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ANESTHETIC MANAGEMENT OF A CASE OF CONGENITAL DIAPHRAGMATIC HERNIA

Rohit Kamal* Final year post graduate, Department of Anaesthesiology, Saveetha Medical College *Corresponding Author

Lakshmi R. Head of department, Department of Anaesthesiology, Saveetha Medical College

Prem Chandar Final year post graduate, Department of Anaesthesiology, Saveetha Medical College

ABSTRACT Congenital diaphragmatic hernia is a defect in the diaphragm which allows protrusion of abdominal contents info the thoracic cavity which affects 1 in 3600 births. The size of the breech determines the symptom exhibhited. Congenital diaphragmatic hernia, when associated with pulmonary hypertension has a higher risk of mortality. The goals of pre-operative stabilization for a case with congenital diaphragmatic hernia are: 1) To maintain hemodynamic stability 2) Minimum difference in pre /post ductal oxygen saturation. The intra-operative goals for stabilizing a case with congenital diaphragmatic hernia are: 1) Gentle ventilation with respiratory rates of 60 -80/min and low tidal volumes to thereby restricting the ETCO2 to 35-45mm Hg and keeping lower airway pressure 2) Avoid right to left shunting by increase in PVR thereby 3) avoiding a decrease in Systemic Vascular Resistance. Here we highlight the successful anesthetic management of Congenital Diaphragmatic Hernia in a 2 day old neonate who had come with difficulty in breathing after feeding since birth. Initial examination revealed peripheral cyanosis, tachycardia and tachypnea with a SpO 2 90% on room air temp of 37°C. On examination the patient had a scaphoid abdomen and auscultation showed air entry reduced bilaterally, more on left side. The chest X-ray showed herniated bowel loops with air and fluid in left hemi-thorax. After successfully reducing the contents and closing the breech, the cardio-pulmonary functions were restored.

KEYWORDS : Congenital Diaphragmatic Hernia; Pulmonary hypertension; right to left shunt;

INTRODUCTION:

CHD (Congenital diaphragmatic hernia) is a defect in the diaphragm which allows protrusion of abdominal contents info the thoracic cavity which affects 1 in 3600 births. It is associated with high mortality and it's therefore important to diagnose and treat the condition as early as possible

It is of two types: 1) Congenital- Bochdalek (70%) – Defect in the posterolateral diaphragm and Morgagni hernia (30%)- Defect in the retrosternal diaphragm (Foramen of Morgagni) 2) Acquired- following trauma

The following indicates that the neonate can be taken for surgery:
-Normal MAP for gestation
-Preductal SpO2 between 85% to 95% on FiO2 < 50%
-Lactate < 3 mmol/L
-Urine Output > 1 cc/kg/hr

Right to left shunt, pulmonary hypertension hypoxemia, hypercarbia and metabolic acidosis are to be anticipated in a case of congenital diaphragmatic hernia

Nitrous oxide should be avoided as it can further aggravate the lung compression

Meticulous monitoring of the neonate is vital for their survival.

Here we present the anaesthetic management of a 2 day old male child planned for congenital diaphragmatic hernia repair

CASE REPORT

A 2-day old male child weighing 2.25 kg was brought to the hospital following difficulty in breathing after feeding since birth. The baby was delivered at an outside hospital and cried immediately.

On physical examination, child was conscious, with peripheral cyanosis.

Pulse rate was 120/min/ Respiratory rate 70/min/ SPO $_2$ 90% on room air temp of 37°C .

On systemic examination, the patient had a scaphoid abdomen/ Respiratory system- auscultation showed air entry reduced bilaterally, more on left side. No rhonchi nor wheeze was heard

The baby was intubated with a size 3.0 cuffed endotracheal tube. A nasogastric tube was placed.

The preoperative mechanical ventilator setting: pressure control, peak inspiratory pressure of 16 mmHg, positive end-expiratory pressure of 5 mmHg, respiratory rate of 40 times/min, inspiration: expiration ratio of 1:2, and inspired oxygen fraction of 30%.

ABG showed pH: 7.194, partial pressure of oxygen(PaO_2)–72.5 mm Hg and partial pressure of carbon dioxide($PaCO_2$) -60.7mm Hg.

Chest X-ray findings: Herniated bowel loops with air and fluid in left hemi-thorax. Mediastinal structures were shifted to left and there was no liver herniation.

A diagnosis of Left congenital diaphragmatic hernia was made and it was confirmed with X-ray Gastrografin.

Echocardiography showed severe pulmonary hypertension of 64mm Hg, PFO/ ASD with a left to right shunt, Grade II LV diastolic dysfunction, dilated left atrium, and moderate to severe tricuspid regurgitation with an ejection fraction of 55%.

The baby was shifted to neonatal intensive care unit (NICU) for ventilator support.

Baby was started on support of Inj. Noradrenaline @0.3mcg/kh/min, Inj. Milrinone @0.7mcg/kg/min and inj. Adrenaline @0.5mcg/kg/min, along with maintanance fluid. Baby was planned for surgery and a written and informed consent was obtained from the parents.

ANAESTHETIC MANAGEMENT:

Monitoring- Routine monitors were connected which included a pulse oximeter (SpO $_2$), electrocardiogram (ECG), and end tidal carbon dioxide ($EtCO_2$).

The stomach was decompressed by the gastric tube suctioning. Injection (Inj.) Fentanyl 5 µg intravenously (IV) was given for analgesia.

Induction was done with oxygen, air and Sevoflurane. Baby was ventilated with a pediatric bains circuit.

Intraoperatively- Pulse rate was maintained around 120/min, SpO_2 was 99%(pre-ductal) and 8%(post-ductal). ECG was within normal limits. Bowel loops in left hemithorax were identified and reduced. The defect in left hemidiaphragm was closed. The surgery time was 3hrs. Intra-operative fluid provided was Ringer lactate according to Holliday Segar's formula. The intra-operative blood loss was 20ml and urine output was 10ml

Post-op- Following surgical correction, the baby was shifted to NICU.

Postsurgical chest X-ray showed both the lungs to be well-expanded. The baby was kept on ventilator support for a week to allow adequate ventilation during the post-operative period. The baby was extubated on the 5 th postoperative day and discharged.

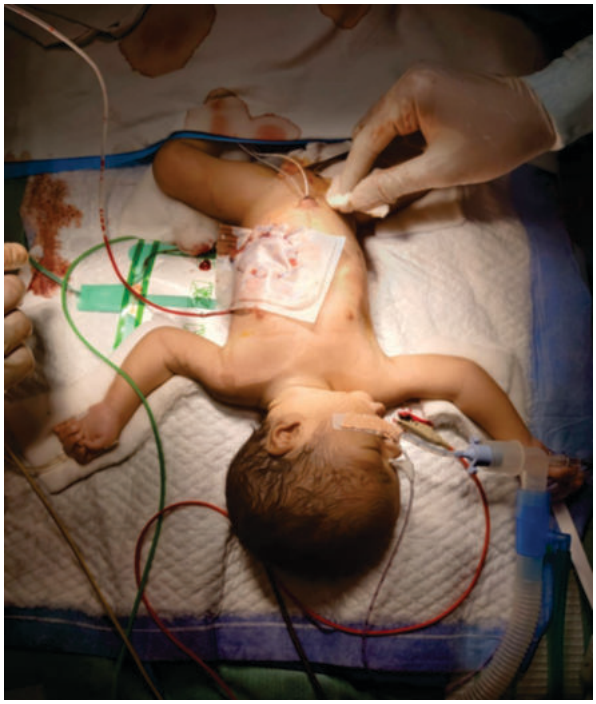

Figure1.

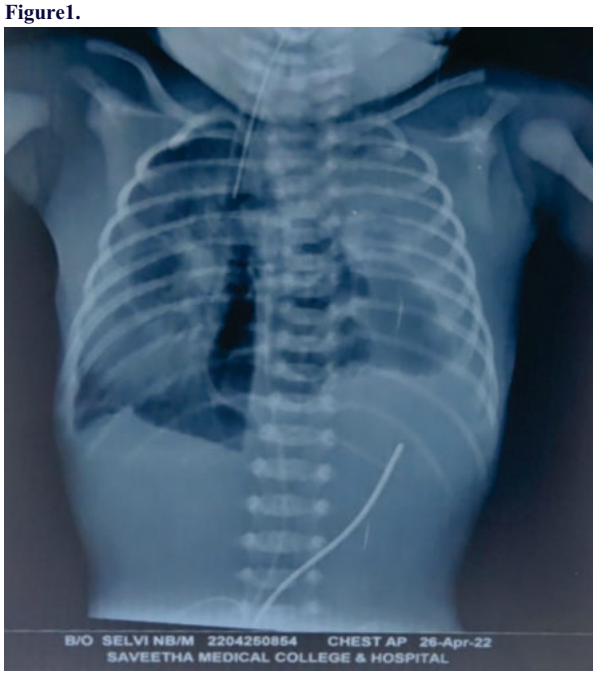

Figure2.

DISCUSSION:

CDH is often considered a challenge for the surgeons, anaesthetists and the pediatrician alike.

Due to the condition being often misdiagnosed for pleural effusion, pneumonia and pneumothorax, it is often not suspected. Patients with congenital diaphragmatic hernia can present with a wide variety of symptoms. In acute cases, children can present with respiratory distress or with severe symptoms of bowel strangulation.

Our patient presented with difficulty in breathing with a fall in saturation which had to be dealt with immediately by mechanically ventilating the neonate

They can also present with gastrointestinal and respiratory symptoms such as recurrent respiratory infections, wheezing, poor growth, intermittent abdominal pain, vomiting, progressive dyspnea, and retrosternal chest pain in chronic cases.

CDH, when associated with pulmonary hypertension has a higher risk of mortality. In view of pulmonary hypertension and LV diastolic dysfunction, patient was started on vasodilator Milrinone @0.7mcg/kg/min which reduces L->R shunting and increases LV filling. Inhalational NO is preferred for those patients with a functioning LV.

Complications in this case includes distress associated with hypoxemia, metabolic acidosis pulmonary hypoplasia, pulmonary hypertension, and right-to-left shunting which has to be diagnosed and treated as early as possible

Post-operative care in the NICU with the patient under mechanical ventilation should be continued and weaned.

For analgesia, opoioids and acetaminophens may be given based on the weight.

CONCLUSION

Despite the advances in ventilation and surgical approaches, congenital diaphragmatic hernia is still considered challenging due to the high mortality rate and uncertainty of the outcome.

The outcome is decided by early antenatal diagnosis, avoiding high airway pressures during ventilation and hemodynamic stability

In neonates with CDH, gentle ventilation, permissive hypercarbia ($PaCO_2$ of 45-55 mmHg and pH of 7-7.3) and meticulous monitoring are the key to successful anaesthetic management

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