

Repair of late-presenting right Bochdalek hernia in a patient with uncorrected tetralogy of Fallot: Anaesthetic management

Sir,

Anaesthesia for patients with isolated tetralogy of Fallot (TOF) or late presenting congenital diaphragmatic hernia (Lp-CDH) can be challenging.^[1-3] No publications on anaesthetic care of patients with concurrent TOF and Lp-CDH were found on thorough literature search.

During pre-anaesthetic evaluation, the patient, a male baby (1-year-old, weighing 7 kg) with TOF was conscious, but irritable and crying, with a regular pulse rate of 150/min, blood pressure (BP) of 90/50 mmHg and peripheral oxygen saturation (SpO₂) of 70% on room air. Results of investigations carried out in the pre-operative as well as intra-operative period are shown in Table 1.

On the morning of surgery, prophylaxis against infective endocarditis and scheduled dose of oral propranolol were administered. Premedication was achieved with ketamine 5 mg, glycopyrrolate 70 µg and midazolam 1 mg through the pre-existing 24 G peripheral intravenous (IV) catheter. Mask ventilation and subsequent tracheal intubation were

carried out 3 min after administration of ketamine 15 mg, fentanyl 15 µg and vecuronium 1.0 mg IV. End tidal CO₂ (ETCO₂) was maintained in the range of 27–40 mmHg (tidal volume 60 ml, respiratory rate 22–26/min) with peak airway pressure of 20–24 hPa. A few minutes into the tracheal intubation, his heart rate (HR) increased to 170/min and SpO₂ rapidly decreased to 63% and invasive BP (measured at right radial artery) was 100/56 mmHg. At this point of time, ETCO₂ was 40 mmHg with normal waveform and auscultation of bilateral lung fields suggested equal ventilation. Isoflurane concentration was increased with not much improvement but subsequent esmolol 3.5 mg IV bolus administration improved SpO₂ to 90% and HR settled at 148/min. Anaesthesia was supplemented further with another bolus of fentanyl and regular top up of vecuronium; a nasogastric tube was inserted nasally. Another intra-operative episode of low SpO₂ and ETCO₂ with tachycardia and normotension did not respond to supplemental dose of fentanyl 15 µg IV. It subsequently responded to RL 70 ml and esmolol 3.5 mg IV bolus administration. The right-sided Bochdalek hernia was repaired through a right subcostal incision and ropivacaine 0.2% (10 ml) was infiltrated in the subcutaneous tissue of the incision site. He was extubated tracheally at the end of surgery. The results of arterial blood gas analysis at different points of time are shown in Table 1. Immediate post-operative period was complicated by another episode of desaturation with tachycardia and normotension that responded to esmolol 3.5 mg

Table 1: Result of laboratory and imaging studies of the patient

Preoperative blood investigation			Preoperative imaging studies
Parameter	November 2014	February 2015	
Hb	15.1 gm/dL	15.2 gm/dL	Computed tomography of abdomen and thorax Pulmonary infundibular/RVOT narrowing with confluent good sized branch pulmonary arteries (Mc Goon's ratio 2.1) Ventricular septal defect Right aortic arch with mirror image branching pattern Tiny mediastinal aortopulmonary collaterals Non visualization of posterior right hemi diaphragm with herniation of large bowel, small bowel, mesentery and right kidney extending superiorly. Mediastinum shifted to left. Features suggestive of diaphragmatic hernia-Bochdalek type Echocardiography Levocardia Tetralogy of Fallot Confluent Branch Pulmonary Arteries (Narrow Left Pulmonary artery origin) Right Aortic Arch Good Biventricular Function Electrocardiography (November, 2014) Normal findings for age Barium follow through examination of stomach and small intestine up to appendix Features suggestive of right sided eventration of diaphragm
TLC	-	15.17x10 ³ /μL	
Platelet	-	114x10 ³ /μL	
RBS	-	80 mg/dL	
Serum creat	0.3 mg/dL	0.25 mg/dL	
Serum			
Na ⁺	131 mEq/L	144 mEq/L	
K ⁺	4.5 mEq/L	5.2 mEq/L	
Cl ⁻	97 mEq/L	-	
HCO ₃ ⁻	19.2 mEq/L	-	
TSH	3.95 μ IU/mL	-	
T Protein	7.0 gm/dL	-	
SGOT	46 IU/L	-	
SGPT	35 IU/L	-	
ALP	346 IU/L	-	
GGT	19 IU/L	-	
PT (control)	14.7 sec (15)	12.3 sec (13)	
INR	0.98	0.92	
APTT(normal)	-	30.3 sec (28-44)	
Perioperative arterial blood gas analysis			
Parameter	10 min after induction of anaesthesia		5 min after tracheal extubation
pH	7.28		7.29
PCO ₂	32 mmHg (ETCO ₂ 36 mmHg)		34 mmHg (spontaneous respiration)
PO ₂	66 mmHg (FiO ₂ 0.66)		54 mmHg (3 L/min O ₂ via face mask)
BE	-10.7 mmol/L		-9.5 mmol/L
tCO ₂	15.8 mmol/L		17.1 mmol/L
HCO ₃ ⁻	14.8 mmol/L		16.0 mmol/L
BE _{ecf}	-11.9 mmol/L		-10.5 mmol/L
Na ⁺	137 mmol/L		138 mmol/L
K ⁺	2.3 mmol/L		3.0 mmol/L
nCa ²⁺	0.6 mmol/L		0.73 mmol/L
t Hb	12.1 gm/dL		13.2 gm/dL
SO ₂	89%		84%
Hct	36%		40%

ALP – Alkaline Phosphatase; BE – Base excess; BE_{ecf} – Base excess in extracellular fluid; FiO₂ – Fraction of inspired oxygen (O₂); GGT – Gamma Glutamyl Transpeptidase; Hb – Haemoglobin; Hct – Haematocrit; Ca²⁺ – Ionized calcium; pO₂ – Partial pressure of O₂ in arterial blood; pCO₂ – Partial pressure of carbon-di-oxide (CO₂) in arterial blood; RVOT – Right Ventricular Outflow Tract; tCO₂ – total CO₂; tHb – Total Haemoglobin; TLC – Total Leukocyte Count; SO₂ – Oxygen saturation of haemoglobin

and RL 60 ml IV administration. He was discharged in stable condition on the ninth post-operative day, no significant improvement of SpO₂ was noted.

Peri-operative haemodynamic goals (e.g., maintenance of normovolaemia, avoidance of decrease in systemic vascular resistance and increase in pulmonary vascular resistance) and management of hypercyanotic spell in patients with TOF has been well described.^[1-3] The first and the last hypercyanotic spell in this case was presumed to be because of increased sympathomimetic activity arising from tracheal intubation and extubation, respectively, leading to right ventricular tract (RVOT) obstruction. As sudden decrease of ETCO₂ may be seen in both RVOT obstruction and myocardial depression,

we did not increase the concentration of isoflurane during the second hypercyanotic spell. Instead, we administered fluid bolus and supplementary dose of fentanyl. In all the instances, esmolol was used due to persistent tachycardia.

Although pre-operative aspiration of stomach contents in patients with Lp-CDH has been recommended, it was not used and we proceeded with gentle mask ventilation, as stomach was intra-abdominal [Figure 1a].^[4] Moreover, there was a high chance of precipitating a hypercyanotic spell during its insertion. Use of double lumen endotracheal tube has been suggested, but we proceeded with single lumen endotracheal tube as pre-operative chest

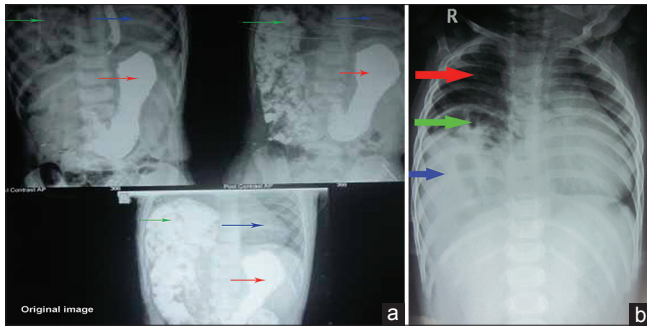


Figure 1: (a) Barium upper gastrointestinal tract radiography (1) Stomach at normal intra-abdominal position (red thin arrow), (2) Few segments of small bowel loops are seen in the right hemithorax (green thin arrow), (3) Cardiac shadow (blue thin arrow). (b) Chest X-ray shows: (1) Well aerated right lung (red thick arrow), (2) There is evidence of bowel loops in the right hemithorax (green thick arrow), (3) Homogenous opacities are also noted in the right lower thorax (blue thick arrow), (4) No demonstrable air containing loops noted in the visualised part of the abdomen

X-ray [Figure 1b] showed a comparatively well aerated right lung.^[5]

We hope that description of this unusual clinical situation and our management strategies will help to identify key clinical management issues and serve to compare outcome in patients who may suffer from similar comorbidities.

Acknowledgements

The authors would like to acknowledge the help of Dr. Manoj Saha, Assistant Professor, Department of Paediatric Surgery; Dr. Mridupaban Nath, Assistant Professor, Department of Anaesthesiology and Critical Care; Dr. Manoj Hazarika, Assistant Professor, Department of Radiology of Gauhati Medical College and Hospital, Guwahati, Assam, India, during peri-operative management of this patient.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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Access this article online	
Quick response code	Website: www.ijaweb.org
	DOI: 10.4103/0019-5049.170041

How to cite this article: Saikia P, Talukdar FA, Phukan B, Chakraborty K. Repair of late-presenting right Bochdalek hernia in a patient with uncorrected tetralogy of Fallot: Anaesthetic management. *Indian J Anaesth* 2015;59:756-8.