Case Report

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Successful management of neonatal tracheoesophageal fistula with epidural and general anaesthesia

Abstract

Surgical repair of trachea-esophageal fistula (TEF) is one of the major neonatal emergencies that poses many challenges to the treating neonatologist, intensivist, paediatric anaesthesiologist and the surgeon. Mostly these babies are premature having physiological immaturity of various organ systems and in association they may be having lung pathologies or other major congenital defects like VATER/VACTERL anomalies. Smooth induction /maintenance, adequate intra/post operative analgesia and uneventful post-operative recovery are the major objectives to be achieved with the anaesthetic plan. The use of regional anaesthesia (RA) has found to be very safe and effective when combined with general anaesthesia (GA). We report a case of one day old baby for surgical repair of TEF (type IIIB) that was managed successfully with GA along with caudal epidural analgesia. The baby was induced and intubated under O2 +sevoflurane anesthesia and maintained with muscle relaxant atracurium. Epidural catheter was passed upto T4 through caudal route to facilitate intra and post operative analgesia with ropivacaine. There was excellent hemodynamic stability, satisfactory perioperative pain relief and uneventful recovery.

Keywords: tracheoesophageal fistula (TEF), general anaesthesia, caudal epidural, ropivacaine, postoperative analgesia

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Kalpana Kulkarni,[1] Shweta KM,[2] Smith Kadakia,[3] Suyash Prasad[3]

[1]Professor, Department of Anaesthesiology, D Y Patil Medical College & Hospital, India

[2]Assistant Professor, Department of Anaesthesiology, D Y Patil Medical College & Hospital, India

[3]Senior Resident, Department of Anaesthesiology, D Y Patil Medical College & Hospital, India

Correspondence: Kalpana Kulkarni, Professor (Department of Anaesthesiology), D Y Patil Medical College & Hospital, Chaitanya, A-5, Syke□s Extension, Takala Square, Kolhapur, 416008, Maharashtra, India, Tel 9822065665, Email drrmk@rediffmail.com

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Abbreviations: TEF, tracheoesophageal fistula; VATER/VACTERL, vertebral defects anal atresia, cardiac defects tracheo-esophageal fistula renal malformations and limb defects; NG, nasogastric tube; GA, general anaesthesia; RA, regional anaesthesia; EA, epidural anaesthesia; ECG, electrocardiogram; ECHO, echocardiography; Inj., injection; PCV, packed cell volume; ET tube, endotracheal tube; ABG, arterial blood gas analysis

Introduction

Incidence of TEF is 1:3000 to 4500 of live births which is a congenital anomaly of esophagus & trachea that manifests within first few hours to days of life. The commonest defect is esophageal atresia with distal TEF (type C/IIIB as described by Gross &Vogt). It is considered a surgically correctable anomaly of the gastrointestinal and respiratory system and continues to be a major challenge in neonatal surgery. However with surgical repair, the rate of survival exceeds 90%, even in infants with a low birth weight. The perioperative factors of major concern to the anaesthesiologist are prematurity < 2kg weight, difficult airway of neonate, associated respiratory distress because of repeated aspirations or lung pathologies, congenital heart diseases (CHD) and large defects.[1,2] Preoperative evaluation with X ray chest after passing nasogastric tube (NG), ECG, ECHO, CT Scan, abdominal and lumbar ultrasound for vertebral anomaly, rigid bronchoscopy for evaluation of the anatomy of airway are considered necessary for anesthetic and post operative intensive care planning.[1] Preoperative corrective measures for low birth weight, anemia, medical optimization of aspiration pneumonia or congestive cardiac failure is necessary, thus management of the TEF needs multidisciplinary approach involving neonatologist, intensivist, paediatric surgeon as well as anesthesiologist for successful surgical outcome.[1,2] We report a case of TEF in a one day old baby, for surgical repair managed with general anaesthesia combined with caudal epidural analgesia.

Case presentation

An 1 day old neonate of 36 week gestational age and 2700 gm weight was delivered at DY Patil Hospital, Kolhapur. After birth, baby had excessive frothing with respiratory distress so he was admitted to NICU with the clinical findings of heart rate 146/min, RR 50/min with intercostal / subcostal in drawing and SpO2 on air was 99%. Patient was managed with oxygen, nebulization, antibiotics. X-ray chest and abdomen showed rolling up of nasogastric tube (NGT) in upper part of esophagus and large gas shadow of stomach (Figure 1). The ECG and ECHO were normal. Routine blood investigations and ABG were within normal limits. Patient was diagnosed as a case of tracheoesophageal fistula type IIIB. High risk consent taken after the parents were informed about the risk involved and about the need of postoperative intensive care. PCV was arranged.

Preoperatively baby was kept in upright position and managed with NG tube for aspiration of excessive secretions two hourly and vital monitoring. After stabilization and preoperative evaluation patient was accepted for surgical repair of TEF under ASA-III risk consent. GA along with caudal epidural catheterization was planned for surgery. Preoperatively adequate hydration achieved with ringer's lactate solution as 100 ml/kg/24 hours.

Patient was transferred to the operating room with oxygen hood (5-6 lit/min). In the operating room, after securing an intravenous line with 24G cannula, monitors were attached for SpO2, ECG, temperature, heart rate and urine output. Precordial stethoscope was fixed in place. Care to prevent hypothermia was taken by wrapping the baby with cotton rolls and silver foils. Preoperatively NG aspiration was done with 5ml syringe. Baby was premedicated with Inj. glycopyrrolate 0.004 mg/kg, midazolam 0.01 mg/kg, ondensetron 0.05 mg/kg, hydrocortisone 5 mg/kg and dexamethasone 0.5 mg/kg. Preoxygenated with 100% oxygen for 5min. Baby was induced with

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inj. ketamine 2 mg/kg IV along with sevoflurane 1.5-2% in oxygen on spontaneous ventilation till loss of corneal reflex and immobility achieved. Following topical anaesthesia laryngoscopy done using No.0 Miller blade and baby intubated with Portex™ uncuffed ET tube of size 3.0mm ID so that distal tip was located below the level of TEF but above the carina and taped after confirming bilateral air entry. Patient was maintained on sevoflurane 0.4-1% in 100% oxygen and muscle relaxant atracurium 0.5mg/kg, gentle controlled ventilation with Jackson-Rees pediatric circuit.

Figure 1 Preoperative X-ray chest of baby.

Figure 2 Anesthetized baby in lateral position with epidural catheter in situ.

He was placed in lateral position and bilateral air entry reconfirmed (Figure 2). Under aseptic precautions, 18 G epidural catheter with bacterial filter was placed in the caudal space and advanced upto15cm to reach T4 level as measured from the caudal space and then fixed. Inj. ropivacaine 0.2% in the dose of 0.5 mg/kg was given epidurally, followed by top ups one hourly introperatively. Surgery was performed through right thoracotomy in 4th intercostals space. The TEF was exposed, ligated and end to end anastomosis of the esophagus was done after mobilization. Surgery lasted for two hours. Intraoperatively, 70 ml of ringer lactate /hour was infused. Heart rate was maintained between 100-120/min. SpO2, ECG and urine output were continuously monitored. Blood loss was approximately 35ml (15%) replaced with ringer's lactate solution in the ratio of 1:3 over 2hrs. Intercostal chest drain was placed and column movement was seen.

Postoperatively, patient was extubated after assessing the signs of full recovery. Paracetamol 40mg suppository was inserted per rectally and the patient was shifted to NICU for postoperative management. The baby was comfortable with stable vitals. Epidural analgesia with Inj. ropivacaine 0.2% 0.5 mg/kg, was repeated in boluses 6 hourly over 48 hours and then epidural catheter was removed (Figure 3). ABG on third postoperative day was normal. On tenth postoperative day barium swallow study was done and it was normal, no leak observed on X-ray chest and abdomen (Figure 4). The baby was discharged on 11th postoperative day when breast feeding was resumed. On telephonic follow-up he was well until 3months after surgery and also reported good weight gain of 500grams.

Figure 3 Postoperaive baby in NICU receiving epidural top up.

Figure 4 Postoperative X-ray Chest with normal chest findings after barium swallow study.

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Discussion

Tracheoesophageal fistula may be associated with some abnormal gene derived syndromes like Feingold syndrome (N-MYC), anopthalmia oesophageal genital (AEG) syndrome (SOX2) and other anomalies like VATER or VACTERL with frequent cardiac and anorectal defects.[3] The anatomical classification describes 5 types –I, II, IIIA, IIIB, IIIC depending upon the oesophageal and tracheal defects but the most common is type III i.e. oesophageal atresia with distal TEF. Our patient a premature baby presented with excessive salivation and tachypnoea immediately after birth. Diagnosed as type IIIB on X-ray chest showing curled nasogastric tube in upper part of esophagus in the neck region and large gas shadow of the stomach. Inhalational Induction with sevoflurane in oxygen and intubation under spontaneous ventilation, also epidural catheter placement through caudal route for perioperative analgesia was planned. Usually postoperative ventlilatory support is required after TEF surgery but probably due to good lung conditions and with epidural analgesia satisfactory recovery was observed and baby could be extubated on table. Proper antibiotics were given, intermittent NG aspiration, oxygen support with mask for 24 hours and postoperative epidural analgesia provided for 48hours.The feeds started through NG tube on 2nd day. Early recognition, prompt and efficient management of the case was possible due to multidisciplinary approach by neonatologist, intensivist and the surgeon. Similar to our case Markandeya et al.[4] also observed excellent hemodynamic stability and intra and postoperative analgesia through caudal route for TEF repair under GA.[4] Use of combination of GA with epidural analgesia is well reported and found improved survival rates.[1,5] The major concern with GA is placing the distal end of ET tube beyond the fistula but above the carina and avoid gastric distension. If the fistula is large, gastric distension with ventilation can result in respiratory compromise. Different strategies are recommended like use of spontaneous ventilation until ligation of fistula or controlled small tidal ventilation, use of fibreoptic scope for correct placement of ET tube, Fogarty catheter or balloon tipped embolectomy catheter to block the fistula under guidance. Yang Ni et al..[6] described a simple strategy of use of bulldog clamp on lower end of esophagus immediately after thoracotomy exposure to prevent gastric distension in a neonate having large fistula. No hemodynamic alterations observed until definitive repair of the TEF.[6]

In a retrospective review of airway and surgical management in 61 cases of TEF where induction of GA using muscle relaxant was done. Rigid bronchoscopy was performed in all cases for proper placement of tube below the fistula and occlusion of fistula with Fogarty catheter was required in some high risk neonates. No patients of small TEF had ventilation difficulties however 8/13 with large TEF had ventilation problem but with occlusion using Fogarty catheter was successful in 3 patients.[7] Broemling N et al.[1] in a review observed success rate in various studies by Waterson et al. (1962), Spitz et al. (1994), Okamota 2009 and found >95% survival in babies weighing >2Kg, 59-72% if associated with cyanotic heart diseases or major CHD and 68% when associated with lobar pneumonias, ASD/PDA or other congenital limb anomalies or cleft palate. Babies with severe pneumonias or severe congenital cardiac anomalies when weight is <1.5Kg had survival rates of 6%.[1] Millano L et al.[8] studied different predictors of mortality in a series of 31 cases of TEF and observed high mortality in 26(31) cases due to sepsis in 20(26), low platelet count in 19 (20), low albumin levels in 11(11). None of the neonates with hypoalbuminemia survived, whereas 5 neonates with normal serum albumin >2.6g/dl survived. Babies with anaemia hemoglobin <13g/dl have found better survival 5(11) than with normal hemoglobin. 5(31) patients had congenital anomalies like anorectal malformations, VACTERL and PDA.[8] Thus TEF needs emergency surgical correction in neonatal period and anesthesiologist faces cardiorespiratory challenges in the perioperative period due to altered pathophysiology and other comorbidities.[9]

Conclusion

Goals in the anesthetic management of TEF are many like consideration of poor organ development/ prematurity, difficult airway, negotiation of endotracheal tube beyond the fistula, cardiorespiratory compromise, maintenance of oxygen saturation with adequate depth of anaesthesia, perioperative analgesia and postoperative intensive care. Multidisciplinary approach, understanding of altered anatomical and physiological changes associated with TEF, skillful use of combination of general and epidural anesthesia can minimize the risks/complications and improves the surgical outcome.

Conflicts of interest

There is no conflict of interest.

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