA, Fares KM, Mohamed SA. Efficacy of intrathecally administered dexmedetomidine versus dexmedetomidine with fentanyl in patients undergoing major abdominal cancer surgery. *Pain Physician* 2012;15:339-48.
 15. Techanivate A, Dusitkasem S, Anuwattanavit C. Dexmedetomidine compare with fentanyl for postoperative analgesia in outpatient gynecologic laparoscopy: A randomized controlled trial. *J Med Assoc Thai* 2012;95:383-90.
 16. Bajwa SJ, Arora V, Kaur J, Singh A, Parmar SS. Comparative evaluation of dexmedetomidine and fentanyl for epidural analgesia in lower limb orthopedic surgeries. *Saudi J Anaesth* 2011;5:365-70.
 17. Ogun CO, Kirgiz EN, Duman A, Kara I, Okesli S. The comparison of intrathecal isobaric ropivacaine and isobaric ropivacaine-clonidine for caesarean delivery. *Internet J Anesthesiol* 2007;15:1.
 18. Bajwa SJ, Kaur J, Bajwa SK, Bakshi G, Singh K, Panda A. Caudal ropivacaine-clonidine: A better post-operative analgesic approach. *Indian J Anaesth* 2010;54:226-30.
 19. Laha A, Ghosh S, Das H. Comparison of caudal analgesia between ropivacaine and ropivacaine with clonidine in children: A randomized controlled trial. *Saudi J Anaesth* 2012;6:197-200.
 20. Swami SS, Keniya VM, Ladi SD, Rao R. Comparison of dexmedetomidine and clonidine (α_2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. *Indian J Anaesth* 2012;56:243-9.
 21. Schnaider TB, Vieira AM, Brandão AC, Lobo MV. Intraoperative analgesic effect of epidural ketamine, clonidine or dexmedetomidine for upper abdominal surgery. *Rev Bras Anesthesiol* 2005;55:525-31.
 22. Yang YW, Chen WT, Chen JY, Lee SC, Chang Y, Wen YR. Bacterial infection in deep paraspinal muscles in a parturient following epidural analgesia. *Acta Anaesthesiol Taiwan* 2011;49:75-8.
 23. Pahys JM, Pahys JR, Cho SK, Kang MM, Zebala LP, Hawasli AH, *et al.* Methods to decrease postoperative infections following posterior cervical spine surgery. *J Bone Joint Surg Am* 2013;95:549-54.

Source of Support: Nil, Conflict of Interest: None declared

Announcement

FAMILY BENEVOLENT FUND OF ISA

Family Benevolent Fund (FBF) is one of the welfare programs of Indian Society of Anaesthesiologists (ISA). It is registered under the Societies Registration Act. Please visit the website www.isafbf.com. Membership is limited only to ISA members and President and Secretary are in the executive body of FBF. ISA member can be a member of FBF by paying the Membership fee depending on the age of members.

Up to 35 years	-	3,000/-
Up to 40 years	-	4,500/-
Up to 45 years	-	6,000/-
Up to 50 years	-	8,000/-
Up to 55 years	-	10,000/-
Up to 60 years	-	15,000/-

Age proof is required, the membership fee increased from April 2010. Immediate settlement of Fraternity amount to the nominee, in case of death of a member. So far 14 members were supported with an amount of Rs. 18 Lakhs.

Dr. S S C Chakra Rao

Secretary. FBF/ISA

67-B, Shanti Nagar,

Kakinada, Andhra Pradesh – 533003, India.

Mob.: +91 94401 76634

Email: secretaryfbf@isaweb.in

Website: www.isaweb.in and www.isafbf.com