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Case Report

Iatrogenic pneumothorax in pediatric practice: a preventable complication

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ABSTRACT

Iatrogenic pneumothorax is an uncommon but potentially life- threatening complication in paediatric practice. Children are particularly vulnerable due to anatomical and physiological differences We report two cases of iatrogenic tension pneumothorax in children following airway and neurosurgical procedures. A one year 2-month-old male child was admitted with complaints of prolonged fever was diagnosed with third ventricle space occupying lesion causing obstructive hydrocephalus. Following craniotomy, he developed sudden desaturations and subcutaneous emphysema. Bilateral tension pneumothorax was confirmed and managed with bilateral intercostal drain (ICD) insertion. A term 37 week born with birth weight 1.7 kilograms small for gestation baby with congenital stridor and respiratory distress a diagnostic laryngoscopy was done. Intraoperative during tracheostomy the baby developed desaturations and tachycardia. Immediate ICD insertion resulted in stabilization. Children are particularly susceptible to pneumothorax because of its smaller airway anatomy, thin pleura, immature fragile lungs, complaint chest wall, higher exposure to positive pressure ventilation. Early recognition and preventive strategies are critical to reducing morbidity and mortality.

Keywords: Iatrogenic pneumothorax, Paediatrics, Tracheostomy, Tension pneumothorax, Mechanical ventilation

INTRODUCTION

Pneumothorax is defined as the presence of air in the pleural cavity. Pneumothorax can be spontaneous, iatrogenic, and traumatic. Although it is less common than adults, it is seen in about 1.1–4 per 100,000 per year in the childhood age group.[1]

Chest radiography remains the conventional diagnostic modality and may be supplemented by bedside transthoracic ultrasonography.[2] Management can be either conservative or interventional depending on the patient's clinical stability and the size of the pneumothorax (a volume higher than 20% of pleural space indicates the need for pleural drainage.[3]

Tension pneumothorax represents a medical emergency requiring immediate decompression.

CASE REPORTS

Case 1

A 1-year-old male came with history of fever for 1 month (highest recorded was 102 ^{0}C) and vomiting for 25 days. A provisional diagnosis of pyrexia of unknown origin was made. Lumbar puncture was planned to rule out meningitis revealed (glucose-56, total protein-130, albumin-8, ADA-14, TC-30 cells with 85% lymphocytes and 10% neutrophils.

In view of drowsiness contrast enhanced magnetic resonance imaging (CEMRI) of brain was performed and demonstrated a third ventricular space occupying lesion associated with obstructive hydrocephalus likely neoplastic in origin. An anterior third parasagittal craniotomy was undertaken Frozen section confirmed neoplastic etiology.

Post-operatively, the child transferred intubated to paediatric intensive care unit (PICU) with 4 mm (inner diameter) oral endotracheal tube (OETT) uncuffed connected to Jackson-Rees circuit. During transfer the child developed sudden desaturation, subcutaneous emphysema, peripheries coldness. Pneumothorax was suspected and immediate chest X-ray bilateral pneumothorax.

Bilateral intercostal drains were inserted, with radiological confirmation of correct positioning. Oxygen saturations and haemodynamic parameters improved subsequently. However, the child developed refractory hypotension and hypoglycaemia and succumbed after two days post operatively (Figure 1).

Figure 1: Chest radiograph showing right sided pneumothorax. Anteroposterior chest radiograph demonstrating right sided pneumothorax (arrow), right intercostal drain and right sided bronchopneumonia with tracheostomy tube.

Case 2

A term 37 weeks' baby born to a primigravida through emergency lower segment caesarean section for failed induction and intrauterine growth restriction had a birth weight of 1.7 kilograms (small for gestation). The baby presented with congenital stridor came and respiratory distress

Due to severe subcostal suprasternal retractions and blood gas showing respiratory acidosis PH-7.2, CO_2-72 upgraded to non-invasive-synchronous intermittent mandatory ventilation (NIV-SIMV). Owing to persistent respiratory distress and carbon dioxide retention, the infant was intubated with 3.0 mm uncuffed endotracheal tube fixed at 8 cm (Figure 2).

The baby was shifted to operation theatre for diagnostic laryngoscopy. Accidental extubation happened during video laryngoscopy, resulting in desaturations and bradycardia. Injection atropine was given and reintubated with 3.5 mm uncuffed endotracheal tube fixed at 8 cm. Surgical tracheostomy was planned with 3.5 mm uncuffed tracheostomy tube (TT) under sevoflurane anaesthesia. Intraoperative baby developed bradycardia, desaturations and cyanosis so right sided pneumothorax was suspected.

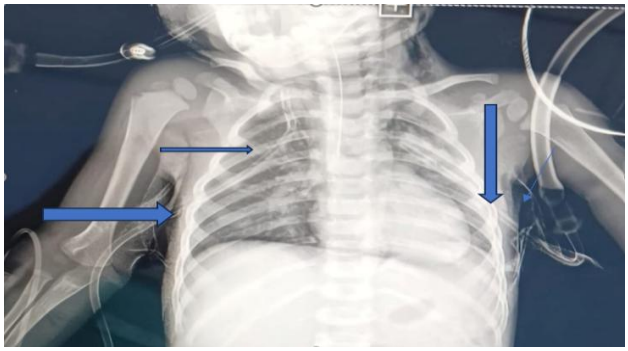

Figure 2: Anteroposterior chest radiograph demonstrating bilateral pneumothorax, intercostal drainage tube in situ with partial lung re-expansion.

Lung ultrasonography showed no sliding sign on the right side, absent respiratory movement were noted on C-arm imaging. An intercostal drain was immediately inserted and saturations improved to 96%. The infant was transferred to the patient neonatal intensive care unit and drain was removed after two days.

Table 1: Preventive measures to avoid tension pneumothorax during surgical tracheostomy.

S. no.	Preventive measures
1	Avoid high PEEP and high peak inspiratory pressure
2	Avoid forceful bag -mask if tube placement is uncertain
3	Limit oxygen flow rates, particularly in neonates and small children
4	Use fibreoptic bronchoscopy guidance to prevent false passage

Table 2: Early detection protocol.

S. no.	Preventive measures
1	Sudden desaturations
2	Increased airway pressures
3	Asymmetric chest movement
4	Subcutaneous emphysema
5	Unequal air entry
6	$ETCO_2$ confirmation
7	Perform immediate chest X-ray post procedure

Table 3: Paediatric-specific risk factors.

Factors	Effect
High pleural dome	Easier pleural injury
Soft tissues	Air tracking leading to pneumothorax
Small trachea	Misplacement risk
Complaint chest wall	Rapid pressure transmission
High ventilation pressures	Barotrauma risk

DISCUSSION

Tracheostomy in children is associated with potential complications, including pneumothorax. Pneumothorax most commonly occurs due to air leakage into the pleural space that cannot exit during exhalation, resulting in progressive lung collapse and in severe cases tension physiology.[4]

Invasive mechanical ventilation is one of the most significant risk factors for pneumothorax in paediatric population. High peak inspiratory pressure (PIP) and positive-end expiratory pressure increases the risk of barotrauma.[5] Maintaining lower inspiratory pressure is essential to minimise the risk.

Fibreoptic bronchoscopic guidance during tracheostomy is recommended to prevent creation of a false passage and tracheal wall injury.[6,7] identify the site and severity of the injury. Small tracheal injury can be managed conservatively, however tears greater than 1 cm generally requires surgical repair.

Lung protection ventilation strategies are increasingly adopted in paediatric practice. These include: low tidal volume (6-8 ml/kg), individual PEEP settings, avoidance of excessive FiO_2, and recruitment manoeuvres when indicated.[8,9]

Bedside lung ultrasonography is a valuable tool for diagnosis and assessment of pneumothorax in children.

In cases of tension pneumothorax, as observed in both patients' abrupt deterioration and impending cardiovascular collapse necessitate immediate needle decompensation followed by definitive chest drainage.

In our cases, mechanical ventilation and air trapping likely contributed to the development of tension pneumothorax, leading to lung hypoventilation and subcutaneous emphysema.

CONCLUSION

These cases emphasise the importance of ensuring that air escape is available to avoid air trapping during airway procedures in children. Awareness of the risk of tension pneumothorax, strict adherence to lung-protective strategies, and immediate availability for urgent thoracostomy are essential in paediatric practice.

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