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Is General Anaesthesia with Paediatric Epidural Anaesthesia Superior to General Anaesthesia Alone in Improving Postoperative Outcome?: A Clinical Study

Uma B.R.[1], Priyadarshini M. Bentur[2]

[1]Professor [2]Associate Professor, Department of Anaesthesiology, JJM Medical College, Davangere, Karnataka 577004, India.

Abstract

Background: Paediatric epidural anaesthesia and analgesia (PEA) is being accepted as a standard method of advanced pain management as epidural catheter offers the advantage of excellent long term post-operative analgesia. *Aims:* This prospective randomised study compares General Anaesthesia (GA) and General Anaesthesia with Paediatric Epidural Anaesthesia (GA+PEA) with regard to (i) Quality of post-operative analgesia (ii) Requirement of rescue analgesics (iii) Parental satisfaction and (iv) Complications if any. *Material & Methods:* 80 children of ASA status I & II (2 to 12 yrs), scheduled for elective surgeries were randomly assigned to GA or GA+PEA groups. Both the groups received routine GA. In GA+PEA group, an epidural catheter was inserted. Post-operatively, in the GA group, analgesia was facilitated with Paracetamol suppository 15mg/kg, in GA+PEA group with epidural infusion of 0.125% Bupivacaine. Pain assessment was done with CHIPPS (2 to 6 yrs) and VAS (7 to 12 yrs) scale. Rescue analgesia was supplemented if pain scale was more than 3. Parental satisfaction was assessed. *Statistical Analysis:* Chi-square test, student-t test and ANOVA test were used to analyse categorical, demographic and rescue analgesic requirements respectively. A p value<0.05 was considered significant. *Results:* The pain scores and requirement of rescue analgesics were significantly lower with $p<0.001$ and $p=0.018$ respectively in GA+PEA as compared to GA alone. The overall parental satisfaction was significantly greater in GA+PEA with $p<0.001$. *Conclusion:* GA+PEA offers advantages of improved post-operative analgesia, decreased requirement of rescue analgesics and greater parental satisfaction.

Keywords: Paediatric Epidural; Postoperative Analgesia; Rescue Analgesic; Parental Satisfaction.

Introdution

Paediatric regional anaesthesia is gaining widespread popularity in the last few decades. Among the paediatric regional anaesthesia techniques, Paediatric Epidural Anaesthesia and Analgesia (PEA) are being accepted as a standard method of advanced analgesia in children. Gone are the days when it was thought that children donot experience pain. Various studies have shown that pain experienced during surgery and post-operative period have a major physical and emotional impact on the development of children. Pain if inadequately managed during the post-operative period leads to long term behavioural, emotional and psychological impact in paediatric population irrespective of the age group [1].

Epidural catheters offer the advantages of long-term analgesia during post-operative period with continuous infusion of local anaesthetics ± opioids/ other adjuvants combined with supplementary rescue analgesics.

This prospective randomized comparative study compares GA (General Anaesthesia) with GA + PEA with regard to pain relief, requirements of rescue analgesics, complications and parental satisfaction.

Corresponding Author: Uma B.R., Professor, Department of Anaesthesiology, JJM Medical College, Davangere, Karnataka 577004, India.
E-mail: umarajshekar9@gmail.com

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Methods

80 consecutive children aged 2 to 12 years, belonging to ASA physical status I & II, scheduled for various elective surgeries were included in the study. Institutional ethical committee clearance, parent/guardian consent in the form of verbal and written consent was obtained. Randomization was generated by Institutional Department of Biostatistics. Children were randomly assigned to GA (General Anaesthesia) or GA + PEA (General Anaesthesia + Paediatric Epidural Anaesthesia) groups.

A standard protocol was followed with regard to pre-medication (glycol-pyrrolate, midazolam), analgesia (fentanyl), induction (propofol), relaxation (vecuronium) and intubation in both the groups. In the GA+PEA group, under strict aseptic precautions, 19 G epidural kit was used to identify the epidural space and the catheter was threaded till the desired length.

The epidural catheter was thoroughly secured to skin using a transparent dressing (without pad). After negative aspiration for blood and CSF, an epidural test dose was given followed by an epidural bolus of 0.25% Bupivacaine (1.5 ml/ segment) was injected. The child was appropriately positioned and surgery started. In GA group, Inj. Fentanyl was repeated in a dose of 1 µg/kg iv after every 45 min. In the PEA group, the epidural top-up of 0.25% Bupivacaine 1.5 ml/segment was repeated every 2 hours after the initial dose.

Towards the end of the surgical procedure, children were reversed and extubated. Decision for elective ventilation was based on intra-operative events like massive blood loss, hypotension, hypothermia or inadequate respiratory efforts. Such children were not included in the study group.

In the GA group, post-operative analgesia was maintained with Paracetamol suppository 15 mg/ kg per rectal, the first dose being inserted before shifting the child to PICU.

In the GA+PEA group, postoperative analgesia was maintained with an epidural infusion of 0.125% Bupivacaine through syringe pump at a rate of 0.3 – 0.5 ml/kg/hr initiated just before shifting the child to PICU.

In both the groups, pain was assessed by personnel not involved in the study directly or indirectly using children and infants postoperative pain score (CHIPPS) for children aged 2-6 years. In older children aged 7-12 years, a Visual Analog Scale (VAS) ranging from 0 (No pain) to 10 (Worst imaginable pain) was used. These older children were explained about VAS scale in the pre-operative period itself.

When pain score was found to be more than 3 [for CHIPPS or VAS] paracetamol suppository 15mg/kg was used as rescue analgesic. The time of rescue analgesia was noted. After 30 minutes of first dose of rescue analgesic, pain was re-assessed and if pain score was more than 3, Inj. Morphine 0.1 mg/kg iv was supplemented.

The pain score was assessed 6th hourly and if found to be more than 3, the step-ladder pattern of rescue analgesia was followed. The total number of rescue analgesics were noted. The epidural infusion through catheter in-situ was continued for 48 hours post-operatively.

During this study period, any complications like nausea, vomiting, haematoma, urinary retention, dysesthesia, local infection, local anaesthesia toxicity, premature discontinuation of LA infusion or catheter dislodgement were noted.

Urinary retention was considered if there was retentionfor more than 6 hours postoperatively (if no Foley's catheter was placed) or more than 6 hours after Foley's catheter removal.

During the performance of epidural procedure, children with technical difficulty or failure were excluded from the study. However, during the first 48 hours postoperatively, if the epidural catheter was found to be placed in an unreliable position (migration of the catheter), it would be included in the adverse events of the technique.

At the end of the study period of 48 hours postoperatively, the parents or guardians were asked to score their overall satisfaction with regard to pain relief which was recorded as Excellent (E), Satisfactory (S) and Unsatisfactory (US).

Statistical Analysis

Demographic data, type of surgery, duration of surgery were recorded.Chi-square test was used for categorical data like sex distribution and parental satisfaction.

The student t-test was used for demographic parameters like age, weight distribution, duration of surgery and pain score. ANOVA statistical test was used for analysis of requirement of rescue analgesics.Irrespective of the statistical test used a p-value of <0.05 was considered to be of significance.

Results

Eighty children were included in our study. There was no significant difference in demographic parameters like age, sex, weight and intra-operative parameters like duration of surgery (Tables 1, 2, 3 & 4).

Post-operative parameters like pain-score, rescue analgesics and parental satisfaction showed a significant difference between the two groups.

The pain score in GA group was found to range from a minimum value of 3 to a maximum value of 6 with a mean ± SD of 4.35±0.66. In the GA+PEA group the pain scores ranged from 0 to a maximum of 5 with a mean ± SD 1.9±1.72 (Table 5 Graph 1). A p value <0.001 indicates a highly significant difference in the pain score between the 2 groups.

In the GA group, 12 children required rescue analgesia in the form of paracetamol whereas 2 children required paracetamol + morphine. In the GA+PEA group, only 5 children required paracetamol as rescue analgesic. None of the children in this group required morphine as rescue analgesic (Table 6, Graph 2). A p value =0.018 implies that there is a significant difference in the requirement of rescue analgesics between the two groups.

The parental satisfaction was correlating with the rescue analgesic requirement. In the GA group, parents of 26 children scored overall satisfaction as

Table 1: Agedistribution(in years) Pvalue 0.409 (>0.05)

Group	Min value	Max value	Mean+/-SD
GA	2.6	12	7.49+/-2.80
GA+PEA	2.8	12	6.97+/-2.86

Table 2: Sex distribution Pvalue 0.178 (>0.05)

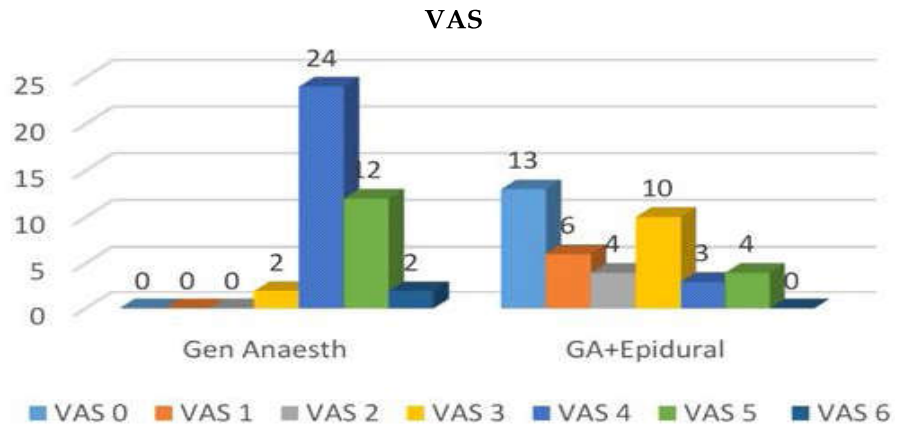
Group	Male	Female	Total
GA	15	25	40
GA+PEA	21	19	40
Total	36	44	80

Table 3: Weight distribution(inkg) Pvalue0.061 (>0.05)

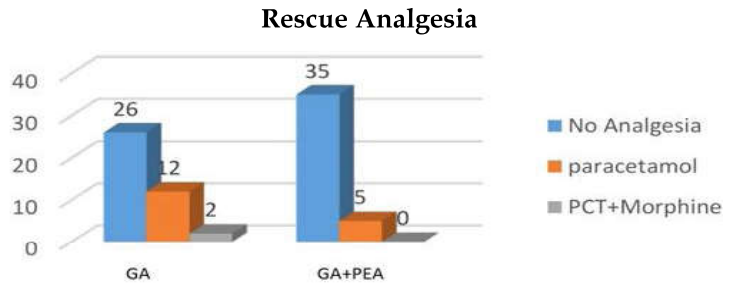
Group	Min value	Max value	Mean+/-SD
GA	14	40	26.2+/-8.05
GA+PEA	12	35	22.6+/-7.56

Table 4: Durationofsurgery(in minutes) Pvalue0.135(>0.05)

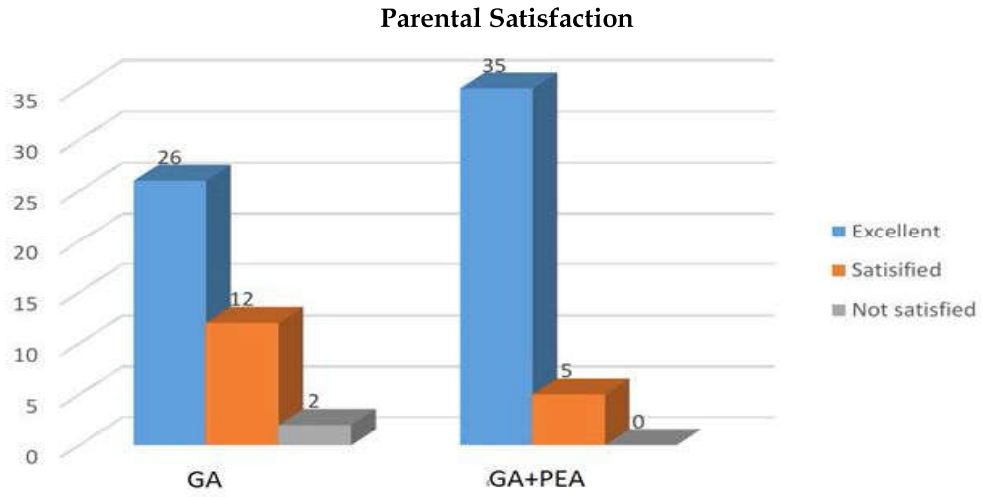
Group	Min value	Max value	Mean+/-SD
GA	90	140	119.8+/-13.6
GA+PEA	60	180	112.8+/-25.9



Graph 1: VAS



Graph 2: Rescue analgesia



Graph 3:

Table 5: VAS Pvalue <0.001

VAS	Min value	Max value	Mean+/-SD
GA	3	6	4.35+/-0.66
GA+PEA	0	5	1.9+/-1.72

Table 6: Rescue Analgesia Pvalue=0.018 (<0.05)

Group	No Analgesia	Paracetamol	PCT+MORPHINE	Total
GA	26	12	2	40
GA+PEA	35	5	0	40
TOTAL	61	17	2	80

Table 7: Parental satisfaction Pvalue<0.001

	Excellent	Satisfactory	Not Satisfactory	Total
GA	26	12	2	40
GA+PEA	35	5	0	40
Total	61	17	2	80

Excellent, parents of 12 children scored as satisfactory and 2 parents scored as unsatisfactory. In the GA+PEA group, parents of 35 children scored their overall satisfaction as excellent, parents of 5 children scored as satisfactory (Table 7, Graph 3). A p value <0.001 showed a highly significant difference in parental satisfaction between the two groups. None of the children in the GA+PEA group had any complications. In GA group, 2 children had desaturation in the immediate postoperative period with a SpO_2 of 92-93% which was corrected with supplemental O_2 administration.

Discussion

This prospective randomized comparative study compares various post-operative parameters namely pain relief, requirements of rescue analgesics, complications and parental satisfaction in children undergoing surgery under GA alone or in combination of GA+PEA. The type of surgeries performed in either of the groups varied from thoracotomy, abdominal, urological and lower limb orthopaedic surgeries. Both the groups had similar pre-medication and induction techniques. The drugs used were calculated on a standard dose in mg/kg body weight chart.

Antony Moriarty[2]in his review article stated that paediatric epidural is an accepted technique of advanced analgesia especially for long term pain management. Elisabeth Giaufre et al [3] confirmed that regional anaesthesia in paediatric population is used as technique of analgesia rather than anaesthesia. Alleviation of pain has been defined as a *"BASIC HUMAN RIGHT"*, irrespective of age, medical condition, treatment, primary service response for the patient care or medical institution by the society of paediatric anaesthesia [4]. Inclusion of postoperative pain treatment in the anaesthetic plan even before induction of anaesthesia was suggested by Langlade et al [5] who thus adopted the idea of *'managing pain before it occurs'*. Gone are the days when it was thought that children neither feel pain nor suffer from pain which had led to its under treatment [1].

The statistically significant lower pain scores in GA+PEA indicates that the biochemical and physiological stress responses are attenuated thus improving the cardiovascular, pulmonary, neuro-endocrinal, gastrointestinal, immunological and metabolic functions. All the above mentioned responses are triggered with under treatment of postoperative pain in children and newborn [6].

The reliability of pain assessment tools namely behavioural, biological pain rating scales have always remained the*"NEED OF THE HOUR"*. Various authors have suggested various methods/ scale/ score for pain assessment. According to H. Breivik [7], since pain is such a subjective, personal and private experience, assessing pain in patients with whom we cannot communicate well is difficult. Children belong to the one such set of patients. In our study we have used the Children and Infants Post-operative Pain Score [CHIPPS] for younger children aged 2-6 years and visual analogue scale (VAS) for children 7-12 years of age. Buttner W. et al [8] have suggested the use of CHIPPS for all clinical purpose by presenting controlled data on its sensitivity, specificity, reliability and validity. The Visual Analog Scale (VAS) and Numerical Rating Scale (NRS) is more powerful in detecting changes in pain intensity than a Verbal Categorical Rating Scale [7]. The CHIPPS and VAS was used in our study depending upon the age group as used by Christopher Dadure et al [9] in their study.

Post-operative analgesia was maintained in a step-ladder fashion. The concerns of pain management was mainly related to side-effects and complications of modalities used in paediatric population. The post-operative pain is acute in nature, associated with a brief episode of tissue injury or inflammation and the intensity of pain diminishes steadily over a period of time[1]. The combination of epidural local anaesthetics with opioids and other adjuvants reduces the complications of epidural over-dosage and side-effects while enhancing the quality of analgesia. The titration of epidural infusion and rescue analgesics improves over-all post-operative outcome.

In GA+PEA group, the requirement of rescue analgesics was significantly reduced indicating the effectiveness of epidural analgesia and thus reducing the side effects due to supplementary rescue analgesics.

The parental satisfaction in the GA+PEA group was significantly better. The parents/ guardian rated their overall satisfaction depending upon whether (1) the child was easy to manage with regard to catheter, IV lines and other drain tubes if present; (2) the child slept comfortably during the night; (3) the child was shifted toward or ICU with various monitors connected. The decision whether to shift the child to PICU or ward mainly depended on the type of surgery, intraoperative events and immediate postoperative condition of the child. Greeley et al [10] in their study of PCEA in children have also mentioned the same.

The parental satisfaction correlated with the requirement of rescue analgesics and the pain scores. As the post-operative pain was treated more efficiently in the GA+PEA group, parental satisfaction was found to be better.

SS Bajwa [11] in their study considered 2 criteria for patient satisfaction namely pain / discomfort during surgery and in the postoperative period. Their study group included adult patients. The same cannot be applied directly in our study which includes only paediatric patients. Pain was assessed using CHIPPS & VAS. However in our study,

parental satisfaction was studied as it is more reliable with regard to comfort of the child in the immediate post-operative period.

Use of Patient Controlled Analgesia (PCA) or Patient Controlled Epidural Analgesia (PCEA) have been studied by various authors. Limitations / contraindications of PEA and PCEA are children with physical or cognitive disabilities, inability of the child to understand the whole mechanism and high cost [12].

The only complication noted in our study was desaturation in 2 children which correlated with use of morphine as rescue analgesic. This however was corrected immediately with supplemental O_2 administration.

The commonest complication of continuous epidural anaesthesia is nausea, vomiting, pruritus, urinary retention.which are mainly associated with use of opioids along with local anaesthetic infusion. In our study, we have used only local anaesthetic infusion and hence such complications were not observed.

The incidence of pruritus due to epidural analgesia is as high as 88% of paediatric patients and most frequently with use of local anaesthetic with morphine [13,14]. Christopher Dadure [9] documented 7.4% incidence of pruritis in continuous epidural blocks which was related with use of nalbuphine as rescue analgesia.

The absence of postoperative urinary retention in our study population may be attributed to catheterisation of children preoperatively or intraoperatively. Wood et al [13] have reported a 5.3% incidence of urinary retention in their patients with continuous epidural analgesia, many of whom had undergone urological procedures and thus had urinary cathetersin-situ.

Conclusion

The advantages of GA+PEA includes excellent post-operative pain relief, requirement offewer doses of rescue analgesics with reduced complication rates and overall enhanced parental satisfaction.

Limitations

Restriction of patient mobility with regard to epidural catheter placement and maintenance was not evaluated in our study.

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