Clinical Reports

Femoral-femoral cardiopulmonary bypass prior to induction of anaesthesia in the management of upper airway obstruction

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A case is presented of a female with respiratory distress who was initially treated as having asthma. Her chest x-ray was normal but tracheal tomograms revealed a tracheal tumour almost completely occluding the tracheal lumen. The impending tracheal occlusion was managed with femoral-femoral cardiopulmonary bypass instituted under local anaesthesia prior to induction of anaesthesia and diagnostic bronchoscopy and airway establishment with tracheal intubation. Other indications for the use of cardiopulmonary bypass prior to the induction of anaesthesia are reviewed.

Key words

LUNG: trachea, tumor; VENTILATION: obstruction;
CIRCULATION: cardiopulmonary bypass.

Lower tracheal obstruction by a tumour presents a problem in airway management for the anaesthetist. With a patient *in extremis* due to this lesion, initiation of femoral-femoral cardiopulmonary bypass prior to induction of anaesthesia will maintain oxygenation should irreversible airway occlusion occur.

Case Report

A sixty-five-year-old female was transferred from a peripheral hospital where she had been diagnosed as having asthma. She had felt well until one week prior to entering hospital, when she developed symptoms of an upper respiratory infection and began to wheeze. Her past medical history included obesity, mild diabetes and atherosclerotic heart disease with an old anterior myocardial infarction. After being treated for five days with aminophylline, antibiotics, hydrocortisone and salbutamol, she was becoming more dyspnoeic and was then transferred to our hospital. On examination she was in respiratory distress, with marked inspiratory and expiratory wheezing. Her respiratory rate was 32 per minute and she was using accessory muscles. Blood pressure was 140/70 mmHg and pulse was 150 per minute. Breath sounds were audible throughout both lung fields but were decreased at both bases.

During initial treatment with oxygen by mask,

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FIGURE 1 Tracheal tomogram showing oval mass within tracheal lumen (arrow).

four litres per minute, FIO_2 – 1.0, arterial blood gases were pH 7.35, pO_2 72 mmHg, pCO_2 34 mmHg and HCO_3 18 mEq/l. A portable x-ray of the chest was unremarkable. Soft tissue films of the neck and tomograms of the trachea revealed an oval mass in the tracheal lumen just below the thoracic inlet at the level of the upper aspect of the aortic arch arising from the right lateral wall and almost completely occluding the tracheal lumen (Figure 1).

ECG and intra-arterial blood pressure monitoring were begun in the Intensive Care Unit. Helium 70 per cent and oxygen 30 per cent were administered by a non-rebreathing mask (Flow – 8 l/min) and arterial blood gases were pH 7.46, pO_2 56 mmHg, pCO_2 35 mmHg, and HCO_3 24 mEq/l. After several hours the patient became agitated and uncooperative and seemed to be in danger of having a respiratory arrest. It was agreed that urgent airway control was necessary. She was transferred to the operating room with continuous monitoring of ECG and blood pressure. She was very agitated and had to be restrained. Femoral-femoral cardiopulmonary bypass was instituted under local anaesthesia after

twenty thousand units of heparin were given intravenously. Halothane 0.5 per cent was administered through the pump, then rigid bronchoscopy was performed and biopsies taken. It was possible to pass the bronchoscope past the large ulcerating tumour. Fentanyl 1000 μg and pancuronium 8 mg were then given into the pump. Tracheal intubation with a 7.5 mm cuffed tube was performed without difficulty, the tube passing beyond the tumour. Cardiopulmonary bypass was discontinued, and 200 mg of protamine administered. The patient was transferred to the intensive care unit with the tracheal tube in place for ventilation.

The pathology report revealed a squamous cell carcinoma. Since a bone scan demonstrated suspected metastatic lesions in two ribs, it was decided that in view of the tumour extension, she was not a candidate for tracheal resection. Palliative radiotherapy was given to shrink the tumour. A tracheostomy was performed on day 10 and the patient was discharged home forty days after admission. It was felt that she would require the tracheostomy for the remainder of her life.

Discussion

In this case, cardiopulmonary bypass was instituted prior to induction of anaesthesia because of impending airway obstruction due to a tumour. Two previous cases have been reported in which the patient was *in extremis* from upper airway obstruction due to tracheal tumour and in which cardiopulmonary bypass was used to improve oxygenation prior to induction.^{1,2} Another case was similarly managed because the patient had severe tracheal stenosis.² In two other cases of obstructing tracheal tumours, the femoral artery and vein were exposed prior to induction, with a membrane oxygenator ready for use, in case ventilation was not possible after induction of anaesthesia by conventional means.^{3,4} Extra-corporeal circulation has been used to support cardiopulmonary function during resection of tracheal tumours.^{1,4,5} Tracheostomy under local anaesthesia was not considered for our patient due to the low level of the mass. Alternative methods of securing an airway would be to introduce a pediatric flexible fiberoptic bronchoscope under topical anaesthesia to assess the lesion and then pass it by the obstruction, or to use a rigid bronchoscope which could if necessary be left in place until a tracheostomy could be performed.

Tracheal tumours are rare, present in only approximately 0.1 per cent of terminal cancer patients.⁶ However, their occurrence should be considered in all patients with a history of dyspnoea, cough, wheezing, or stridor, with "normal" chest x-rays.⁶ Indeed, the patient presenting with such symptoms may be mistakenly treated for asthma, as occurred with our patient.⁷ Other causes of wheezing such as foreign body aspiration, bronchial stenosis, left ventricular failure, chronic bronchitis, carcinoid tumours and recurrent pulmonary emboli have to be considered. With tracheal tumours harsh respiratory sounds may be localized to the area of the trachea but diffuse wheezing over the chest may make the diagnosis difficult.

A helium-oxygen mixture was administered to our patient preoperatively as it may substantially improve the efficiency of breathing during upper airway obstruction. The addition of low density helium to oxygen lightens the gas mixture and therefore improves flow. Fanning's law states that gas flow through a narrow orifice is inversely proportional to the square root of its density.^{8,9} However, the main disadvantage of using the helium-oxygen mixture is that a relatively high concentration of helium must be used in order to significantly reduce the density of inspired gas, and therefore the inspired O₂ concentration is reduced.

In summary, cardiopulmonary bypass instituted under local anaesthesia was used for induction of anaesthesia because of airway obstruction by a tracheal tumour. Other indications for this type of induction may include tracheal laceration and rupture, severe tracheal stenosis, and foreign body impaction in the airway.^{1,2} Apart from the patients with difficult tracheal problems, those with a compromised cardiac status may require stabilization with femoral-femoral cardiopulmonary bypass prior to induction. The chief disadvantage of cardiopulmonary bypass in these situations is that the necessary heparinization would predispose to intrapulmonary haemorrhage.¹⁰

References

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Résumé

On présente le cas d'une patiente adulte souffrant de détresse respiratoire qui était initialement traitée pour asthme. La radiographie de la cage thoracique était normale mais la tomographie trachéale décela une tumeur trachéale obstruant presque complètement le lumen trachéal. A cause de l'occlusion trachéale imminente, on fit un pontage cardio-pulmonaire (fémoral-fémoral) sous anesthésie locale avant l'induction de l'anesthésie, de la bronchoscopie diagnostique et du rétablissement du conduit aérien avec l'intubation trachéale. D'autres informations sur l'usage du pontage cardio-pulmonaire avant l'induction de l'anesthésie sont discutées.