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COMPARATIVE EVALUATION OF EPIDURAL VERSUS INTRAVENOUS FENTANYL FOR POST-OPERATIVE ANALGESIA FOLLOWING LOWER LIMB SURGERIES.

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ABSTRACT

Background: Epidural opioid supplementation has been commonly researched with well proven efficacy for postoperative analgesia however; epidural analgesia comes with its own demerits for which an alternative method for analgesia needs to be searched for. Some studies have suggested that intravenous opioids have advantage of achieving analgesia of comparable efficacy as that of epidural opioids. Hence this study is undertaken to compare the efficacy of epidural versus intravenous opioid and establish superiority of one over the other.

Material and Method: With approval of institutional ethics committee and written informed consent, a prospective, randomised study is undertaken on 40 patients from 16 to 60 years of age belonging to ASA physical status I and II, posted for elective lower limb surgery. These patients are randomly divided into two equal groups of 20 each. The patients are given standard anaesthesia using combined spinal epidural approach and cases are conducted under subarachnoid block. During postoperative period, when patient complain of pain, group A (n=20) patients receive 100 mcg fentanyl via epidural route + 10ml of normal saline IV while group B (n=20) patients receive 100 mcg of fentanyl IV + 10ml of NS via epidural route. Pain intensity (using VAS), Hemodynamic parameters (HR, MAP, SBP and DBP) and side effects were taken at 30, 60, 90, 120,150,180,210 and 240 mins and observations were compared between the two groups using appropriate statistical tests.

Results: VAS score between two groups was not significantly different till 120 min after fentanyl supplementation. However, after 120 mins patient who received epidural fentanyl did better on VAS score than those who received intravenous fentanyl. Also VAS score at 240 min in group A was 2.54±0.24 where as in group B was 3.25±0.35 which was statistically significant ($P<0.05$). Thus epidural fentanyl provided better analgesia at 240 min. Patients receiving epidural fentanyl showed more stable HR and MAP during follow-up after 120 mins.

The incidence of pruritis and urinary retention was more in patients receiving epidural fentanyl while incidence of nausea, vomiting and respiratory depression was more in group B, who received intravenous fentanyl.

The percentage of patient who required supplementary analgesia with diclofenac was lower in group A than in group B.

Conclusion: Intravenous fentanyl provides equally efficacious analgesia as compared to epidural but only for shorter duration while epidural fentanyl provides longer duration of postoperative analgesia due to its action at both spinal and supraspinal level via absorption in systemic circulation through epidural space and hence provides hemodynamic stability for longer duration than intravenous fentanyl.

KEYWORDS : Analgesia, Epidural, Fentanyl, Pain, Postoperative.

INTRODUCTION

Epidural opioid administration has been advocated for providing excellent postoperative analgesia by activating receptors located in the dorsal horn of the spinal cord as well as via supraspinal action after absorption in systemic circulation and distribution into brain[1,2,3]. This high quality of pain relief may carry some disadvantages with it, such as respiratory depression and annoying side effects (itching, nausea, vomiting, & urine retention). Epidural fentanyl is known to produce excellent pain relief with minimal risk of respiratory depression. The majority of clinical publications deal with the use of morphine[4]. The benefits sought by using other opioids are greater analgesia, lower incidence of side effects or both.

Fentanyl has been one of the most used opioid by epidural injection. It has fast onset with satisfactory pain relief and analgesic effects lasting 4 to 8 hours. Epidural fentanyl is known to produce excellent pain relief with minimal risk of respiratory depression because of its rapid onset and short duration of action. Epidural opiate analgesia, however, is not without an element of risk and an incidence of side effects[5]. To date there have been no controlled clinical comparisons between intravenous (IV) and epidural fentanyl.

The aim of present study was to compare the efficacy of epidural versus intravenous fentanyl for postoperative analgesia.

MATERIAL AND METHODS

The present study was conducted after obtaining the clearance from institutional ethical committee and written informed consent from all study subjects. The included subjects were 40 patients of age between 16 and 60 years having ASA grade I and II undergoing elective lower limb surgeries under subarachnoid block. Patients with infection at the puncture area, spinal deformity, any neurological disease, those with coagulation disorders, pregnant patients, and patients using opioids were excluded from the study.

The 40 patients were randomly divided into two study groups of 30 patients each using 'slip in the box' method for randomization. During postoperative period, when patient complained of pain, Group A (n=20) received 100 mcg fentanyl via epidural route + 10ml of normal saline IV while Group B (n=20) received 100 mcg of fentanyl IV + 10ml of NS via epidural route.

Once the patient is wheeled into the operating table; a peripheral venous access using 18G I.V. cannula will be secured. Pre-loading will be done with Ringer's lactate 10 ml/kg over 15-20 min prior to epidural block. Patient will be connected to a multichannel monitor showing electrocardiography, heart rate, non-invasive blood pressure (NIBP), pulse oximetry and respiratory rate. All the patients will be premedicated with IV Glycopyrrolate, IV Ondansetron, and when required sedation was achieved using 1-2 mg of injection midazolam.

For the administration of epidural block, patients will be placed in the sitting position, and the skin, subcutaneous tissue and the supraspinous ligament will be anaesthetised using 2 ml of 2% lignocaine. The epidural space will be identified by loss of air resistance method using a 16G Tuohy epidural needle with the bevel directed cephalad via the median approach at L4-L5 or L3-L4 intervertebral space. A 16G Epidural catheter will be advanced 3cm into the epidural space.

Following placement of epidural catheter, a test dose of 2ml of 2% lidocaine with 1:2,00,000 adrenaline will be given, and in same space spinal block is given using inj. bupivacaine (0.5%, heavy) 3 ml. Patients will returned to the supine position.

The analgesic supplementation was done with IV inj. diclofenac 75 mg and if necessary further supplementation is done with inj. Bupivacaine plain (0.5%) given epiduraly. During postoperative period, when patient complained of pain, Fentanyl supplementation (either intravenous or epidural) was done and following parameters were recorded at 30, 60, 90, 120,150,180,210 and 240 mins after supplementation:

1) Heart rate (HR), systolic blood pressure(SBP), diastolic blood

pressure (DBP), mean arterial pressure (MAP).
2) Pain intensity assessment using VAS score
3) Side effects

Statistical Analysis

Sample size estimation was done using sample size and power analysis by software G*power (version 3.1.9.2) to detect a mean VAS difference of approximately 15% between the two study groups with alpha error 0.05 and beta error 0.10 (power of study=0.90) based on previous similar studies[5]. This revealed the minimum required sample size to be 13 for each study group.

All observations were tabulated and analysed using independent student 't' test and chi-square test in Statistical Package for Social Sciences (SPSS) software version 22. Statistically significant difference in findings was considered when p-value was <0.05.

RESULTS

There were no significant differences between the two groups regarding to age, gender distribution, weight, ASA physical status. There were also no significant differences between the two groups in terms of baseline HR, MAP as shown in table 1. In addition, no significant difference in the level of sensory block achieved and the duration of surgery was observed between the two groups. The interval between the beginning of anaesthesia and the administration of study drug was not statistically different in two groups.

Table 1: Patient characteristics in the two study groups (Data represented as mean ± SD)

Characteristic	Group 'A'	Group 'B'	p-value
Age (Years)	39.17 (±11.27)	38.57 (±11.52)	0.839
Gender Ratio (Male: Female)	11:9	10:10	0.948
Weight (Kg)	68.93 (±12.33)	68.57 (±12.43)	0.909
ASA Grade (Grade I: Grade II)	13:7	12:8	0.781
Baseline HR (BPM)	79.60 (±10.83)	80.73 (±10.67)	0.685
Baseline MAP (mm Hg)	94.40 (±3.99)	93.67(±4.53)	0.508

We found that VAS score between two groups was not significantly different till 120 min after fentanyl supplementation. However, after 120 mins patient who received epidural fentanyl did better on VAS score (as depicted in fig. 1) than those who received intravenous fentanyl. Also VAS score at 240 min in group A was 2.54±0.24 where as in group B was 3.25±0.35 which was statistically significant (P<0.05). Thus epidural fentanyl provided better analgesia at 240 min.

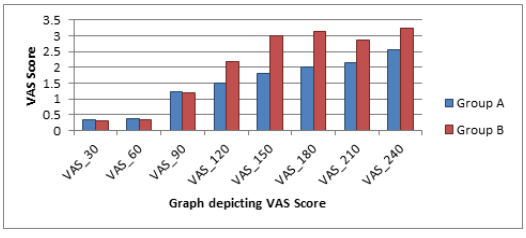

Fig 1: Comparison of VAS Score between the two study groups at different time intervals.

The values of HR and MAP at different time intervals between the two study groups are shown in figures 2 and 3 respectively. As shown in some studies, improved postoperative analgesia have better hemodynamic parameter, similar to this we also found that patients receiving epidural fentanyl showed more stable HR and MAP during follow-up after 120 minutes as shown in the graphs below.

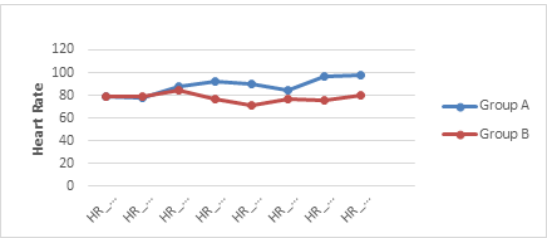

Fig 1: Comparison of mean HR between the two study groups at different time intervals

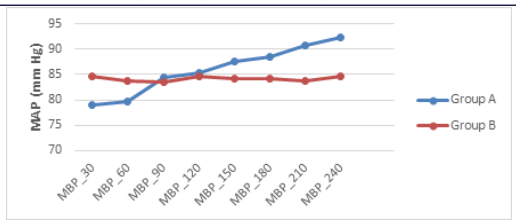

Fig 2: Comparison of mean MAP between the two study groups at different time interval.

The incidence of pruritis and urinary retention was more in patients receiving epidural fentanyl while incidence of nausea, vomiting and respiratory depression was more in group B, who received intravenous fentany l.

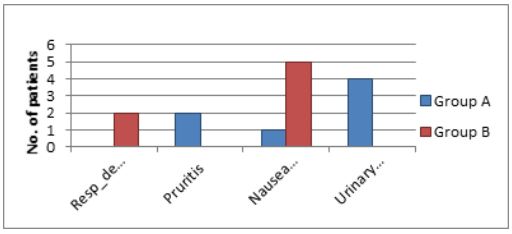

Figure 4 shows the incidence of side effects in both study groups.

DISCUSSION

Our study has evaluated patients submitted to similar surgical procedures to compare similar pain intensities.

Demographics data were similar between groups, which is an important factor to prevent pharmacological differences. Surgery length as well as time between beginning of anaesthesia and postoperative intravenous or epidural fentanyl was also similar, resulting in a more homogeneous sample.

Post-operative analgesia is essential for achieving patient satisfaction and enhanced recovery effective pain management facilitates early mobilisation and reduction in respiratory and cardiac complications reducing stress response and in turn improving wound healing and recovery.

Opioids are most commonly used for post-operative pain management. Potent lipid soluble opioids with strong affinity for the opioid receptors provide effective analgesia at sufficiently lower doses to limit side effects[6].

In this study we therefore compared the efficacy of IV fentanyl and epidural fentanyl for post-operative pain management in patient undergoing orthopaedic lower limb surgeries.

Intravenous fentanyl distributes rapidly from plasma to highly vascular tissue. It mainly binds to receptors in CNS and peripheral tissues and modulates the effect of nociceptors.

Epidural fentanyl has mainly two mechanisms; first mechanism is inhibition of afferent nerve transmission by to opioid receptors presynaptically and post synaptically within the dorsal horn of the spinal cord. Another mechanism is at supraspinal region in view of the high lipid solubility with consequential absorption into the systemic circulation and distribution to brain.

Epidural catheter was placed as close as possible to the dermatome corresponding to higher painful stimulus [7,8]because it provides more effective analgesia with less drug volume[9,10].

The findings of our study suggests that both IV fentanyl and epidural fentanyl promoted good pain relief within first 30 mins of supplementation however after this time period analgesic effect is mediated by epidural supplementation was much superior.

We found that requirement of supplementary analgesia was more in group B patients than in group A. Our finding was consistent with that of Marcelo Soares Privado et al.[11] who also found increased supplementary analgesic requirement in patients receiving 100 µg fentanyl via intravenous route as compared to epidural route in their

randomized double-blind study on 29 patients. This finding suggests that epidural fentanyl is better that IV administration of the drug and also epidural fentanyl has long lasting effect.

The better analgesic effect of epidural fentanyl observed in the present study suggests the spinal action in addition to the supra-spinal action occurring after systemic absorption.

In summary, we have concluded that after lower limb orthopaedic surgeries epidural fentanyl provides better post-operative analgesia as compared to IV fentanyl.

CONCLUSION

From our study we conclude that intravenous fentanyl provides equally efficacious analgesia as compared to epidural but only for shorter duration while epidural fentanyl provides longer duration of postoperative analgesia due to its action at both spinal and supraspinal level via absorption in systemic circulation through epidural space and hence provides hemodynamic stability for longer duration than intravenous fentanyl.

REFERENCES

1. Sandler AN, Stringer D, Panos L et al ¬ A randomized, double¬blind comparison of lumbar epidural and intravenous fentanyl infusions for postthoracotomy pain relief. Analgesic, pharmacokinetic, and respiratory effects. Anesthesiology, 1992;77:626-634.
2. Coda BA, Brown MC, Schaffer R et al ¬ Pharmacology of epidural fentanyl, alfentanil, and sufentanil in volunteers. Anesthesiology, 1994;81:1149¬1161.
3. D'Angelo R, Gerancher JC, Eisenach JC et al ¬ Epidural fentanyl produces labor analgesia by a spinal mechanism. Anesthesiology, 1998;88:1519¬1523.
4. Wang JK, Nauss LA, Thomas JE ¬ Pain relief by intrathecally applied morphine in man. Anesthesiology, 1979;50:149¬151.
5. Cousins MJ, Mather LE. Intrathecal and epidural administration of opioids. Anesthesiology 1984;61:276310.
6. McQuay HJ, Sullivan AF, Smallman K, Dickenson AH. Intrathecal opioids, potency and lipophilicity. Pain 1989;36:111- 5.
7. Ellis DJ, Millar WL, Reisner LS ¬ A randomized double¬blind comparison of epidural versus intravenous fentanyl infusion for analgesia after cesarean section. Anesthesiology, 1990;72: 981¬986.
8. Naulty JS, Datta S, Ostheimer GW et al ¬ Epidural fentanyl for postcesarean delivery pain management. Anesthesiology, 1985;63:694¬698.
9. Birnbach DJ, Johnson MD, Arcario T et al ¬ Effect of diluent volume on analgesia produced by epidural fentanyl. Anesth Analg, 1989;68:808¬810.
10. Dickenson AH, Sullivan AF, McQuay HJ ¬ Intrathecal etorphine, fentanyl and buprenorphine on spinal neurones in the