Clinical Anaesthesia File

A patient presenting for pharyngeal biopsy

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Case discussed by
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A 68-yr-old man presented for pharyngeal biopsy under general anaesthesia. Coincidentally he was found to have a large mediastinal mass. The evaluation of this patient is described. The exact risk of catastrophic airway collapse on induction of anaesthesia in patients with mediastinal masses is controversial but probably small. As there is no test to prevent airway collapse, it is suggested that attempts at biopsy be performed with regional anaesthesia after radiotherapy.

Un homme de 68 ans se présente pour une biopsie laryngée sous anesthésie générale. On découvre fortuitement qu'il est porteur d'une masse médiastinale. L'évaluation de ce patient est rapportée. Le risque réel d'un collapsus des voies aériennes catastrophique est discutable mais probablement peu élevé. Comme on ne connaît pas de test permettant la prédiction d'un tel collapsus, il est suggéré de tenter une biopsie sous anesthésie régionale après radiothérapie.

A 68-yr-old man was scheduled for pharyngeal biopsy under general anaesthesia as an inpatient. During the preoperative visit, his complaints were an ear ache of one year's duration and minor haemoptysis for the previous two weeks. He took cardizem and used a nitro-patch regularly. On further questioning, he also admitted taking coumadin, initiated following a pulmonary embolism one month previously. He had stopped taking this medication two days before admission, in preparation for surgery.

He had symptoms suggesting mild COPD. Six months before admission, he had stopped using salbutamol and ipratropium inhalers because of symptomatic improvement, but continued to take oral theophylline. He had had a heart attack 16 yr ago but currently could ascend two flights of stairs without difficulty and had no angina. In passing, the patient mentioned that his underlying diagnosis was "bronchial non-small-cell carcinoma," discovered one month ago during the workup of the pulmonary embolus.

He had had previous uneventful general anaesthetics for Dupuytren's contracture and cholecystectomy. In ad-

Key words

AIRWAY: assessment; obstruction.

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Accepted for publication 25th February, 1994.

dition, he stated that he had recently noted severe shortness of breath on one occasion when he was emotionally distressed.

On examination, he appeared to be in no distress and his vital signs were normal. He was not obese. His precordium showed markings for radiotherapy. There were no extra heart sounds or murmurs. His jugular venous pressure was normal. His upper airway was assessed as Mallampati Class I (no pharyngeal mass was apparent). The lungs were clear with slightly prolonged expiration.

The laboratory information on his chart was an ECG, normal apart from inferior Q waves, and reported normal values for haemoglobin, creatinine, and electrolyte concentrations.

This man presents a number of potential problems. Some of these are chronic disorders which appear to be stable (ischaemic heart disease, COPD); other are more acute and require further classification, for example, lung carcinoma and pulmonary embolism. Since he has had treatment for some time, additional information should be available from his chart. The episode of shortness of breath indicates further evaluation is necessary. Potential causes for this episode include coronary ischaemia, reactive airways disease, or mechanical obstructive or compressive effects from the tumour. Additional information should be elicited from the patient about other episodes of shortness of breath. Was there associated haemoptysis? Does he have paroxysmal nocturnal dyspnoea? Does he become short of breath lying flat? His previous treatment should also be reviewed in detail. Specifically, have any chemotherapeutic agents been used? How much radiation has this man received?

Further investigations which should be sought in the old records are a recent chest x-ray, CT or MRI scan of the thorax, spirometry, and arterial blood gas determination. The current ECG tracing can be compared with previous tracings for evidence of change.

Further evaluation of his cardiac condition should wait until the above information is available. Assessment of coagulation (PT, PTT, INR) is also important because it has been only 2 days since the coumadin was suspended.

He also stated that he was short of breath when recumbent. The chest x-ray revealed a large mediastinal mass. Pulmonary function tests were ordered for the next morning, including a request to compare sitting with supine flow-volume loops.

At this point, the indication for urgent surgery is not apparent. The risks posed by the induction of general

anaesthesia in patients with large mediastinal masses are considerable. I would discuss this with the attending respirologist and surgeon.

His forced vital capacity decreased from 3.24 L to 2.70 L on changing from the sitting to the supine position (74% and 62% of predicted respectively). The current chest x-ray showed "a large mass in the left lung, posterior to the hilum. Fullness of the left hilum suggests adenopathy. There is a suggestion of post-obstructive atelectasis and/or pneumonitis. This mass is substantially increased in size since the last determination." In addition, there was a suggestion of a metastasis in the right lung. The pulmonary consultant opined that the increase in this patient's dyspnoea was due to the progression of his tumour mass. No recent CT scan or MRI existed; however, a previous CT scan from one month prior showed a large left hilar mass surrounding the left upper lobe bronchus. The surgery proposed was elective and was part of the investigation for chronic ear ache.

At this point, the proposed general anaesthetic should be cancelled, and the course of radiotherapy continued. The pharyngeal biopsy is not urgent and could be performed under local anaesthesia, preferably after the mediastinal mass had responded to radiotherapy. Mediastinal masses have been associated with life-threatening intraoperative airway collapse at induction of general anaesthesia.¹⁻⁵

The mediastinum

The mediastinum is divided into superior (a line joining the lower border of T₄ to the sternal angle) and inferior parts. The inferior mediastinum is subdivided into anterior (in front of the pericardium), middle (heart, great vessels and oesophagus) and posterior.

Most mediastinal masses are secondary tumours. Typical primary tumours of the anterior mediastinum are lymphoma, thymoma, and germ-cell tumours.⁶ In the middle mediastinum, lymphoma, bronchial, oesophageal, and pericardial cysts can occur. Neurogenic tumours are the majority of tumours in the posterior mediastinum.

When adult and paediatric populations were compared in a 49 yr retrospective review of 257 patients with primary mediastinal masses,⁷ children had more neurogenic tumours, while adults had more lymphomas.

Two-thirds of the tumours in adults are asymptomatic, but those which are symptomatic are more likely to be malignant tumours. The most common symptoms are cough, shortness of breath, chest pain, dysphagia and the superior vena cava syndrome. This syndrome consists

of oedema of the head, neck and periorbital regions, upper body venous distention, changed mentation, and sometimes cough, shortness of breath and orthopnoea. The airway symptoms are caused by mediastinal venous distention. The usual aetiology of superior vena cava syndrome is bronchial carcinoma with hilar metastases (87%) and most of the remainder are due to lymphoma. It is noteworthy that 50% of children and young adults with Hodgkin's disease have a mediastinal mass at presentation.¹ A neurological examination may be important since the most common primary mediastinal mass requiring surgery in adults is thymoma, and 50% of these are associated with myasthenia gravis.¹

Investigations

A comparison of old with new chest x-rays can give an impression of the doubling time of the mass (the volume of a sphere is proportional to the radius cubed). Also, CT and MRI scan may help to delineate the anatomical extent of the tumour. An MRI is justified in preference to CT scanning if there is a dye allergy, the CT findings are equivocal, or if MRI would better delineate nearby structures (pericardium or spinal cord).

Before anaesthesia is commenced, a dynamic assessment of the airway must be performed, since diagnostic imaging does not demonstrate the effect of expiration on airway diameter. During normal forced expiration, a high alveolar pressure is generated by a high intrathoracic pressure, while pressure at the mouth remains atmospheric. Intrathoracic airways nearer the mouth are subject to compression from the intrathoracic pressure of expiration, and the airway may be compressed. This compression is augmented by extrinsic obstruction caused by the mass, and also by the Bernoulli effect which may produce dynamic narrowing of the airway. Loss of chest wall tone on induction of anaesthesia may exaggerate airway closure by loss of the distending forces imparted by the chest wall.

Dynamic airway assessment may be accomplished with either flow-volume loops (upright and supine) or fiberoptic bronchoscopy. A loss of expiratory volume on change of position suggests increased risk of intraoperative airway collapse.

Anaesthesia for mediastinal mass

Induction of anaesthesia may cause acute tracheobronchial obstruction. When such cases have been reviewed, not all patients were symptomatic preoperatively, and "there are no determinates of which patients will be intolerant of anaesthesia."¹

What is the risk of intraoperative collapse? At least three reports have looked at the incidence of airway collapse in these patients. In one,¹⁰ 44 children had no in-

traoperative airway problems even without prior radiotherapy. In the next,¹¹ 29 patients with less than 50% tracheal narrowing on CT had no intraoperative fatality. The third study described five patients of 74 with life-threatening intraoperative airway collapse.¹² All three papers may in fact describe a similar incidence of airway collapse. The interpretation of a zero numerator follows the "rule of three."¹³ The rule of three states that in a study of n patients having no observations of a given event, there is a 95% confidence that there is a less than $3/n$ chance of the event occurring. For the first paper, 0 out of 44 occurrences of airway obstruction means there was a 95% confidence of less than $3/44$ or 7% chance of airway obstruction. In the second paper, the rule of three predicts a chance of airway obstruction as $3/29$ or 10% or less, with a 95% confidence limit. In the third paper which has the largest n , the observed incidence was $5/74 = 7\%$. Despite the differences in the authors' conclusions, their results may not be dissimilar.

Anaesthetic management¹

Since there is no predictor of airway collapse, the key is expectant management. All attempts should be made to perform the procedure under local anaesthesia. Many of these tumours are radiosensitive and preoperative radiotherapy to all but a small area of the tumour (blocked from radiation to allow tissue diagnosis), can dramatically alter symptoms. If general anaesthesia is unavoidable, a crossmatch for packed cells should be completed and a drying agent administered before manipulation of the airway. A fiberoptic bronchoscope with an armoured tube and a rigid bronchoscope and its operator should be available in the operating room. Intravenous lines should be started in both an upper and a lower limb in case of compromise of venous return from the upper body. The operating team should be ready to assist in the rapid change of patient position if needed. Spontaneous ventilation should be maintained during anaesthesia. Since risk of airway compromise remains present even after a tumour is resected (due to oedema formation which may re-occlude the airway) these patients must be watched closely postoperatively.

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