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Case Report

Management of Respiratory Complications after Maxillofacial Surgery on Board Ship

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SUMMARY: An eight year old girl who probably inhaled gastric contents during surgery for cleft palate repair was ventilated for 10 days in the post-operative recovery area on board the Mercy Ship Anastasis with pulse oximetry as the only monitor of oxygenation. She walked off the ship on the seventeenth day.

Case Report

A previously fit eight year old Ghanaian girl was scheduled for elective pharyngoplasty, palatoplasty and cleft lip repair (Fig 1). Her pre-operative haemoglobin

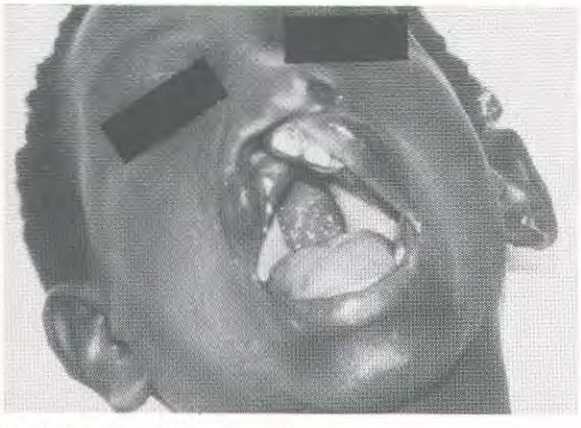

Fig 1. Pre-operative photograph.

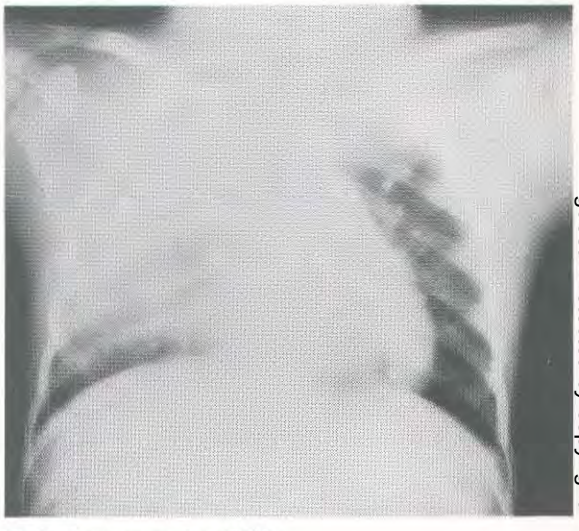

Fig 2. Post-operative CXR.

was 10.4 g/dl, white cell count 8.7 x 10^9/1, and platelets 329 x 10^9/1. Serology was negative for human immunodeficiency virus (HIV), rapid plasma reagin (RPR), sickledex and malaria.

After premedication with oral diazepam 2mg 90 mins pre-operatively inhalation induction was performed using halothane and nitrous oxide in oxygen. She was then intubated with a 6.0mm RAE orotracheal uncuffed tube; an appropriate leak was obtained but the tube was too long when the surgeon's gag was positioned, so it was shortened by cutting about 1.5cms off the distal end and reinserted.

During two hours of surgery, anaesthesia was maintained by spontaneous respiration of halothane 1-2% in oxygen supplemented by intermittent intravenous bolus doses of pethidine, but the oxygen saturation (Sa02) gradually began to decrease; breath sounds were heard on auscultation during assisted ventilation, suggesting the tube was correctly positioned, but an increased gas flow from that normally used of one litre per minute, via an Ohio circle system, to keep the reservoir bag suitably distended should perhaps have alerted the anaesthetist to the possibility of a wrongly placed tube. At the end of the operation the Sa02 was only 83% on 100% oxygen and after removal of the blood stained throat pack the tracheal tube was found to be out of the larynx, spontaneous ventilation was not satisfactory and a chest X-ray (Fig 2) showed diffuse shadowing throughout most of the right lung and similar shadowing in the left upper zone. The appearance was in keeping with an aspiration pneumonitis as there was no evidence of volume loss or mediastinal shift and the upper lobes were more affected which is consistent with aspiration in the supine position.

Ghana has no facilities for long term ventilation, so the patient was managed in the post-operative recovery area on the ship; she was connected to a Bains type breathing system, the proximal end of which was attached to the fresh gas outlet of an anaesthetic machine from which changes in the inspired oxygen concentration could be obtained by appropriate alterations to the oxygen flow rate. Ventilation was achieved using room air as the driving gas by attaching an old electrically

driven Bennett to the expiratory limb of the Bains system via the reservoir bag connection. The expiratory tubing from the ventilator was placed in a flask of water to generate positive end expiratory pressure (PEEP) the magnitude of which could be altered by varying the length of tubing positioned vertically below the water level. The initial introduction of 5-6 cms of PEEP increased the Sa02 dramatically from 82% to 92%. Sa02, blood pressure, ECG, urine output and nasogastric aspirate were continuously monitored, but there was no facility on board to measure blood gases, inspired oxygen concentration or end tidal carbon dioxide. Sedation when required was with intravenous bolus doses of midazolam fentanyl and vecuronium. Antacid chemoprophylaxis was initially with intravenous ranitidine and subsequently with sucralfate via a nasogastric tube.

The following day her white cell count rose to 26.4 x 10^9/1 and gram negative cocci and rods were seen on sputum microscopy. She was started on intravenous ceftizoxime. Her airway pressure was now 40cms of water. By day 4 her haemoglobin and platelets had decreased to 8.0 g/dl and 81.0 x 10^9/1 respectively and the white cell count to 12.0 x 10^9/1.

For ease of management, particularly to facilitate suction and weaning, a tracheostomy was performed on day 5 and an appropriate sized Portex uncuffed tube inserted. Her condition gradually began to improve and weaning off the ventilator commenced on day 6. By day 7 she breathed for some hours on a continuous positive airway pressure (CPAP) circuit, but on the afternoon of day 8 her condition deteriorated dramatically, ventilation became difficult and the saturation fell to 60% for nearly 20 minutes. An an X-ray was considered to be essential, to eliminate treatable chest pathology (e.g. pneumothorax), she was carried along the ship's corridor to the X-ray machine and the subsequent chest X-ray (Fig 3) showed that the tip of the tracheostomy tube was almost touching the carina; it also showed resolving right sided consolidation with some residual consolidation also in the left mid and lower zones. The acute episode was probably due to secretions transiently blocking one of the main bronchi so the tracheostomy tube was withdrawn one centimetre and kept in position with a piece of polystyrene.

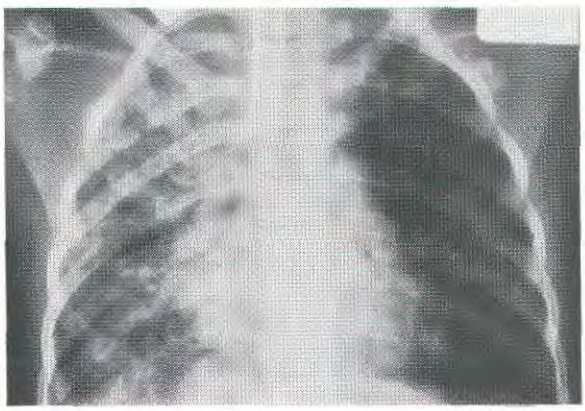

Fig 3. CXR — day 8.

The next day, after 36 hours of full ventilation, sputum sample culture showed a profuse growth of gram negative rods which were sensitive to gentamicin and ticarcillin. As ticarcillin was not available, she was started on appropriate doses of intravenous gentamicin and piperacillin, also quinine sulphate via the nasogastric tube for malaria which had been demonstrated on a blood film. A 250ml blood transfusion was also given.

On the morning of day 10, her chest sounded dramatically better on auscultation. Her oxygen saturation stayed at 98% and inspiratory pressure had decreased to 15cms of water. She was taken off the ventilator and allowed to breathe spontaneously on a continuous positive airways pressure (CPAP) circuit as illustrated by Hinds (1). She was gradually weaned off the CPAP during the following 48 hours and attached to a 'torpedo tube' (60ml syringe drilled with the appropriate size hole) connected to oxygen tubing. The torpedo tube also acted as a convenient trap for the sputum which was now being coughed up in copious amounts as her secondary pneumonia rapidly resolved.

Her condition continued to improve; on day 14 she maintained an adequate saturation on room air; the next day the tracheostomy tube was removed and on day 16 she walked off the ship, the day before the Anastasis sailed on schedule for Europe.

Discussion

This girl's respiratory problems occurred because of the unrecognised fact that the tracheal tube had become displaced, probably either at re-intubation or during positioning of the head by the surgeon after the tube had been shortened. The problem of the recommended size by age (4.0 + age/4) of pre-formed oral tubes being too long, has been previously noticed by Lowson (2), while working in Nepal; he suggested that it was a result of poor nutrition or familial short stature. However Black and Mackersie (3), in a study at Great Ormond Street Hospital found that accidental bronchial intubation occurred in 20 per cent of their series. It should also be noted that in 1986, Mallinckrodt shortened their paediatric size RAE tubes by up to 1.5cms; as all the tubes on the ship had been donated free of charge there is a possibility that they were manufactured before 1986.

After considering the clinical chain of events and the X-ray findings, the most likely diagnosis was acute aspiration pneumonitis followed by secondary pneumonia.

Aspiration pneumonia has a significant mortality even in the best equipped intensive care units in the developed world; but in spite of the lack of a modern ventilator and

'essential' equipment to monitor blood gases and inspired oxygen concentration a young girl was kept alive until her life threatening pathology resolved, by dedicated nurses giving all prescribed drugs, provision of regular suction, physiotherapy and monitoring 24 hours a day for two weeks and by effective use of available equipment including a flask of water as a PEEP valve, a CPAP circuit, an early tracheostomy to facilitate suction and a pulse oximeter.

The pulse oximeter proved its value as an exceptional monitor, by both providing an early warning signal of developing problems and also rapidly indicating the effect on oxygen saturation of varying such parameters as inspired oxygen flow rate, tidal volume, respiratory rate and the amount of PEEP.

It would be difficult also to forget the unquantifiable effect of the 450 'volunteers' on the Anastasis, all supporting the efforts of the medical team and 'willing' this young girl to survive and make a full recovery.

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