**Supplemental Table 1:** Data of patients where regional anesthesia played a role in morbidity/mortality n=4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S. No** | **Patient Information**  **Age/wt. (kg)/ ASA/ Surgery** | **What Happened and Outcome** | **Anesthetic Factors Identified** | **Action taken and**  **Recommendations** |
|  | 9 months/7 kg/3/ Anorectoplasty | GA administered with propofol, N2O & O2.A single shot caudal (6 mls of 0.25% bupivacaine) was followed by insertion of 19 g epidural catheter through caudal route. 8.5 cms of catheter was left in situ. A 2 ml per hour infusion of 0.125% bupivacaine was continued intraoperatively .Patient was operated in Jack knife position and operation lasted 7.5 hours. Postoperatively infusion was continued at a rate of 1-1.5 mls /hr. Decreased upper limb movements were noted on 2 nd postop day .Neurological opinion sought. Patient underwent MRI, EMG studies. Spinal artery syndrome diagnosed based on 2nd MRI report. Child survived with quadriparesis | * Catheter length in caudal space was inappropriate * Lapses in intraoperative monitoring identified * Postoperative care found inadequate * Contribution of surgical position to morbidity | * Guidelines prepared for length of epidural catheter to be left in epidural space * Training of nurses looking after pediatric epidurals postoperatively |
| 2 | 1.5 years /NA /3/  Diaphragmatic hernia repair \* | Caudal block performed at end of surgery using 23 g butterfly needle .1 ml/kg of 0.25 % bupivacaine with buprenorphine 2.5 ug/kg was administered .Patient had bradycardia and hypotension and needed ventilation postoperatively. Patient survived. | * Use of sharp needle for caudal.(caudal needles were not available) * Possibility of subarachnoid space being lower than normal in this child | * Avoid caudal in patients with congenital abnormalities.(This case was also published as a case report)\* |
| 3. | 1 year and 9months/10.5 kg /2/Right pyeloplasty for posterior urethral valve obstruction | After routine inhalational induction the child received 1ml/kg of 0.25% bupivacaine for caudal block which was below the maximum safe dose .Patient was then placed supine with a wedge under right flank .Surgeon started palpating surgical site .Patient had immediate severe bradycardia unresponsive to IV atropine.  CPR started. It was only after removal of wedge that the patient responded to CPR & survived | Patient was investigated postoperatively and found to have mild congenital cardiomyopathy. This was a retrospective finding .It was postulated that the surgical examination and the wedge may have led to a fall in cardiac output due to IVC compression ,which led to myocardial depression even with a safe dose of LA | * Familiarity with pediatric CPR |
| 4. | 6 years /13 kg/1/Tendo Achilles lengthening | The details regarding this case are not entirely clear. This child received GA combined with caudal analgesia 1ml/kg 0.25% bupivacaine combined with buprenorphine 2.5 ugs /kg. She was also given pethidine 1mg/kg IV (not clear why).After thirty minutes in recovery room the child had sudden bradycardia ,followed by apnea and needed tracheal intubation .She was extubated the same day without any residual effects. | Simultaneous use of caudal and IV narcotics | * Avoidance of IV narcotics if narcotics have been used in epidural space. * Vigilance in recovery room monitoring in patients who receive narcotics through epidural route. |

NA: Not available; \*Afshan G , Khan FA. Total spinal anesthesia following caudal block with bupivacaine and buprenorphine. Pediatric Anesthesia 996;6:239-242.

**Supplemental Table 2: Data of patients who had perioperative cardiac arrest (CA) n =13**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Patient Information Age/wt. (kg)/ ASA/ Surgery** | **What Happened and Outcome** | **Anesthetic factors identified** | **Action taken and Recommendations** |
|  | 32 weeks, premature neonate/1.2kg /4E Tracheo-esophageal fistula repair | This child was on a ventilator in NICU. Cardiac arrest during maintenance phase .The child had multiple cardiac congenital abnormalities. Just after closure of chest wound she went into bradycardic arrest. CPR 4 cycles done. Revived and moved to NICU on ventilator | * Surgery without optimization | * There should be a mutual discussion between concerned surgeon, anesthesiologist and cardiologist for optimization before bringing such case to the operating room. |
|  | Two day old infant/2.7kg/3/  Excision of sacrococcygeal teratoma | Full term baby. Inhalational induction, following by fentanyl & atracurium. Pressure controlled ventilation in prone position. Pre-operative Hb 9.3g/dl, intra-operative blood loss approximately 55mls replaced with packed cells and FFP. Went into cardiac arrest when skin stitches were being applied. Patient survived. | * Acceptance of urgency of surgery without optimization * Assessment of cardiac anomalies not done preoperatively. Suspicion of prolonged QT interval * Lack of judgement in terms of fluid management. | * Preoperative evaluation by pediatric cardiologist should be done for patients with congenital heart disease. * Separate credentialing for anesthesiologists handling neonatal cases. * PALS training for anesthesiologists handling pediatric cases. |
|  | Five days old neonate/3.1kg/3 /Insertion of VP shunt | Patient had congenital hydrocephalus, cleft lip and palate. Initially awake intubation attempted, which was unsuccessful. Then O2/halothane induction done. Face mask ventilation was possible. Succinyl choline given which lead to bradycardia & cardiac arrest associated with tall peaked T waves. Patient survived. | * Serum K+ was not rechecked before induction. High K in a previous sample was assumed to be high due to hemolysis. | * Not to use succinyl choline in pediatric patients unless there is a strong indication. (There was no black box warning regarding succinyl at that time) |
|  | Fourteen days old neonate 1.98 kg/4/ Formation of colostomy | Full term sick neonate, she was on a ventilator for past 2 days because of respiratory distress & sepsis. Had multiple congenital defects i.e. AV canal defect, Pierre Robin syndrome, microcephaly, & imperforate anus. No IV line in situ. Surgeon inserted an interosseous line. Induction was done with interosseous ketamine, followed by O2 sevoflurane. Mask ventilation was easy. CVP insertion tried on right side of neck. Patient went into bradycardic arrest .Did not survive resuscitation | * Airway control not ensured before attempting CVP | * Discussion with surgeon regarding justification of surgery in such cases. * Involvement of cardiothoracic anesthesiologist in cases with CHD * Venous cut down before proceeding to CVP |
|  | 2 months old infant/5kg/3 /  Laparotomy for congenital biliary atresia. | Inhalational induction with oxygen & halothane followed by atracurium & fentanyl 3 ugs /kg. Patient’s trachea was extubated awake .After 1 hour in PACU, paracetamol suppository was being inserted when he went into bradycardic arrest and desaturated.  Patient survived. | * A junior nurse in the PACU * Inadequate monitoring during insertion of suppository | * If suppository is planned it should be inserted in the operating room |
|  | 3 months old infant/3.5kg/2 /  Insertion of cysto- ventriculo-peritoneal shunt | Patient had a cyst in 3rd ventricle. Full term child .GA induction with fentanyl and atracurium. Maintenance on O2/N2O/Isoflurane. First hour blood loss 30mls, sudden blood loss of further 75mls at the time of burr hole. Patient developed tachycardia and hypotension and then had cardiac arrest. Patient survived. | * Lack of knowledge of procedure * Fluid replacement not timely * Unreliable IV line which was placed preoperatively on the ward | * Always check IV line placed on the ward * Better communication with surgical team regarding nature of unfamiliar procedure |
|  | 9 months /6.5kg/2 /  Cleft palate repair | Full term baby. Induction with thiopentone, fentanyl, atracurium. Maintenance on O2/N2O/halothane. Uneventful intraoperative period. At emergence throat pack removed, suction done and childs trachea was extubated in light plane in lateral position. He went into laryngospasm, desaturated (O2 sat70%) and had bradycardic arrest. Given atropine and succinyl choline. Saturation did not improve, resuscitation continued but child did not survive. | * Use of succinyl choline in a hypoxic bradycardic child * Poor choice of vasoactive drug ,atropine rather than adrenaline | * Underlying CHD a possibility in this child. Assessment by pediatric cardiologist in all cleft cases to rule out underlying CHD |
|  | 1yr 9 months /5kg/3/ Closure of colostomy | A diagnosed case of ASD, VSD and PDA, had previously undergone PA banding, and laparotomy for enterocolitis. She was on digoxin and furosemide. Uneventful GA. She was kept in recovery breathing spontaneously, on O2. 12 hours later she became tachypneic, tachycardic and dropped her O2 saturation. Her trachea was intubated and she was put on ventilation in the recovery, 2nd post op day she was extubated on O2 but again dropped her saturation and had cardiac arrest. Chest X-Ray during CPR showed left lung collapse. Patient did not survive. | * Inadequate recovery room cover after working hours | * Recovery room coverage to be reassigned if pediatric patients are to be ventilated there |
|  | 1yr 9 months/10.5kg /2/  Right pyeloplasty | (see Supplementary Table 1 for details) |  |  |
|  | 2yrs/ 7.5kg/4 E  Bronchoscopy for foreign body removal | This child presented with acute respiratory distress and foreign body in bronchus. Intraoperatively there was a sudden decrease in compliance, desaturation and cardiac arrest .Pneumothorax was suspected. CPR done for 30 minutes patient reverted and put on ventilation. Had hypoxic brain damage. | * No measures taken to correct preoperative acidosis. * Consultant was not called for an ASA 4 case. * Resident who had not done pediatric rotation allowed to ventilate during procedure. * Use of O2 flush and 500ml bag in a child. | * Consultant on call must be called in for all ASA 4 cases * Residents who have not done their pediatric rotation should not be allowed to handle pediatric cases. |
|  | 3 years and 4 months/12kg/4E /  Burr hole evacuation of cerebral abscess | Patient admitted with history of fever, seizures and unconsciousness from emergency room. Child had CHD, trans-positioning of greater arteries (TGA) with ventricular septal defect and had pulmonary BT shunt done 2yrs ago. Tracheal intubation and ventilation in ER. Cerebral abscess diagnosed on CT scan. Rushed to OR at midnight. Post operatively admitted to recovery room for overnight ventilation. Six hours later went into cardiac arrest. Arterial blood gases showed metabolic acidosis just before arrest. Could not be resuscitated | * Postoperative management left with junior resident * Pediatric cardiologist was not involved in postoperative management * No effort made to correct acidosis. | * Senior anesthetist, pediatric cardiologist and surgical colleagues should be jointly involved in the management of such complicated cases. |
|  | 16yrs/41/4E /exploratory  Laparotomy | Patient was admitted with a history of abdominal pain, projectile vomiting and acute renal shut down. BP was being maintained, but had tachycardia. Patient was preoxygenated and given thiopentone and succinylcholine .Tall peaked T waves appeared on ECG followed by cardiac arrest. Patient could not be resuscitated. | * Patient had acute renal shut down and the preoperative labs were not reviewed by the anesthesiologist * Use of narcotic analgesic in compromised airway | * Always review all lab investigations ordered before proceeding in emergency cases. |
|  | 16yr/NA/3 /Tracheostomy | This patient presented with neurofibromatosis of tongue and tracheal deviation. Awake fiberoptic intubation attempt failed .Surgeon proceeded with tracheostomy under local.75 ugs of fentanyl was also administered I.V by anesthesiologist. There was difficulty in insertion of tracheostomy tube since the tracheal rings were very soft .Patient went into hypoxic cardiac arrest. Resuscitation was successful once the tracheostomy tube was inserted. | * Full extent of patients pathology was not discussed between the anesthesiologist and surgeon as disease was extending below the vocal cords | * Better communication with the surgical team before proceeding with such cases |

NA:Not available

**Supplementary Table 3:** Details of additional cases where anesthesia was considered the predominant cause of morbidity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.no** | **Patient Information**  **Age/wt. (kg)/ ASA/ Surgery** | **What Happened and Outcome** | **Anesthetic Factors Identified** | **Action taken and Recommendations** |
| 1. | 40 days /4.8 kg/1/  Repair of bilateral inguinal hernia | Inhalational induction with oxygen & halothane followed by insertion of LMA .Patient went into laryngo-spasm during movement for positioning and desaturated (SaO274%).Difficulty in tracheal intubation .On suction of ETT, blood and secretions. Suspected aspiration. | * Lack of experience & inadequate supervision. Case left with junior resident after induction | * Positioning to be done in the presence of consultant and in adequate anesthesia plane |
| 2. | 3 years/9.9kg/3/  Cystoscopy and cystofulgration of posterior urethral valves and uretrorenoscopy | Syndromic child (Silver Russel syndrome).Difficulty in IV line insertion .Right internal jugular vein cannulation attempted and successful .Intraoperatively patient was stable but swelling noticed in right side of neck .In PACU patient became dyspneic and desaturated. Chest X-ray done. Hemothorax post CVP insertion. | * Error of judgement in choice of technique for IV maintenance since CVP measurement was not a requirement for case management | * Peripheral cut down to be attempted for IV maintenance as a first choice rather than CVP if CVP measurement is not a case requirement |
| 3. | 3 years/NA/2/  Repair of bilateral cleft lip and palate | Uneventful anesthesia .Intubation was grade 2.Reinforced ETT with stylet with plastic coating used. Desaturation and left lower lobe collapse on second postoperative day which was diagnosed on chest X ray. One week later child again readmitted with pneumonia. Given antibiotics .Pneumonia resolved. Three weeks later child coughed up the plastic tip of the introducer which the father removed from childs mouth. | * Tracheal tube stylets were being reused after sterilization | * Rechecking of stylets prior to use and after being used * Replacement by disposable stylets |
| 4. | 3years/11 kg/1/  Hypospadias repair | Pulmonary edema at emergence .Change of anesthesia team since the case ran over working hours. On call consultant was looking after more than 2 ORs .He was only called in at emergence when the resident noticed that the child was irritable and had a puffy face and lot of secretions .Pulmonary edema was diagnosed and child responded to furosemide. | * Inadequate consultant cover after working hours | * One consultant should not cover 2 ORs if there are pediatric cases scheduled. * Avoid switching whole team for continuity of care |
| 5. | 12 years/ NA/2 (mentally challenged)  Bilateral intraocular lens & anterior vitreotomy | Endo-bronchial intubation leading to hypoxia and lung collapse and leading to unplanned hospital admission.GA with Propofol, atracurium,& fentanyl , tracheal intubation with RAE tube. Fall in oxygen saturation intraoperatively leading to tube change .Nasogastric tube inserted, on aspiration large volume of residual food .Aspiration suspected. | * Endobronchial intubation due to head position. * Aspiration | * Careful positioning and vigilance with RAE tube in pediatric patients and where airway is not immediately accessible. NPO status to be reconfirmed in mentally challenged patients |
| 6. | 16 years /NA/1/  Elective repair of arteriovenous fistula in left leg | Trachea was intubated and patient was on spontaneous ventilation with O2, N2O and halothane. Uneventful anesthesia till extubation. Laryngospasm and post extubation pulmonary edema. | * Wrong risk assessment as ASA 1 * No call for help given immediately | * Lack of experience and judgement in assessment of plane of anesthesia by trainee |
|  |  |  |  |  |

NA: Not available