Abstract

Aim
To study the feasibility of caudal anaesthesia in infraumbilical surgery with sedation, to study hemodynamic changes, the respiratory and other complications during intraoperative and postoperative period and the total no of rescue analgesics used during the 6 hour post-operative period.

Methods
Fifty paediatric patients of either sex undergoing various lower abdominal surgeries and belonging to ASA (AMERICAN SOCIETY OF ANAESTHETIA) Grade I, II were selected for this study. Patients were premeditated with Inj. Glycopyrollate 0.04 mg kg\(^{-1}\), Inj. Fentanyl 1 mcg kg\(^{-1}\), Inj. Midazolam 0.03 mg kg\(^{-1}\). Induction was done with Inj. Propofol 1 mg kg\(^{-1}\). 0.3 % Ropivacaine at 1 ml kg\(^{-1}\) was administered caudally. Maintenance of sedation was done with Inj. Propofol 2 mg kg\(^{-1}\) hr\(^{-1}\). Patients were followed intra operatively and postoperatively for adequacy of analgesia, hemodynamic changes, respiratory and other complications and need for rescue analgesics.

Results
There was no incidence of bradycardia, tachycardia or hypotension during intraoperative period. All patients remained asleep after the performance of the block with quick arousal at the end of surgery. Due to conscious sedation, intubation sequel like laryngospasm, stridor, were not seen in our study. Complications like prolonged motor block, prolonged respiratory depression and hypotension were not observed in the postoperative period. Only 4 patients developed complications in form of nausea vomiting. 38 patients required no rescue analgesic.

Conclusions
Caudal anaesthesia under sedation in paediatric patients is associated with high success rates and a low incidence of adverse events with care for perioperative management.

Keywords
Caudal anaesthesia under sedation, Ropivacaine, Infra umbilical surgeries, Paediatrics.

Introduction
Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Caudal epidural technique has attracted attention of many research workers for the simplicity in its technique, rapidity with which it is accomplished and the extensive safety record in patients\(^1,2\). Other advantages of caudal block are early ambulation, and decreased risk of chest infection, decreased post operative analgesic requirements and early discharge. A calm and relaxed child after caudal block will not have problems like bleeding and dislodgement of dressing in the recovery room due to pain or agitation.

Ropivacaine, being a pure S (-)-enantiomer, has a significantly higher threshold for cardiotoxicity and CNS toxicity than Bupivacaine\(^3,4\). It is less lipophilic than Bupivacaine and less likely to penetrate large myelinated motor fibres; therefore, it has selective action on the pain transmitting A delta and C nerve rather than A \(\beta\) fibre which are involved in motor function. It is generally well tolerated in paediatric patients aged from 1 month to 15 years regardless of the route of administration. The overall incidence of adverse events associated with Ropivacaine appeared to be low, only nausea and/or vomiting were found most frequently\(^5-8\). The synergy of a Propofol-opioid combination has been clearly established in anaesthetic practice.

Awake caudal block\(^9\) may be stressful for the child, is associated with a significant failure rate and requires experienced performers. Sedation during the performance of the block might minimize these limitations. General anaesthesia is regarded to be safe, but the risk of laryngeal complications as well as postoperative apnoea and hypoxemia is not negligible in paediatric patients. Our sedation regimen provided optimal conditions for caudal puncture represented by our success rate of more than 98%.

Material and methods
Fifty paediatric patients of either sex undergoing various lower abdominal surgeries and belonging to ASA Grade I, II were selected for this study. All routine preoperative anaesthetic assessment done. Patients were kept fasting for 4-6 hours according to age. After taking I.V. line injection Ringer Lactate started at the rate of 4ml kg\(^{-1}\) hour\(^{-1}\). Monitors like ECG, NIBP, Pulse oximeter and Temperature probe were applied. Patients were premeditated with Inj. Glycopyrollate 0.04 mg kg\(^{-1}\), Inj. Fentanyl 1 mcg kg\(^{-1}\), Inj. Midazolam 0.03 mg kg\(^{-1}\), all by i.v. (intravenous) route. Induction was done with Inj. Propofol 1 mg kg\(^{-1}\) i.v. After induction, caudal block was performed with full aseptic and antisepsic precautions, with patient in
the left lateral position. 0.3 % Ropivacaine 1 ml kg\(^{-1}\) was administered caudally. The site of injection was dressed and the patient was turned supine. Sedation was maintained with Inj. Propofol 2 mg kg\(^{-1}\)hr\(^{-1}\) i.v. infusion and oxygen by face mask at 2-3 litre min\(^{-1}\).

Heart rate, blood pressure, respiratory rate and oxygen saturation were recorded every 10 minutes during surgery thereafter. Adequate analgesia was defined as hemodynamic stability as indicated by the absence of an increase in SBP (systolic blood pressure) or HR (heart rate) of more than 20% compared with baseline value. A decrease in MAP (mean arterial blood pressure) >30% was defined as hypotension and was treated with intravenous fluids/ Inj. Ephedrine. A decrease in HR >30% was considered as bradycardia and was treated with Inj. Atropine 0.01 mg kg\(^{-1}\).

Assessment of onset of caudal block was done by pinprick method. Adequacy of Caudal block was defined as the absence of gross movements or significant (>20%) change in pulse rate and/or respiratory rate on application of forceps to the foreskin in patients undergoing circumcision, or with the inguinal incision in those undergoing inguinal hernia repair or orchidopexy. In case of changes in two of these three clinical parameters, the block was considered clinically ineffective. The Propofol infusion was stopped at the end of surgery. After arousal, patients were transferred to the recovery room.

The proportion of patients receiving analgesic medication after operation and the time between the caudal block and the administration of analgesics were used to measure pain relief.

Postoperative pain was evaluated using Broadmans scale\(^{10}\) as it was easy to be applied and did not require the patients’ cooperation or comprehension as required in VAS scale, as all the patients belong to the paediatrics age group. When the score was 5 points or more, suppository of Paracetamol 10 mg kg\(^{-1}\) was administered.

We observed 5 points post-operatively in Broadman’s scale.
1. Blood pressure.
2. Crying
3. Movement
4. Agitation
5. Complaints of pain when appropriate by age.

The patient was then shifted to the recovery room. There patient was observed half hourly for 2 hours and every 2 hourly till the effect of analgesia weared off. The minimum score that can be obtained after using Broadman’s scale was 0 and maximum score was 10. Higher scores were obtained as the effect of analgesia weared off.

Results

**Table-1: complication after caudal block**

<table>
<thead>
<tr>
<th>COMPLICATIONS</th>
<th>NO. OF PATIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged motor block</td>
<td>0</td>
</tr>
<tr>
<td>Hypotension</td>
<td>0</td>
</tr>
<tr>
<td>Respiratory paralysis</td>
<td>0</td>
</tr>
<tr>
<td>Intrathecal or intravenous injection</td>
<td>0</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table-2: post operative pain discomfort score**

<table>
<thead>
<tr>
<th>SCORE</th>
<th>NO OF PATIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>at 0 hr</td>
</tr>
<tr>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
</tr>
</tbody>
</table>

**Table-3: total duration of analgesia**

<table>
<thead>
<tr>
<th>NO. OF PATIENTS</th>
<th>DURATION OF ANALGESIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>6 hours</td>
</tr>
<tr>
<td>8</td>
<td>4 hours</td>
</tr>
<tr>
<td>4</td>
<td>3 hours-30 minutes</td>
</tr>
</tbody>
</table>

**Table-4: total number of rescue analgesics required in 6hr period**

<table>
<thead>
<tr>
<th>NO. OF RESCUE ANALGESICS</th>
<th>NO. OF PATIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Majority surgeries included in the study are infra umbilical in nature like herniotomy, circumcision, and orchidopexy. Six patients were below 2 year, 41 patients in 2-5 years age group and 3 patients in 6-10 years age group. There were 3 patients whose weights were below 10 kg and 47 patients whose weights were between 11-20 kg. There was no incidence of tachycardia, bradycardia or hypotension during intra operative period.

The mean preoperative systolic BP was (88.4 mm of hg) and the mean preoperative pulse rate was (101.25 per min). The mean intraoperative systolic BP was (93.12 mm of hg) and the mean
intraoperative pulse rate was (103.12 per min). The mean postoperative BP was (96 mm of hg) and mean postoperative pulse rate was (105.20 per min). There was no significant difference in blood pressure and pulse rate during operation. There was no significant difference in oxygen saturation during operation.

Four patients had post operative vomiting (Table-1). Immediate post operative score was 0 in 35 patients, 1 in 7 patients, 2 in 5 patients, 3 in 3 patients. At 2 hours score was 0 in 36 patients, 1 in 10 patients and 2 in 4 patients. The score at 4 hours was 0 in 34 patients, 1 in 10 patients and 2 in 6 patients. At 6 hours the scores was 0 in 25 patients, 1 in 9 patients, 2 in 5 patients, 3 in 5 patients, 4 in 5 patients and 5 in 1 patient (Table-2). The effect of epidural analgesia lasted for 6 hrs in 38 patients, 4 hrs in 8 patients, 3 hrs-30 minutes in 4 patients (Table-3). 38 patients required no rescue analgesic, 10 patients required 1 rescue analgesic and 2 patients required 2 rescue analgesic doses in 6 hours period (Table-4).

Discussion
A large number of infants and small patients require inguinal, analorectal, and lower extremity surgery. Caudal anaesthesia is established to be safe in these patients, because the procedure is technically simple to perform, the success rate is high and complications are rare and minor.

Brenner in 2010 carried out a study of caudal anaesthesia under sedation (with i.v. Nalbuphine 0.1 mg kg$^{-1}$ i.v. and Propofol 1 mg kg$^{-1}$ i.v., and maintained with Propofol 5 mg kg$^{-1}$hr$^{-1}$ i.v. infusion) with Ropivacaine (0.2% and 0.35%) in 512 patients and concluded that Caudal anaesthesia under sedation is associated with high success rates and a low incidence of adverse events with careful perioperative management.

S. Ahmed in 2012 carried out a study of Caudal Analgesia in Paediatric Patients: Comparison between Bupivacaine (0.25%) and Ropivacaine (0.2%). Caudal Ropivacaine provides effective post-operative analgesia and possessing less motor blockade makes it a suitable agent for day care surgery with increased margin of safety particularly in younger patients.

Dr. B. Locatelli and his colleagues induced patients with Propofol 2 mg kg$^{-1}$ and Fentanyl 0.002 mg kg$^{-1}$ by i.v. route. Anaesthesia was maintained with a Propofol infusion of 0.125–0.130 mg kg$^{-1}$ min$^{-1}$ i.v. infusion and the airway was controlled with a facial mask or laryngeal mask. Gregory A. Hollman concluded that 34 % less dose of Propofol required, when it is given with Fentanyl as compared to Propofol alone and adverse effects were in 50 % patients in Propofol group compared to 18% in Propofol Fentanyl group. In present study, we used Inj. Fentanyl 1 mcg kg$^{-1}$, Inj. Midazolam 0.03 mg kg$^{-1}$ i.v. as sedation. Induction was done with Inj. Propofol 1 mg kg$^{-1}$ i.v. and maintained with inj. Propofol 2 mg kg$^{-1}$hr$^{-1}$ i.v. infusion with 0.3 % Ropivacaine 1 ml kg$^{-1}$ administered caudally. Studies consistently show that Propofol requirements for anaesthetic induction and surgical stimulus are less when Propofol is combined with an Opioid than when Propofol is used alone. Propofol sparing effect of Fentanyl is observed as well. Studies show that the magnitude of the Propofol-Opioid interaction is more pronounced the greater the stimulus. Consequently the Propofol sparing effect of Fentanyl would be expected to be greater for a painful stimulus than it would be for achieving unconsciousness. Use of Propofol is also associated with smooth and early arousal.

Even if complications are rare, the risk of laryngeal complications and incidence of postoperative apnoea is significant with general anaesthesia. Due to conscious sedation, intubation sequel like laryngospasm, stridor, were not seen in our study. There was no incidence of tachycardia, bradycardia and hypotension during intra operative period. There was no adverse event requiring respiratory support and subsequent tracheal intubation. Short apnoea after induction of sedation required short bag-valve-mask ventilation until spontaneous respiration regained. All patients remained asleep after the performance of the block with quick arousal at the end of surgery. All patients had good sensory and motor block with good cardiovascular stability during intraoperative period. None of our patients showed any other signs of local anaesthetic toxicity, like seizures, or ECG changes.

Need for rescue analgesic is decreased. Only 4 patients developed complications in form of nausea vomiting. Complications like prolonged motor block, respiratory depression and hypotension were not observed in the postoperative.

Ropivacaine, having the potential to produce differential neural blockade with less motor block and reduced cardiovascular and neurological toxicity has been proved attractive for day case surgery in patients, which is increasing in frequency. For single injection caudal block, a volume of 1 ml kg$^{-1}$ of Ropivacaine 3 mg ml$^{-1}$ solution (3 mg kg$^{-1}$) will reliably produce analgesia for infraumbilical surgery with an acceptable incidence and duration of motor block. Majority of patients had surgical procedures like inguinal hernia, circumcision and orchidopexy. There were no significant hemodynamic change during intra and postoperatively. As the effect of
caudal analgesia weared off higher scores on Broadmans scale were obtained.

**Conclusion** Caudal anaesthesia is a common procedure for infants and patients undergoing infraumbilical surgery, mostly performed in conjunction with general anaesthesia. The risk of laryngeal complications and incidence of postoperative apnoea is significant with general anaesthesia. Caudal block in sedated, spontaneously breathing patients might be a safe alternative method. Caudal anaesthesia with Ropivacaine under sedation is associated with high success rates and a low incidence of adverse events with careful perioperative management.

**References**

5. Daconceicaomj, coehl, caudal anaesthesia with 0.375%Bupivacaine or 0.375% Bupivacaine in paediatric patients. Br J Anaesth 1998;80: 507–8