ISSN NO. 2320-5407

Journal homepage:http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Skull pins and scalp incision infilteration with Bupivacaine Hydrochloride and Tramadol hydrochloride -- effects on the haemodynamic response in craniotomy under general anesthesia

Dr. Kinna G Shah M.D, Dr. Bhavna C. Shah M.D, Dr. Devendra Prajapati M.B.B.S, Dr. Gaurav Prajapati M.B.B.S, Dr. Honey Parmar M.B.B.S, Dr. Bipin M Patel M.D

Anesthesia Department, Gujarat Cancer & Research Institute, Civil Hospital, Asarwa, Ahmedabad, Gujarat, India.

Manuscript Info

Manuscript History:

Received: 12 July 2014
Final Accepted: 26 August 2014
Published Online: September 2014

Key words:
Scalp infilteration, Bupivacaine, Tramadol, Haemodynamic parameters

Corresponding Author

Dr. Kinna G Shah M.D

Abstract

Aim:-To evaluate the effect of Bupivacaine hydrochloride (0.25%) and Tramadol hydrochloride 1mg/kg in skull pin and scalp incision infiltration on haemodynamic response.

Method:-120 patients planned for elective craniotomy were chosen and randomly divided in 3 equal groups. Skull pin site and scalp incision infiltration was done after 10 minutes of general anesthesia induction. In Group S patients, scalp infilteration was done with saline, Group B patients received 0.25% Bupivacaine and Group T patients received Tramadol 1mg/kg. Craniotomy frame pins were inserted 10 minutes after the infiltration. Pulse, systolic and diastolic BP was recorded as follows: 5 minutes before induction of GA (V_1), 2 minutes after endotracheal intubation, 2 minutes before and after scalp infiltration, 2 minutes after scalp incision (V_2), 2 minutes after scalp flap reflection, 2 minutes after bone flap removal (V_3), 2 minutes after dural incision (V_4).

Result: - At V_2, haemodynamic parameters were significantly higher ($p<0.05$) in Group S compared to Group B and Group T. In Group S, 18 patients (45%) required additional thiopenton sodium and more isoflurane dial concentration to control haemodynamic parameters and 3 patients needed Esmolol to control pulse rate. One patient in the Group B and 2 patients in Group T required such treatment. 39 (98%) patients in Group B and in Group T 39(98%) had satisfactory brain relaxation compared to Group S 22(55%)

Conclusion: - Scalp incision and pin site infiltration with Bupivacaine or Tramadol provides stable haemodynamic parameters and intraoperative satisfactory brain relaxation. However no advantage was found of Tramadol over Bupivacaine

Introduction

It was shown that skin incision for elective craniotomy frequently accompanied by sudden tachycardia and hypertension even after an adequate proper depth of general anesthesia. This stress response is detrimental in patients with intracranial pathology, which might result in increase in intracranial pressure (Hillman DR, 1987) and this may precipitate intracranial hemorrhage especially in patients having vascular malformation such as aneurysm.

(Hillman DR, 1987, Pinosky ML et al, 1996) blockade of the nerves that supply the involved region of the scalp may be effective in reducing sudden tachycardia and hypertension during incision. (Pinosky ML et al, 1996)

So, we had decided to study and compare the local anesthetic effect of scalp infiltration with Bupivacaine HCl (0.25%) and Tramadol 1mg/kg on haemodynamic response during skull pin insertion and scalp incision in craniotomy under general anesthesia.

METHOD

After taking informed consent from patients and approval from our institutional ethical board, 120 patients posted for elective craniotomy were included in our study. Patients having unstable hypertension taking antihypertensive drugs or surgery with previous scalp incision, documented allergy to amide local anesthetic, coagulopathy and local scalp infection were excluded from the study.

Premedication was not given any group. On arrival in operation room, IV access was established. E.C.G (5 leads), SpO2, systolic, diastolic, mean blood pressure and Etco2 were recorded at every 2 minute from at least 10 minutes prior to induction and up to 10 minutes after dural incision. Bladder catheterization was done.

Pre oxygenation was done for 5 minutes. Induction of general anesthesia was done with Inj.Glycopyrolate 0.2 mg IV, Inj. Thiopenton Sodium 5 mg/kg IV, Inj Fentanyl citrate 2 mcg /kg IV, Inj. Vecuronium Bromide 0.1 mg/ kg IV to facilitate endotracheal intubations. Inj. Ondansetron 8 mg, Inj.Phenytoin sodium 100mg IV slowly and Inj. Dexamethasone 8 mg IV was given. Inj. Manitol 0.5 mg/kg IV was completed before the scalp incision.

Maintenance was done with O_2 50%, Nitrous oxide 50%, Isoflurane, InjVecuronium Bromide 0.2 mg / kg/hr infusion. Ventilation was controlled to maintain Etco2 between 25- 30 mm of Hg. Inj. Diclofenac sodium 75 mg/kg IM was given just after Induction. Reversal was done with Inj. Neostigmine 0.03mg/kg and Inj. Glycopyrolate 0.4mg at the end of surgery.

The surgeon performed infiltration of the scalp after proper positioning and skin preparation with antiseptic solution before draping. The injection volume was determined solely by the magnitude of incision length.

120 patients posted for elective craniotomy were divided in three groups of 40 patients each. Inj Bupivacaine 0.25% without adrenaline 20 ml was infiltrated in scalp in Group B and saline without adrenaline was infiltrated in Group S patients. In Group T, Inj. Tramadol hydrochloride 1mg/kg total dose calculated and diluted in 20 ml of saline was used for infiltration.

A pair of 10 ml syringe was supplied in OT containing study solutions prepared by anesthesia resident who is not involved in this study. All syringes were identical in gross appearance. The one code number was given to those two syringes .All data were submitted and decoding was done after the surgery is over. Frame was hold/adjusted just beside to skull for pin insertion. The proposed points were marked with marker pen. Than this points were infiltrated with respected assign group drugs.

23 gauge needle was inserted at 90 degree to skull skin than gradually withdrawn, with simultaneous injecting the solution in all patients. 2 ml of study drug was infiltrated at proposed site of each pin insertion. Pin was pushed in skin 2 minutes after the solution injected.

Sustained severe hypertension (>20% rise in the MAP above pre induction level) was treated with additional thiopenton (2.5 mg/kg) and Fentanyl 1mcg/kg. If haemodynamic parameters were remained higher, than dial concentration of Isoflurane was gradually increased. Bolus Inj. Esmolol 0.5 mg/kg was given if previous drug regime was not effective, such treatment was noted in the recordings.

Eight events were identified for the purpose of haemodynamic comparison

(1) 5 minutes before induction of general anesthesia(V_1)
(2) 2 minutes after endotracheal intubation
(3) 2 minutes before scalp infiltration
(4) 2 minutes after scalp infiltration
(5) 2 minutes after scalp incision(V2)
(6) 2 minutes after scalp flap reflection
(7) 2 minutes after bone flap removalV_3)

(8) 2 minutes after dural incision(V_4)

Heart rate, systolic blood pressure, diastolic blood pressure, means arterial pressure, SpO2 and ETCO2 was measured for each of eight events.

Obtained data were processed as mean +/- SD and percentage. Statistical comparison was done between groups at each event by Student's t test. For brain status, Chi square with Yate's correction was done. All statics was done on www.graphpad.com.

RESULTS

The groups were matched for age, weight, sex and site of craniotomy. The mean age was 46.2 +/- 7.9 yrs in Group S, Bupivacaine group 44.5 +/- 4.3 yrs; Group T was 45.67 +/- 7. 2 yrs. The mean injection volume of saline, bupivacaine and Tramadol injected were 14.96 +/- 4.3ml, 14.76+/- 3.6 ml and 15.01+/- 4.0 ml respectively. The mean time between infiltration of scalp and the incision was 17.76 +/- 2.5 min in saline group, 18.16 +/- 2.68 min in Bupivacaine group and it was 17.86 +/- 2.65 minutes in Tramadol group.

No significant difference ($p>0.05$) was found in systolic blood pressure and diastolic blood pressure and heart rate at induction of anesthesia in all groups. (Table 1)

During scalp incision a significant difference ($p<0.05$)was seen in the Group S,(Table 1) in whom hypertension, tachycardia was present as compared to pre induction level, while there was no significant haemodynamic changes in Bupivacaine and Tramadol groups. There was a progressive rise in blood pressure and pulse rate in Group S from time of incision to end of the study (10 minutes after dural incision)

While values of all haemodynamic parameters were significantly lower ($p<0.05$) in Group B and Group T compared to Group S (Table 2, 3, 4). Haemodynamic stability was same in Group B and group T. There was no significant advantage seen in Group T compared to Group B.

Out of 40 patients of Group S, 16 (40%) patients required additional thiopenton to control haemodynamic parameters, 4 patients required additional isoflurane dial concentration and other 3 patients need Inj. Esmolol to control pulse rate. One patient in the Group B and 2 patients in Group T required such treatment .Clinically no apparent adverse reactions attributable to systemic absorption of Bupivacaine were noted.

Brain was relaxed on craniotomy bone flap lifted up in 39 (98%) patients in Group B and 39 (98%) patients. Group T, while it was 22(55%) patients in Group S. (Table 2)

Complication such as local errthymas, convulsion, and bradycardia or hypo tension was not noted in any of patients in all three groups.

Table I. Mean+/- SD of Haemodynamic data of study a various time interval

		V1 Pre op	V2 post incision	V3 bone flap removal	V4 Dural incision
Group S	Pulse	87.16+/-14.3	107.52+/-10.0	107.8+/-10.4	109.04+/-8.3
	Systolic	117.28+/-16.30	135.36+/-12.23	128.84+/-3.92	119.76+/-11.80
	Diastolic	82.28+/-6.0	97.64+/-8.3 ♦O	94.0+/-5.8 ♦O	89.91+/-6.4 ♦O
Group B	Pulse	86.08+/-9.4	90.88+/-7.9♦	89.6+/-6. 9♦	86.4+/-6. 2♦

	Systolic	118.3216.0	117.76+/-10.6♦✪	110.04+/-9.9♦✪	106.76+/-8.1♦✪
	Diastolic	84.44+/-6.6	87.48+/-2.4	87.24+/-24	83.88+/-3.2
Group T	Pulse	85.72+/-8.0	90.42+/-6.5 ✪	88.96+/-7.2 ✪	87.2+/-6.6 ✪
	Systolic	117.32+/-16.30	118.28+/-8.4✪	112.06+/-8.2✪	109.36+/-6.6✪
	Diastolic	85.02+/-5.95	86.69+/-3.9✪	87.04+/-4.4✪	84.22+/-4.0✪

♦Significance versus group S&B, ✠ significance versus group B &T,

✪ Significance versus group S&T

Table II Brain Status at bone flap lifting

	Group S	Group B	Group T	Statically sig.
Yes	22(55%)	39(98%)	39(98%)	P<0.0001
No	18(45%)	1(5%)	1(5%)	P<0.0001

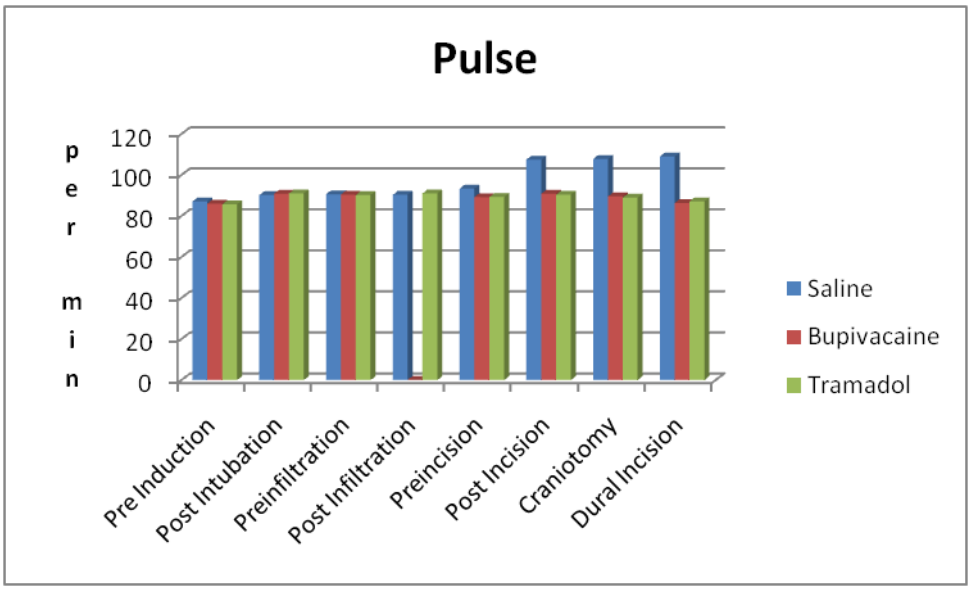

Figure 1 Progressive rise in pulse rate in saline group after incision

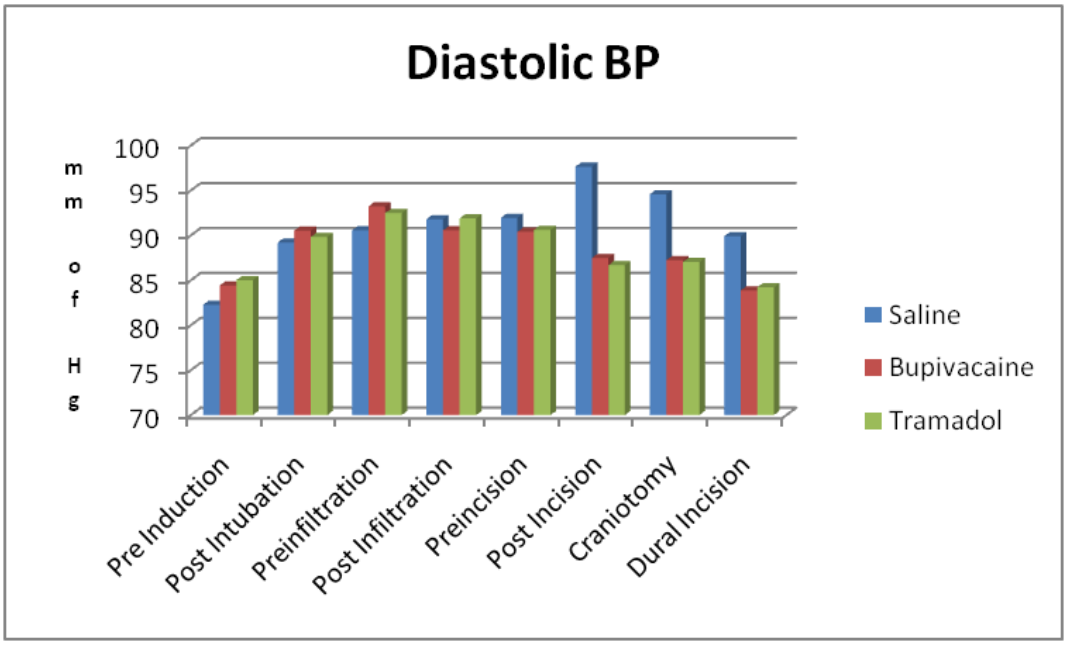

Figure 2 Increase in BP in Group S after incision compared to Group B &Group T

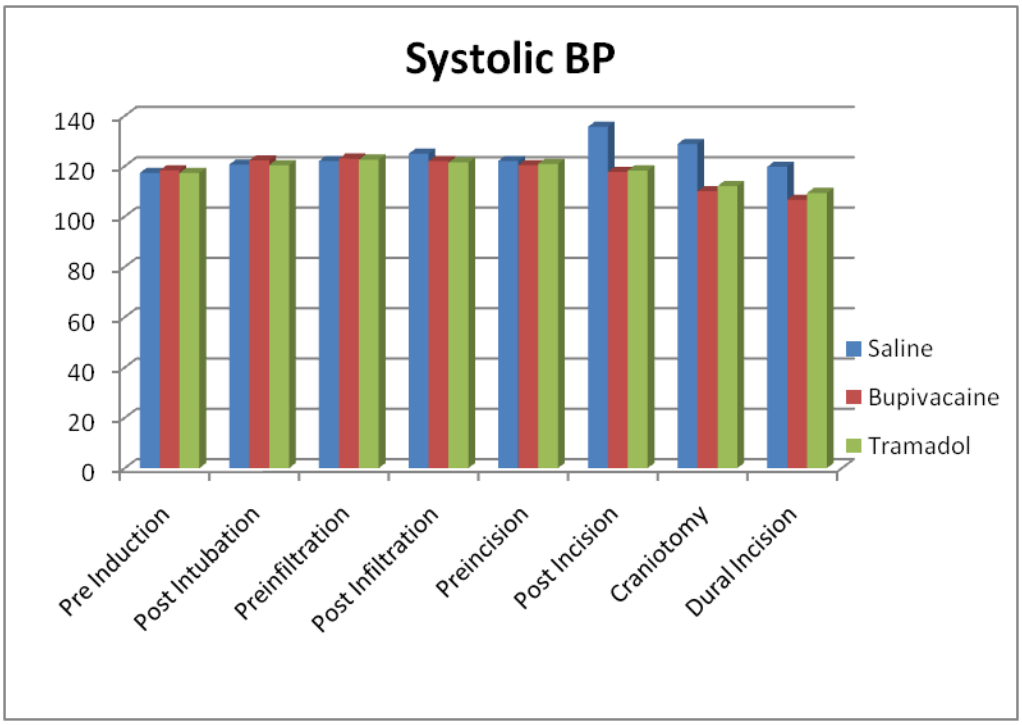

Figure 3. No rise in BP in Group B& Group T after incision

DISCUSSION

In our study, the notable cardiovascular stability was seen in Bupivacaine and Tramadol groups confirmed our impression that local anesthetic scalp infiltration prior to craniotomy minimizes the haemodynamic stress response

to skull pin and scalp skin incision. It provides smooth induction course as there is minimal fluctuation in blood pressure and pulse compared to baseline level and hardly needs additional requirement of Thiopenton or Isoflurane.

The scalp is densely innervated by C fibers (Bala I et al, 2006)
.Many studies of scalp block and wound infilteration (Bloomfield EL, 1998), Biswas (2003) has been done to describe post operative pain relief after craniotomy. Subcutaneous local anesthetic scalp infiltration blocks peripheral nerves supplying the skin, subcutaneous tissues, muscle and periosteum of the outer table of the skull (Hillman DR, 1987).
We had used Bupivacaine hydrochloride because of its longer duration of action and safety in vascular tissues such as scalp. (Hillman DR,1987, Pinosky ML et al,1996 , Colley PS, Heavner JE,1981)

Several possible mechanisms for analgesic phenomenon of bupivacaine as local anesthetics have been suggested. A membrane stabilizing effect occurs on the vascular smooth muscle or sympathetic nerves. Prolonged action is due to decrees of absorption or increase in capillary permeability by bupivacaine.

Gunes et al (2004) had used Tramadol as an analgesic purpose in children. There are multiple studies in which Tramadol was used as an analgesic purpose, other than IV route as in brachial plexus with mepivacaine (Robaux S et al, 2004)
Proposed mechanism of action of Tramadol, suggest that presence of large Ca+2 concentrations in the external medium increases Tramadol activity (Mert T, 2002)

Jou et al (2003) suggested that tramadol affects sensory and motor nerve conduction by voltage dependent sodium channel leading to axonal blockage. Shipton suggested that tramadol exerts analgesic action through dentral monoaminergic systems

We have not used the vasoconstrictor in local anesthetic or in saline for infiltration because scalp is a highly vascular structure. There might be an accidental intravascular injection and absorbed in circulation and could cause hypertension and tachycardia.

Isoflurane is a safe inhalation anesthetic agent for neurology anesthesia. At 1.5 MAC, Isoflurane does not causes any change in cerebral blood flow with hyperventilation and causes 50% reduction in cerebral metabolic rate. (Shipson EA, 2000)

Scalp infiltration with local anesthetic, irrespective of drug or dosage injected provides smooth intraoperative stable blood pressure. This coupled with the fact that the scalp infiltration can be done by any anesthesiologists as this is easy to do, and the success rate is excellent. (Pinosky ML, 1996)

The study done by S.S.Mohammadin (2009) shows, that mean difference between the two groups for heart rate was significant ($p = 0.03$) using bupivacaine 0.25%. We had noted that noxious stimuli like incision causes increase in all haemodynamic parameters in Group S and stable cardiovascular condition in Group B (0.25%) and Group T. (Table 1). Haemostasis was subjectively perceived to be adequate in all groups.

Hartly(1991) et al had successfully used 0.5% Bupivacaine HCL in scalp infiltration in pediatric patients but they have not infiltrated pin sites.

Bloomfield(1998) reported a blunting of the haemodynamic response to scalp incision using 0.5% bupivacaine without epinephrine. We have shown the same stable haemodynamic response in a lower concentration of bupivacaine (0.25%) without epinephrine.

Likewise, Pinosky (1996) have shown that skull blockade with bupivacaine (0.25%) can reduce the haemodynamic response to head pinning, our data shown similar results with lower concentration of bupivacaine (0. 25 %).

Scalp infiltration with Local anesthetic agent prior to incision and at skin closure was successful in decreasing pain in the postoperative period. (Bloomfield1998)

P.Bithal et al (2007) had done study in 44 patients of cervical disckectomy, in which they have to insert to sharp pins. There was increase in BIS and all haemodynamic parameters when skull pins were inserted without local anesthetic drug in scalp. These changes were completely blunted by scalp infilteration with Lignocaine. We had extended our study to infiltrating scalp incision with local anesthetic drug. Our findings are correlated with them but we are unlucky to have BIS monitoring facility.

Our study result was great revolutionary effect in our oncology set up as an everyday we are providing anesthesia for patients having intracranial tumor with or without peritumoral edema. Further study is needed to set correlation with BIS monitoring.

In our study, Tramadol scalp infiltration had excellent analgesic properties, shows that it act as local anesthetic drug but mechanism may be different.

Altunkaya et al (2004)used tramadol as local anesthetic infilteration in minor surgical procedure and found that it is good alternative to lignocaine intraoperatively.

Others like Deiraran et al (2006) and kakki & Al Marakbi W (2008) used Tramadol in herniorrhapy and circumcision like surgery in children. All of them were satisfied with local anesthetic property of Tramadol and accepted Tramadol as supplement to local anesthetic drugs.

. E Said et al (2010) used combination of Tramadol (1mg/kg) and Bupivacaine (0.25%) in half calculated does and found profound analgesia. He suggested that this might be due to synergistic effect of both drugs which can allow half dose. We were not sure of stability of chemical reaction occurs on mixing tramadol and bupivacaine in one syringe. So, we are not in favor of using such combination.

CONCLUSION

Scalp infiltration with local anesthetic drug like Bupivacaine and Tramadol resulting stable haemodynamic parameters, intraoperative relaxed brain status and abolished the additional drug treatment requirement during skull pinning and scalp incision.

REFERENCES:-

1) Altunkya H, Ozer Y, Karrgi E , Ozkocak I , Hosnuter m, Demirel CB, Babuccu O.2004:The postoperative analgesic effect of Tramadol when used as subcutaneous local aesthetic .Anes Analg.,99(5):1461-4

2) Bala I, Gupta B, Bhardwajal, Ghai B, and Khosla VK.2006: Effect of scalp block on post op pain relief in craniotomy patients.Anesth.Intensive Care, 34(2)224-7.

3) Biswas, Binay K.; Bithal, Parmod K.2003.Preincision 0.25% Bupivacaine Scalp Infiltration and Post craniotomy Pain. A Randomized Double-Blind, Placebo-Controlled Study Journal of Neurosurgical Anesthesiology., July - Volume 15 - Issue 3 - p 234–239

4) Bloomfield EL, Schubert A, Secic M, Barnett G, Shutway F, Ebrahim ZY. 1998. The influence of scalp infiltration with bupivacaine on haemodynamic and postoperative pain in adult patients undergoing craniotomy.AnesthAnalg. Sep; 87(3):579-82

5) Colley PS, Heavner JE. 1981. Blood levels of bupivacaine after injection into the scalp with and without epinephrine. Anesthesiology. Jan,54(1):81-4

6) Demiraran Y, Ilce Z, Kocaman B , Bozkurt P. 2006 .Dose Tramadol wound infiltration offer an advantage over bupivacaine for postoperative analgesia in children following herniotomy . PaediatrAnesth; 16 (10):1047-50.

7) Ehab Said, Islam Aboufetouh, Hossam Ibrahim. 2010. Pre-emptive combined tramadol / bupivacaine scalp block facilitates operative procedure and post operative neurological assessment after elective supratentorial brain tumour resection. Ain Shams Journal of Anaesthesiology; 3:53-63.

8) Entrie C, LeszeniewskiW, Carlsson C.1985 .Local application of 133 xenon for measurement of regional cerebral blood flow darning halothane, enflurane and isoflurane anesthesia in humans. Anesthesiology; 63:391-4.

9) Gunes Y, Gummous M, Unlugenc H, Ozalevi M,Ozecengiz D,2004.Comparison of caudal versus intravenous tramadol administered either preoperatively or postoperatively for pain relief in boys.Paediat Anesth.14(4):324-8.

10) Hartly EJ, Bissonnette B, St.Louis P ET al1991. Scalp infiltration with bupivacaine in paediatric brain surgery. Anesth Analg., 73:29-32.

11) Hillman DR, Rung G W, Thompson W R, Davis N J. 1987.The effect of

Bupivacaine scalp infiltration on the haemodynamic response to craniotomy under general anaesthesia. Anaesthesiology. 67:1001-4

12)Jou IM, Chu KS, Chen HH, 2003.The effects of intrathecal tramadol on Spinal somatosensory evoked potentials and motor evoked responses in rat, Anesth Analg., 96:783-8.

13) Kaki AM, Al Marakbi W.2008. Post herniorrhapy infiltration of tramadol versus bupivacaine for postoperative pain relief: a randomized study. Ann Saudi med., 28(3):65-8.

14) Mert T, Gunes Y, Guven M. 2002.Comparison of nerve conduction blocks by an opioids and a local anesthetic. Eur. J Pharmacol. 439: 77-81.

15) Mohammadi SS, Shahbazian E, Shoeibi G, Almassi F. 2009.Effect of scalp infiltration with Bupivacaine on early haemodynamic responses during craniotomy under general anesthesia .Pak J Biol Sci. Apr 1; 12(7):603-6.

16)Pinosky ML, Fishman RL, Reeves ST, ET al.1996. The effect of bupivacaine skull block on the haemodynamic response to craniotomy. Anesth Analg; 83:1256-61

17) Pramod Kumar Bithal, Mihir PrakashPandia, Rajender Singh Choun, Deepak Sharma, Hemant Bhagat, Hari Hara dash and Rajni Arora. 2007. Haemodynamic and Bispectral index changes following skull pin attachment with and without local aesthetic infiltration of the scalp. J Anesth; 21:442-444.

18) Robaux S, Blunt C, Cuvillon P, nouguier P, Dutel G, Boileau S, Girard F, Bouaziz H.2004 Tramadol added to 1.5% mepivacaine for axillary brachial plexus block improves post operative analgesia dose -dependently. Anesth Analg. 98:1172-7.

19) Shipson EA. 2000 .Tramadol present and future. Anesth Intensive Care. 28: 363-74.