Case Report

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Challenges in the Anaesthetic Management of Congenital Disorder Infantile Hypertrophic Pyloric Stenosis

Anaesthesia Section

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ABSTRACT

Pyloric stenosis is characterised by a thicker, lengthened, and larger pylorus as well as hypertrophy of the circular and, to a lesser extent, the longitudinal smooth muscles.The classical presenting features are non bilious, projectile vomiting, visible peristalsis and hypochloremichypokalaemic metabolic alkalosis. Definitive treatment is often performed by a relatively quick surgical procedure shortly after diagnosis. Surgery for pyloromyotomy is usually performed when fluid, acid/base, and electrolyte imbalances have been properly and completely corrected, which inturn results in speedy recovery of patient. The complications linked to these diseases call for caution when administering anaesthesia for even ostensibly straightforward surgical procedures. The case report is about a 1-month old male neonate who presented with features of pyloric stenosis. Weighing the increase risk of complications and mortality, the neonate was managed using rapid sequence induction approach in combination with caudal block for an adequate analgesia.

Keywords: Electrolytes, Neonates, Postoperative risk, Pyloromyotomy surgery

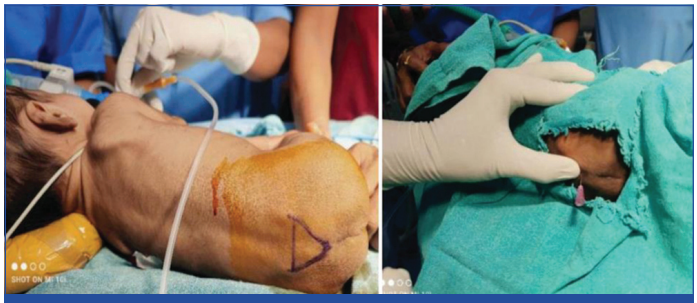
CASE REPORT

A 1-month-old, 2.5 kg neonate, presented with mild dehydration and non bilious projectile vomiting after breast feedings for the previous ten days. He had been experiencing small amounts of non bilious, non bloody emesis after feedings since previous week. He was alert, afebrile, did not seem tired to his parents, had a regular amount of feedings during the week, and had wet diapers on a consistent basis. He had the following vital signs: Heart Rate (HR) 142 beats per minute, Blood Pressure (BP) 86/44 mmHg, Respiratory Rate (RR) 36/min, temperature 36.8°C, and Oxygen Saturation (SpO_2) 100%. Upon physical examination, he showed signs of activity and had normal mucous membranes, capillary refill time, and a fontanelle. The respiratory and cardiovascular systems performed normally. There were no obvious abdominal masses felt on palpation.

Investigations revealed that, the patient had 11.6 g/dL Haemoglobin (HB), 3.6 lakh platelets, 0.6 mg/dL serum creatinine, 10.8 mg/dL blood urea nitrogen, and electrolytes of 128 mmol/L Na+, 2.9 mmol/L K+, and 74 mmol/L Cl. Tests to measure thyroid function were within acceptable ranges. He had a pH of 7.6, a partial pressure of carbon dioxide (pCO_2) of 38.4 mmHg, and Bicarbonate (HCO_3) of 38.6 mmol/L in his arterial blood. A 48-hour period of medical care consisted of correcting electrolyte imbalance and dehydration with 5% dextrose in 0.45% saline and potassium chloride. He had preoperative blood sugar of 100 mg%, Na^+ 133 mmol/L, K^+ 4.2 mmol/L, and Cl^- 91 mmol/L, and an abdominal ultrasound indicated abnormalities that were perhaps related to pyloric stenosis. Pyloromyotomy surgery was therefore planned accordingly.

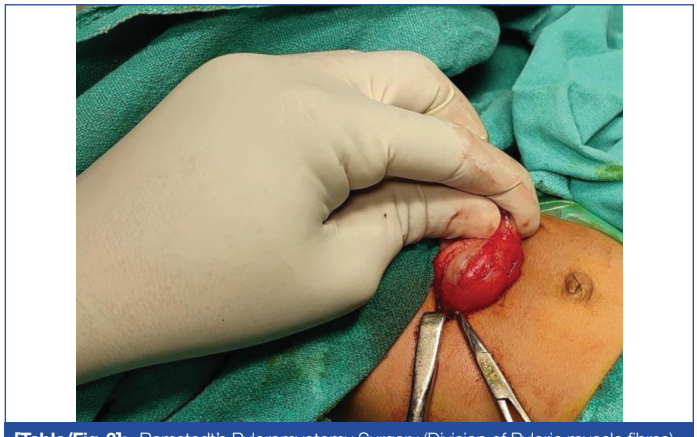
Operation theatre was equipped with Miller and Macintosh laryngoscope blades, endotracheal tubes, stylets, and Laryngeal Mask Airways (LMA) in anticipation of difficult airways. Monitors for the SpO_2 and electrocardiogram were fitted. Ryle's tube aspiration was performed. Keeping in mind about providing good analgesia, prior to induction, after taking all necessary aseptic precautions, patient was given left lateral position, caudal block total 1 mL volume (0.5 mg/kg) of 0.25% bupivacaine local anaesthetic was administered [Table/Fig-1]. It was performed by inserting a needle through sacral hiatus [Table/Fig-2].

After preoxygenation for 5 minutes, the infant was premedicated with intravenous (i.v.) glycopyrrolate and i.v. midazolam for 5 minutes.



[Table/Fig-1]: Patient's position.
[Table/Fig-2]: Caudal Anaesthesia. (Images from left to right)

With the help of atracurium 0.5 mg/kg and propofol 2 mg/kg, general anaesthesia was achieved. With a modified rapid sequence induction approach with cricoid pressure and gentle and smooth laryngoscopy, the patient was intubated using a 3 mm endotracheal tube. Sevoflurane, oxygen, and air was used to maintain anaesthesia during the procedure. Fentanyl top-ups i.v. were used to give adequate analgesia intraoperatively (1 mcg). A temperature probe and capnograph were fitted. In case replacement of fluids required, a second i.v. access was established. 1% dextrose in ringer lactate was given to him in 25 mL over the course of the 45-minute procedure. His temperature was kept between 35.5°C and 36.5°C, SpO_2 was kept between 97-99%, and his heart rate was kept between 120 and 140 beats per minute [Table/Fig-3].



[Table/Fig-3]: Ramstedt's Pyloromyotomy Surgery (Division of Pyloric muscle fibres).

The neuromuscular blockade was reversed with glycopyrrolate 8 mcg/kg and neostigmine 0.05 mg/kg. He had a good cry after being extubated, and then he was moved to the Paediatric Intensive Care Unit (PICU) for postoperative monitoring and fluid replacement. His postoperative electrolytes revealed Na+ concentrations of 131 mmol/L, K+ concentrations of 5.0 mmol/L, and Cl concentrations of 98 mmol/L. Appropriate electrolyte correction was carried out while maintaining input output charting.

Postoperatively, there was no complaint of pain and vital signs were steady. On the second postoperative day, the patient began consuming oral feeds. On the fifth postoperative day, he was moved out of the PICU, and on the seventh day, he was discharged from the hospital without any complications.

DISCUSSION

Infantile Hypertrophic Pyloric Stenosis (IHPS) has an uncertain specific aetiology, but it is likely influenced by both genetic and environmental factors [1,2]. The condition has been linked to a number of environmental factors, including living in a rural region, using bottles while nursing, and exposure to macrolide antibiotics [3-6]. Patients with IHPS are often first-born males, and there may be a very slight association between preterm and IHPS [7]. A infant with IHPS would typically present as a three to five week old with non bilious projectile vomiting and a healthy appetite [8]. During a physical examination, a palpable pyloric "olive like" mass in the belly may be present along with symptoms of dehydration [9]. Patients may experience substantial hypovolemia and concomitant electrolyte problems due to stomach acid loss [10].

The index patient presented with the typical non bilious projectile vomiting, hypokalemic, and hypochloremic, metabolic alkalosis symptoms with mild dehydration, which was treated with potassium replacement and 5% dextrose in 0.45% saline. Following the initial 20ml/kg 0.9% saline bolus, maintenance fluid was initiated with the aim of ensuring appropriate hydration and preventing hypernatraemia and hypoglycaemia. Barium investigations have been supplanted with ultrasound as the preferred diagnostic method for IHPS. Pyloric muscle thickness, length, and diameter are typical measurements. Patients with IHPS have values for these dimensions that are higher than usual. Since, pyloromyotomy is often not an emergency procedure, hypovolaemia and electrolyte abnormalities should be treated with intravenous treatment prior to surgery. The risk of aspiration during the anaesthetic process may be reduced by maintaining an appropriate NPO interval while providing fluid treatment [11], a complete preoperative evacuation of the stomach's contents using a nasogastric or orogastric tube to further reduce the risk of aspiration. In this case, the infant was provided some continuous i.v. fluids but did not need aggressive volume replacement. If necessary, intraoperative boluses of an isotonic fluid (10 mL/kg of hartmann's solution or saline 0.9%) can be administered to adjust the circulation volume. In the operating room, glucose-containing maintenance solutions may be continued, but they must not be used to replace bolus fluid. If intraoperative glucose-containing maintenance fluids are stopped, the blood glucose level should be monitored frequently to guarantee normoglycemia throughout the perioperative phase [12]. Similarly, Puri B et al., had treated the initial hypovolaemia with a bolus of Ringer lactate as part of the resuscitation strategy, and the shortfall was then corrected with calculated quantities of normal saline. Then, to supply maintenance fluids, 5% dextrose with a fifth strength of normal saline was employed. They had shown the preferred method is balanced general anaesthesia combined with aspiration prevention prophylaxis [13].

Sevoflurane or desflurane is used to sustain anaesthesia in a mixture of oxygen and air as seen in study by Scrimgeour GE et al., since nitrous oxide causes bowel gas to expand, it is typically avoided. When compared to desflurane, isoflurane causes more bouts of postoperative apnoea in infants undergoing pyloromyotomy and prolongs recovery durations [14].

In order to prevent cooling, it is important to keep an eye on the patient's temperature and keep the patient in a warm atmosphere. Because infants undergoing pyloromyotomy are more likely to aspirate gastric contents, a secured airway with endotracheal intubation is necessary [15]. Awake intubation, fast sequence intubation, and modified rapid sequence intubation were the three procedures that Cook-Sather SD et al., compared [16]. Awake intubation is no longer utilised since it failed to stop oxygen desaturation or bradycardia. Modified rapid sequence was used that included pre-oxygenation, i.v. induction, and a non depolarizing muscle relaxant because these babies are often low weight and cannot survive total apnoea even for 60 seconds during rapid sequence intubation. Prior to endotracheal intubation, gentle positive pressure ventilation and cricoid pressure was applied. Sevoflurane, oxygen, and air were employed for maintenance.

Infant must be fully awake, have strong protective reflexes mechanisms, and a regular breathing pattern before extubation. Regardless of the medication used, apnoea monitoring and pulse oximetry are recommended for the first 24 hours following surgery due to the increased risk of postoperative apnoea. Parenteral fluids are given to maintain adequate hydration until oral intake is sufficient [17]. Although intravenous opioids like fentanyl 1 mcg/kg can be used intraoperatively to generate adequate analgesia, opioids should be avoided due to the increased risk of respiratory depression. In index patient, analgesia was maintained utilising low dose fentanyl in conjunction with caudal anaesthesia. It was discovered that caudal analgesia was just as effective as injecting bupivacaine locally into a wound for treating postoperative pain in children undergoing surgical correction of congenital pyloric stenosis [18]. Caudal anaesthesia with 0.25% bupivacaine has also been used among children undergoing surgical correction of congenital pyloric stenosis in various studies.

Loetwiriyakul W et al., had used 1.2 mL/Kg of 0.25% bupivacaine plus 50 g/Kg of morphine to the caudal region, and concluded that this combination is adequate for intraoperative analgesia and surgical relaxation when given to children, undergoing intra-abdominal surgeries, after induction of general anaesthesia [19]. The use of caudal block in this case led to a lower fentanyl dose requirement and reduction in additional demand for other analgesics both intraoperatively and postoperatively. The patient's vital signs were stable throughout the perioperative period, and there was no postoperative pain. Patients should remain under cardiorespiratory surveillance throughout the night because of the infants' relatively recent postconceptional ages. There are particular cases of postoperative apneic episodes in IHPS patients following surgery who were previously full-term [20,21]. The exact origin of the predisposition is unknown, although it's conceivable that respiratory depression could result from metabolic alkalosis, which raises the pH of the Cerebrospinal Fluid (CSF).

CONCLUSION(S)

Pyloric stenosis is not a medical emergency, although, it can become one if an early surgical correction is performed without sufficient resuscitation. Thus, the report presents recent evidence-based medical research on the perioperative care of infants with pyloric stenosis with focus on preoperative metabolic abnormality assessment and correction, intraoperative care, including airway management maintenance anaesthetic techniques, and postoperative pain management strategies. During an infant's recovery from general anaesthesia, it is important to keep an eye out for any signs of respiratory depression and episodes of apnoea brought on by metabolic alkalosis, general anaesthesia, and reduced body

temperature. It also reflected that use of rapid sequence intravenous induction and maintenance with an inhalational agent among these infants is common and safe mode without any significant complications.

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