Cervical Epidural Anaesthesia with Ropivacaine for Modified Radical Mastectomy

Kulkarni K, Namazi IJ, Deshpande S, Goel R

Department of Anaesthesia

D.Y. Patil Medical College, Kolhapur

Maharashtra, India

Corresponding Author

Kalpana Kulkarni

Department of Anaesthesia

D.Y.Patil Medical College, Kolhapur

Maharashtra, India

Email: drrmk@rediffmail.com

Citation

Kulkarni K, Namazi IJ, Deshpande S, Goel R. Cervical Epidural Anaesthesia with Ropivacaine for Modified Radical Mastectomy. *Kathmandu Univ Med J* 2013;42(2):126-131.

ABSTRACT

Backgroud

Cervical epidural anaesthesia (CEA) using local anesthetics (LA) is a well established technique for the surgeries in the neck, chest and upper arms. Recently ropivacaine is introduced with better safety profile.

Objectives

The aim was to observe the safety of Cervical epidural anaesthesia as an anaesthetic technique and to compare the efficacy of epidural 0.25% bupivacaine with 0.375% ropivacaine for radical mastectomies.

Methods

A double blind study was conducted on 40 ASA grade I / II females who received CEA with 10 ml of 0.25% of bupivacaine +25µg of fentanyl in group B (n=20) and 10 ml of 0.375% of ropivacaine +25µg of fentanyl in group R (n=20) epidurally. Assessment of the block, vital monitoring and complications noted.

Results

No significant differences observed in the onset of sensory block (5.05min and 5.4min in group B and R respectively, P>0.05).The mean motor blockade score, time to achieve complete blockade and time to grade I motor recovery was significantly longer in group B (2.3, 22.5 and 79.5 minutes respectively) as compared to group R (1.5, 18.3 and 66.3 minutes respectively, P<0.05). Respiratory distress developed in two patients of group B that required general anaesthesia (GA) with intubation.

Conclusion

Use of 0.37% ropivacaine is safer than 0.25% bupivacaine for CEA for radical mastectomy. It provides good surgical anaesthesia with lesser degree of motor blockade and the respiratory effects.

KEY WORD

Bupivacaine, cervical epidural anaesthesia, radical mastectomy, ropivacaine

INTRODUCTION

Bonnet F et al. and Hakl P et al. reported the sole use of CEA for the ease of monitoring cerebral and motor functions during carotid artery surgery.[1,2] CEA as an anaesthetic for mastectomies, breast reconstruction in elderly females and in patients with pulmonary diseases has been reported for better acceptance and safety over GA.[3-5] In recent years successful use of CEA for thoracic/coronary artery bypass surgery is also documented.[6,7] Racemic bupivacaine is an equal mixture of R+ and S- enantiomers, where R+ isomer is mainly responsible for the systemic toxicity due to differential affinity for ion channels of Na, K+ and Ca. Ropivacaine being a pure S- enantiomer have less toxicity profile and it is 40-50% less potent than bupivacaine with stronger differentiation between sensory and motor blockade. Clinical studies on lumbar epidural blocks have confirmed similar pattern of sensory block but motor blockade of slower onset, less intense and of shorter duration with ropivacaine as compared to bupivacaine.[8,9] The technique of CEA requires special skill and expertise to avoid potential complications like inadvertent dural

puncture, spinal cord trauma, epidural hematoma/abscess.[6] Considering the safe use of sole CEA in literature, with all precautionary measures a pilot study was conducted on 10 female patients undergoing radical mastectomy using either 10ml of 0.25% bupivacaine (n=5) or 0.375% ropivacaine (n=5).Later 40 females with carcinoma breast were enrolled for the double blind study with the aim to compare the efficacy and safety of CEA with the use of 0.25% bupivacaine versus 0.375% ropivacaine by addition of 25µg of fentanyl in each.

METHODS

A prospective randomized double blind study was conducted in patients undergoing radical mastectomy. Written informed consent for regional and general anaesthesia obtained from 40 female patients of ASA grade I /II, age between 50-65 years, BMI 25+/-5 kg/m2, height 140-170cms. They were thoroughly assessed and investigated. The patients with any contraindication for CEA, refusal for the technique or having respiratory problems were excluded from the study. 5-10mg tablet diazepam was given at night before surgery. Once the patient shifted in the operation theatre, baseline vital parameters noted with standard monitoring of electrocardiogram (ECG), heart rate (HR),non invasive blood pressure(NIBP), oxygen saturation (SpO2), respiratory rate (RR). Preloading was done with 15ml/kg of Ringer Lactate. Injection (Inj.) glycopyrrolate 0.004mg/kg, antiemetic prophylaxis with Inj. ranitidine 50mg and Inj. metoclopramide 10mg were given intravenously (IV). Later patient was placed in sitting position with head flexed and supported on the table. The senior anaesthesiologist having expertise, performed the technique of CEA. The anesthesiologists' performing block and who made the observations were blinded to the drug prepared for epidural injection.Under asceptic precautions CEA was given at C6-C7 or C7-T1 level in the midline, using18 gauge Tuohy's needle with bevel facing cranially at an angle of 30 degrees and by loss of resistance method to identify the epidural space (Fig 1). An epidural catheter was placed 3cm cranially, tested for negative aspiration. In supine position, test dose of 2ml, 2% lignocaine with adrenaline given epidurally and vitals observed for any signs of deterioration for five min, then patients in group B (n=20) received 10 ml of 0.25% of bupivacaine +25µg of fentanyl and in group R (n=20) 10 ml of 0.375% of ropivacaine +25µg of fentanyl epidurally.

Figure 1. Technique of cervical epidural.

The onset and level of sensory block was assessed by loss of sensation to pin prick test with a 25 gauge needle, every 2 min for 10 min and then every 5 min for 15 minutes, later postoperatively every 30 min for four hours. Time to first top up dose was considered as an effective duration of sensory anaesthesia. Onset and duration of motor blockade was assessed as described by Pavel Mickalek et al with upper limb lift, noted as grade I-III score (Grade I= absence of motor block, II =possible movements but not against resistance, III= complete motor block) and the hand grip strength (grade I- good, II-impaired, III-no strength) every 10 min for 30 minutes, later every hourly for six hours.[10] From onset of motor blockade to return of grade I upper limb lift was considered as duration of motor blockade. Routine continuous monitoring for (ECG, NIBP, HR, RR, SpO2) before and every five minutes after the block, besides the blood loss and urine output intra operatively. All the patients were observed for any complications related to the CEA like hypotension, bradycardia, subarachnoid/ intravascular injection as well as for the respiratory effects. Bradycardia of HR<50/min was treated with Inj. atropine 0.02mg/kg and the mean arterial pressure (MAP) of < 30% of the baseline with Inj. mephenteramine 3-6mg IV in boluses. Oxygen supplementation was done throughout the procedure and post operatively for two hours. Conscious sedation by supplementation of midazolam 0.05mg/kg IV bolus given and 1µg/kg of fentanyl IV bolus was added as a rescue analgesic whenever required. Level of sedation assessed according to the modified Wilson sedation scale (Grade I –awake, II-sleeping, easily arousable, III- deep sleep but arousable, IV- deep sedation but not arousable) noted hourly following block for four hours, later at six and 12 hours.[11] Patients who developed moderate discomfort / respiratory distress were given GA with intubation. Epidural top up was given with 50% of the bolus dose (5 ml) when patient complained of pain or discomfort. Postoperative vital parameters and pain noted on visual analogue scale (1-10 points) every 30 min for four hours, later four hourly for 24 hours. Post operative analgesia provided with 5ml of 0.125% bupivacaine and 0.2% ropivacaine in group B and R respectively, which was on demand or when VAS reached >3. Epidural catheter was removed after 48 hours. Sample size was estimated by formula n=4pq/E 2 by keeping power of study 0.9. Observational data mentioned as mean (SD) and percentage wherever appropriate and analyzed by using MS Excel-data analysis Tool Park option. Students' unpaired "t" test was applied for comparisons' of mean observations of the quantitative data for continuous variables like observations for sensory, motor blockade, hemodynamic parameters and data related to the post operative analgesia in two study groups. For comparison of proportions of the categorical qualitative data like incidence of requirement of sedation or GA and about complications,

Fisher's Exact Test applied using Instat software and two tailed P value was calculated.P< 0.05 was considered as statistically significant(*), P <0.001 as highly significant(**) and P>0.05 as insignificant (+).

RESULTS

There were no differences in demographic variables among the groups while considering age, BMI, height and ASA grade of the patients (P>0.05). Mean duration of surgery was 119 min and 116 min in-group B and R respectively. There were no significant differences in the sensory parameters achieved in group B and group R (P > 0.05) (Table 1).The mean time required to achieve motor blockade was significantly longer in-group B (22.5 minutes) as compared to group R (18.3minutes) P=0.001, time to grade I motor recovery was also significantly longer in group B than in group R, (79.5 and 66.3 minutes respectively), P= 0.0000005 (P<0.001) (Fig 2). The mean grade of motor blockade observed in-group B (2.3) was significantly more

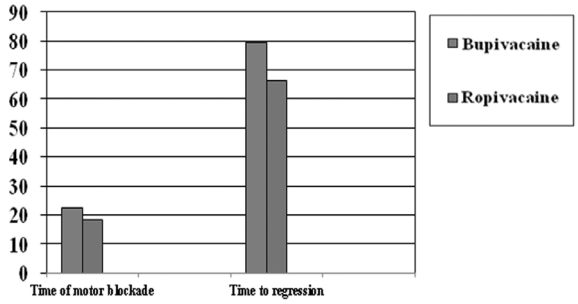

Figure 2 .Comparisons of mean time to complete motor blockade and duration of motor blockade. Observations noted as mean time in minutes. (* P=0.001 and * *P<0.001 respectively).

as compared to group R (1.5) P=0.00005 (P<0.001), which clinically correlated with lesser strength on hand grip test in group B patients than in group R. Baseline HR and MAP was comparable in both the groups. There were no statistically significant differences in the intraoperative mean HR (73+/-7/min) and (77+/-8/ min) (P=0.33), mean MAP (85+/-7 mm of Hg) and (83+/-7 mm of Hg) (P=0.28),mean RR (15+/-1.1min) and (15+/-1.3min) (P=0.36) in group B and group R respectively. Mean SpO2 was (98+/-1%) and (98+/-1.5%),

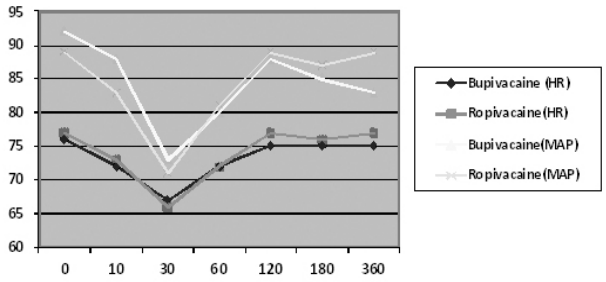

Figure 3. Record of mean HR (beats/min) and MAP (mmHg) in group B and R intraoperatively. (P <0.001) HR: Heart rate; MAP: Mean arterial pressure over time in minutes.**

(P=0.35) and the blood loss was (301 +/-20 ml) and (302+/-25 ml), (P=0.45) in group B and R respectively (P>0.05). However, there was significant drop in the mean HR and MAP at 30 min after the block in patients of both the groups when compared with respective base line values (P <0.001) (Fig 3). Along with sedation supplementation of analgesic needed in 20 % and 30 % patients in-group

Table 1. Comparisons of mean onset time, time to reach T4 and maximum effect, level of block achieved and duration of effective sensory block. Data expressed in mean+/-SD and range.

	Group B (n=20)	Group R (n=20)	P Value
Onset of sensory block (min)	5.05 (0.75)	5.4 (1.23)	0.14 +
Time to reach level T4	7.9	8.5	0.0613+
Max level (min)	12 (2.5)	12.2 (2.1)	0.39+
Level of block	C3-T7	C3-T6	-----
Duration of block (min)	91.8 (4)	90 (5.8)	0.16+

* Statistically Significant (P< 0.05), + Statistically Insignificant (P>0.05).

Table 2. Comparisons of supplementation with sedation and analgesic, sedation score, duration of post operative analgesia, requirement of epidural top ups and mean VAS score. Data mentioned as number (percentage) ,range, mean+/-SD. + Statistically Insignificant (P>0.05).

	Group B (n=20)	Group R (n=20)	P Value
Sedation with analgesic given (No. and % of patients	(4)20%	(6)30%	P=0.31+
Sedation score	II -III	II -III	---
Duration of PO analgesia (hrs)	6.6(0.9)	6.8(0.8)	P=0.23+
Post OP top ups in 48 hrs	6.9(0.8)	7.2(0.7)	P=0.11+
Mean VAS in 24 hrs	2.9(0.8)	3.1(0.6)	P=0.14+

+ Statistically Insignificant

Table 3. Peri-operative complications expressed as number (percentage) of patients.

	Group B (n=20)	Group R (n=20)	P Value
Hypotension	(5)25%	(3) 15%	P=0.69+
Bradycardia	(5)25%	(4)20%	P= 1 +
Respiratory distress/ Needed GA with Intubation,IPPV	(5)25% (2/5)10%	(0)0% (0)0%	P=0.047 * ---
IV/Dural puncture	(0) 0%	(0) 0%	---
Nausea/vomiting /pruritis	(0) 0%	(0) 0%	---
Tingling numbness in upper limbs	(1) 5%	(1) 5%	P=1.51 +

* Statistically Significant, + Statistically Insignificant .

B and R respectively for the reason of anxiety and mild discomfort. The mean doses of drug used were midazolam 0.05mg/kg and fentanyl 1µg/kg IV. While comparing the post operative parameters (sedation score, duration of analgesia, VAS score and epidural top ups) no significant differences observed statistically. (Table 2)

The incidence of hypotension / bradycardia was more in group B as compared to group R but it was statistically insignificant and that responded to the injections of incremental 3-6 mg of mephenteramine (mean dose of 4.2mg in group B and 4 mg in group R patients) with fast IV fluids and atropine (mean dose 0.02mg/kg) respectively. Incidence of mild (feeling of shortness of breath but SpO2 >95%) to moderate respiratory distress (tachypnoea and desaturation (SpO2 <95%)) observed after 30 minutes of block in five (25%) patients in group B. Three (15%) patients out of five, settled with higher FiO2 supplementation by ventimask and remaining two (10% patients of age > 60 having SpO2 = 85%) required GA with intubation whereas no patient (0 %) in-group R developed respiratory distress (P=0.047, P<0.05). Post operatively one patient in each group complained of tingling numbness in one of the upper arms that responded to immediate removal of the epidural catheter and injection dexamethasone 8mg 12 hourly for 48 hours. None of the patients had accidental intravascular injection, dural puncture, nausea / vomiting or pruritus in both the groups (Table 3).

DISCUSSION

Till date, inspite of certain disadvantages GA is the most preferred technique for radical mastectomy. Combined GA with high thoracic/cervical epidural anaesthesia as a balanced technique is well reported.[12,13] The CEA as a sole technique for radical mastectomy is less practiced, as it requires more skill, vigilant monitoring for its high potential for complications due to the close proximity of spinal cord and the consequent cardiac or respiratory effects. In experienced hands sole use of CEA for various neck and chest surgeries is documented, highlighting the advantages like stable cardio-respiratory status by avoiding airway instrumentation, less blood loss and post operative morbidity.[1,10,14] CEA blocks the cervical plexus (C1-C4), phrenic nerve (C3-C5), brachial plexus C5-T1) and upper thoracic dermatomes along with sympathetic fibers that are responsible for the stress induced neuro- hormonal reactions. Major concerns with CEA are the hemodynamic and respiratory complications. Different concentrations of bupivacaine are used and studied for the hemodynamic/ respiratory effects following CEA.[15,16]

In recent years efficacy of ropivacaine has also been studied for CEA.[10,17,18] Ropivacaine 0.5-0.75% reported to have favorable effect on hemodynamic variables by blocking the sympathetic innervations of the heart.[5,19] In our study, the mean onset time and duration of sensory anaesthesia was almost similar in patients receiving epidural bupivacaine and ropivacaine. Similarly Agrawal M et al noted onset time of 6.98 min with 10-12ml of 0.25 % bupivacaine where top up doses required after 90-120 min in 73.3 % cases under CEA for neck or upper thoracic surgeries.[20] The Extent of sensory block observed was similar to the studies by Bonnet F et al (C2 toT4-8 with 15 ml of 0.5% bupivacaine) and Capdevila X et al (C2 to T5 with mean 9.3 ml of 0.25% bupivacaine and C2-T6 with 0.375% of bupivacaine) with CEA.[1,16]Addition of opioids to epidural anaesthetic is known to improve the quality and duration of anaesthesia.[1,21]

Bonnet F et al used 15 ml of 0.5% bupivacaine in 49 patients of CEA for carotid artery surgery and observed dyspnea in three patients of COPD who required controlled ventilation.[1] Capdevila X et al studied the effect of 0.25% and 0.375 % of bupivacaine on pulmonary function in ten healthy conscious patients and concluded that both concentrations impaired the diaphragmatic function but SpO2 decreased by 2 % after administration of 0.375% of bupivacaine. He also observed significant decrease in diaphragmatic excursion and forced vital capacity by 21 % and 18 % with 0.25 % bupivacaine and 39 % and 26 % with 0.375 % bupivacaine respectively without affecting the FEV1/FVC ratio significantly. He noted significant reduction of handgrip strength by 35 % with 0.25 % bupivacaine and 52 % with 0.375 % of epidural bupivacaine with sensation of dyspnea.[16] This suggests that higher concentration of bupivacaine induces respiratory muscle paralysis and diaphragmatic dysfunction that may lead to dyspnea. Addition of opiods may depress the ventilation, and increase in Paco2 from 37.3 to 40.2 was observed by F Bonnet et al in patients who received fentanyl bupivacaine combination.[1,22] Michalek P et.al did not observe any respiratory insufficiency but observed bilateral partial motor block of grade II in upper extremities in one patient without dyspnea in 15 patients who received 10 ml of 0.75 % ropivacaine.[10] Dominguez F et al conducted shoulder surgeries in three patients with 0.75 % ropivacaine under CEA and concluded that ropivacaine provides an effective sensory block and a restricted motor blockade, reducing the probability of the restrictive pulmonary syndrome associated with cervical epidural anesthesia.[18] Considering the findings of above studies we decided to use 0.25 % of bupivacaine and compared it with 0.375 % of ropivacaine with the addition of fentanyl 25 µg, so as to improve the quality of anaesthesia with lower concentrations of LA agents.[1,10,16,18,22] In our study, the mean score of motor blockade and time of its recovery was significantly longer with 0.25 % of bupivacaine than with 0.375 % of ropivacaine. We observed mild dyspnea in three patients and respiratory embarrassment requiring controlled ventilation in two females of age > 60 years who received 0.25 % bupivacaine with fentanyl. The extent of sensory anaesthesia observed in these two patients was from C4-T7 with grade II motor blockade in upper limbs. Probably decrease in diaphragmatic excursion/ thoracic compliance might be responsible for the mild to moderate respiratory distress .

Whereas patients in ropivacaine group had no significant respiratory complications. Epidurally administered ropivacaine causes significantly less motor blockade at lower concentration than bupivacaine due to lower relative potency.[23] There was no significant change in haemodynamic parameters that could be attributed to the lower concentration of both the drugs as observed by other studies.[10,20] Use of higher concentrations of bupivacaine 0.5 % or lignocaine 2 % with dose of > 15 ml results in excessive bradycardia and hypotension. Preloading with 10-15 ml/kg and compensatory vasoconstriction in the unblocked region prevents the effects due to peripheral pooling of blood.[24] Singh AP used sole CEA with one percent lignocaine adrenaline for cancer breast surgeries in 49 patients and observed stable hemodynamic and respiratory status.[25] The overall incidence of hypotension and bradycardia was 15-20 % with significant drop in the HR and MAP at 30 minutes of the block in both the groups that easily responded to the treatment as observed by other studies.[10,20,26] However clinically the effects were short lived in patients receiving 0.375 % ropivacaine than 0.25 % bupivacaine epidurally. The other complications reported with CEA are venipuncture, dural puncture, PDPH, seizure and mortality due to epidural hematoma.[1,25] Epidural abscess may occur following injection of steroids or long term in dwelling catheter. Emergency lamminectomy may be required to avoid permanent neurological damage. Neural irritation or injury due to the needle or catheter is also possible.[6] CEA significantly decreases the blood loss due to blockade of cardiac sympathetic fibers leading to decrease in cardiac output, blood pressure, reduction in airway and thoracic pressures.[6,24] Efficacy of epidural ropivacaine is comparable to bupivacaine for postoperative pain relief and it is well documented.[17,21,23] We did not observe any significant differences in the mean VAS score and requirement of top up doses in both the groups. The safety features of ropivacaine over bupivacaine are greater sensory motor differentiations with decreased potential for central nervous system and cardiac toxicity.[27]

Few limitations with our study are the small sample size, patients belonged to ASA grade I/II, so no baseline pulmonary functions were evaluated. Safety of GA or other regional techniques like paravertebral block or thoracic epidural are not considered in this study. Further study with CEA using different concentrations of ropivacaine in more number of patients is needed to evaluate the effects on pulmonary function in normal and in pulmonary compromised patients to confirm the safety of ropivacaine over bupivacaine for sole CEA.

CONCLUSION

In spite of above limitations, we can conclude from our study that ropivacaine 0.375 % is safer as compared to bupivacaine 0.25 % for cervical epidural anaesthesia. It provides acceptable surgical anaesthesia with lesser degree of motor blockade, that offers the clinical advantage of minimal respiratory effects and hemodynamic stability. Use of adjuvant like fentanyl (25 µg /kg) with LA, improves quality of block with minimal motor blockade that minimizes the chance of respiratory distress and depression. CEA with conscious sedation can be an alternative to GA for radical mastectomy but requires proper patient's counseling /cooperation, expertise (to avoid major potential complication like cord trauma) and close monitoring of the vital parameters.

REFERENCES

1. Bonnet F, Derosier JP, Pluskwa F, Abhay K, Gaillard A. Cervical epidural anaesthesia for carotid artery surgery. *Can J Anaesth* 1990; 37: 353–8.
2. Hakl M, Michalek P, Sevcik P, Pavlikova J, Stern M. Regional anaesthesia for carotid endarterectomy: an audit over 10 years. *Br J Anaesth* 2007; 99:415-20.
3. Stevens RA, Stevens MM. Cervical and high thoracic epidural anesthesia as the sole anesthetic for breast surgery. *Techniques in Regional Anesthesia and Pain Management* 1998; 2:13-18.
4. Lynch EP, Welch KJ, Carabuena JM, Eberlien TJ. Thoracic epidural anesthesia improves outcome after breast surgery. *Ann Surg* 1995; 222: 663-69.
5. Groeben, Harald, Schafer, Beatrix, Pavlakovic et.al. Lung function under high thoracic segmental epidural anesthesia with opivacaine or bupivacaine in patients with severe obstructive pulmonary disease undergoing breast surgery. *Anesthesiology* 2002; 96:536-41.
6. Mineo TC. Epidural anesthesia In awake thoracic surgery. *Eur Cardio thorac Surg* 2007; 32:13-19.
7. Chakravarthy M, Patil T, Krishnamurthy J, Nadiminti S, Jawali V. Horacic epidural anesthesia in cardiac surgical patients: A prospective audit of 2,113 cases. *Journal of Cardiothoracic and Vascular Anaesthesia* 2005; 19: 44-58.
8. Leone S, Di Cianni S, Casati A, Fanelli G. Pharmacology, toxicology and clinical use of new long acting local anesthetics, ropivacaine and levobupivacaine. *ACTA Biomed* 2008; 79: 92-105.
9. Agarwal A, Verma RK, Srivastava S. Ropivacaine-The latest local anaesthetic in Indian Market. *J Anaesth Clin Pharmacol* 2010; 26: 223-28.
10. Michalek P, David I, Adamec M, Janousek L. Cervical epidural anaesthesia for combined neck and upper limb procedures. *Anesth Analg* 2004; 99:1833-6.
11. Hohener D, Bluementhal S, Borgeat A. Sedation and regional anaesthesia in the adult patient. *Br J Anaesth* 2008; 100:8-16.
12. Nakatani T, Saito Y, Sakura S, Kanata K. Haemodynamic effects of thoracic epidural anesthesia during induction of anesthesia: an investigation into the effects of tracheal intubation during target-controlled infusion of propofol. *Anaesthesia* 2005; 60:530–4.
13. Kumar A, Anand R, Wadhwani S, Rahal A. Effects of thoracic epidural anaesthesia on the haemodynamic response during induction and endotracheal intubation and on induction dose of propofol. *J Anaesthesiol Clin Pharmacol* 2010; 26:213-18.
14. Khanna R, Singh DK. Cervical epidural anaesthesia for thyroid surgery. *Kathmandu Univ Med J* 2009; 7: 242-5.

15. Biboulet P, Deschodt J, Capdevilla X, Landreau L, Aubas P, Cailar J et.al. Hemodynamic effects of 0.375% bupivacaine versus 0.25% bupivacaine during cervical epidural anesthesia for hand surgery. *Reg Anesth* 1995; 20: 33–40.

16. Capdevila X, Biboulet P, Rubenovotch J, Serre-Cousine O, Peray P, Deschodt J et.al. The effects of cervical epidural anesthesia with bupivacaine on pulmonary function in conscious patients. *Anesth Analg* 1998; 86:1033-38.

17. Tsui B. C. H., Bury J. Bouliane M. Ganapathy S. Cervical epidural analgesia via a thoracic approach using nerve-stimulation guidance in adult patients undergoing total shoulder replacement surgery. *Acta anaesthesiologica scandinavica* 2007; 51: 255-60.

18. Dominguez F, Laso T, Tijero T, Ruiz-Moyano J, Hernandez J, Puig A. Cervical epidural anesthesia with 0.75% ropivacaine in shoulder surgery. *Rev Esp Anestesiol Reanim* 2002; 49:39-43.

19. Simon MJG, Veering BT, Stienstra R, W van Kleef J, Burm AGL. The effect of age on neural blockage and haemodynamic changes after epidural anaesthesia with ropivacaine. *Anesth Analg* 2002; 94: 1325-30.

20. Agrawal M, Kang LS. CEA for neck and upper thoracic surgeries. J *Anaesthesiol Clin Pharmacol* 2010; 26: 189-92.

21. Bachmann-Mennenga B, Veit G, Steinicke B, Biscoping J, Heesen M. Efficacy of sufentanyl addition to ropivacaine epidural anaesthesia for caeserian section. *Acta Anaesthesiol Scand* 2005; 49:532-7.

22. Negre I, Gueneron JP, Ecoffey C, Penon C, Gross JB, Levronm JC et.al. Ventilatory response to carbon dioxide after intramuscular and epidural fentanyl. *Anesth Analg* 1987; 66:707-10.

23. Zink W, Graf BM. Benefit-risk assessment of ropivacaine in the management of postoperative pain. *Drug Saf* 2004; 27:1093-114.

24. Bylot D, Mahul P, Navez ML Hajjar J, Prades JM, Auboyer C. Cervical epidural anesthesia. *Ann Fr Anesth Reanim* 1993; 12:483-92.

25. Singh AP, Tiwari M, Singh DK, Shukla HS. Cervical Epidural Anesthesia: A safe alternative to general anesthesia for patients undergoing cancer breast surgery. *WJ Surgery* 2006; 30:2043-47.

26. Patel MG, Swadia VN. Cervical Epidural Anaesthesia for various neck surgeries. *J Anaesthesiol Clin Pharmacol* 2009; 25:297-300.

27. Kuthiala G, Chaudhary G .Ropivacaine: A review of its pharmacology and clinical use. *Indian J Anaesth* 2011; 55:104-10.