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Bronchial lavage in asthma

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LAVAGE (from the Latin word *lavo*—to wash) is defined as the washing out of a hollow organ by copious injections and rejections of water (Stedman, 1961). Birley & Rochford (1968) state that bronchial lavage is the instillation of a minimum of 400 ml of buffered saline into the lung. It has been suggested that bronchial lavage might be useful in any condition in which there is an abnormal accumulation of material in bronchioles and alveoli, such as unremittent asthma, chemical pneumonias, hyaline membrane disease, and certain viral, fungal and protozoal pneumonias (in some of these conditions, the lavage may be of some diagnostic value) (Ramirez-R, Kieffer & Ball, 1965).

Techniques

Two techniques which have been described for the performance of bronchial lavage are the bronchoscopic (Thompson, Pryor & Hill, 1966) and the endobronchial (Ramirez-R *et al.*, 1965). In the former technique, Thompson and his colleagues at Christchurch, New Zealand, have performed a total of 177 lavages on ninety-two patients with intractable asthma. Under general anaesthesia they have inserted a bronchoscope, and using a metal syringe and bronchial catheter, they have performed a wash via all segmental bronchi visualized, using a total of 800–1500 ml of normal saline (25–30% of the volume used being recovered). The patients were then allowed to recover from the anaesthesia, and given large doses of steroids and bronchodilators over the next few hours.

Of their ninety-two patients, thirty were much improved and twenty-seven slightly improved. The remaining thirty-five were either unchanged or worsened (fifteen have died subsequently). Three of the patients developed surgical emphysema during or following the technique and there was one anaesthetic explosion.

With the endobronchial technique, topical anaesthesia is used and a Carlen's bronchospirometry tube inserted. The lungs are then denitrogenated by washing out with 100% oxygen for 10 min. The lung to be lavaged is then 'degassed' by clamping the appropriate catheter mount at the end of a normal expiration and allowing 5 min for absorption of approximately one-third of the residual pulmonary gas. The lung is then filled with up to 1800 ml of a saline solution containing 1% acetylcysteine, maintaining the level of the irrigating solution at about 30 cm above the patient's chest to promote alveolar filling. Filling is maintained for 10 min and then emptied by gravitation and suction.

Results

Birley & Rochford (1968) have compared these two techniques in severe asthmatics, though using general anaesthesia for both. They consider the endobronchial technique more satisfactory as the airway is controlled throughout the procedure and oxygen tension can be maintained.

Some undesirable effects of lavage must be mentioned. Prolonged lavage with physiological saline in dogs has been shown to remove surfactant from the lungs, and produce destructive changes in the alveolar structure (Huber & Finley, 1965).

Strunin and his colleagues (1968) consider that after lavaging a patient on IPPV (Intermittent Positive Pressure Ventilation) the ventilator pressure may actually rise, when a volume-cycled machine is being used. This could be due either to increased airways obstruction from retained lavage fluid, or fall in compliance from loss of surfactant. Although surfactant could not be measured quantitatively (for example, by measuring the surface tension of the removed fluid using a Wilson balance), chemical analysis has shown active constituents present. The surfactant may already have been present in the casts removed, or appear due to alveolar trauma from the lavage (Strunin, Abrams & Simpson, 1968).

Indications

Our own approach to bronchial lavage at Whiston Hospital has been a part of the therapeutic plan in the resuscitation of the patient in severe status asthmaticus (Williams & Crooke, 1968).

The indications for such resuscitation have been primarily clinical, and include exhaustion and pre-coma with failure to respond to conventional medical therapy, signs of severe cardiac embarrassment such as gross tachycardia with or without pulsus paradoxus, and marked inspiratory wheeze with a silent

expiratory phase, suggesting air trapping and increasing carbon dioxide retention. Such a situation may have been further complicated by iatrogenic factors such as the injudicious use of sedatives, or uncontrolled oxygen therapy in the presence of a chronically elevated P_{CO_2}.

Such patients need oxygen and rest, and this can only be achieved safely by the use of endotracheal intubation and controlled IPPV until the attack is controlled.

The use of bronchial lavage prior to commencement of mechanical ventilation could be theoretically justified on the following grounds:

(1) By removing tenacious plugs, and thus mechanical obstruction of the small airways, initial control of ventilation would be facilitated.
(2) By decreasing airways resistance, lower peak inflation pressures would develop, thus reducing the risk of pneumothorax and mediastinal emphysema.
(3) The removal of plugs may interfere with some 'vicious circle'. Thus the acute attack may subside earlier and the period of ventilation would be shorter.

Present technique

With these factors in mind, the following technique was developed: Hypovolaemia is corrected and cardiovascular monitoring undertaken. Anaesthesia is induced with a minimal dose of methohexitone, followed by suxamethonium, and the patient intubated with a cuffed oral 'Portex' endotracheal tube. The patient is then ventilated with an oxygen/ether mixture until the third plane of surgical anaesthesia is reached (as evidenced by mid-dilation of the pupils); the bronchodilator effect of the ether usually makes manual inflation less difficult.

Ether is now discontinued, and lavage commenced via the endotracheal tube using a 1% bicarbonate solution. The fluid is introduced from an infusion set until it starts to overflow. The lungs are then inflated with three to four breaths of 100% oxygen to ensure maximal distribution of the solution, and an artificial cough is produced by manual compression of the chest during the expiratory phase. Endobronchial suction with an angled catheter is carried out, and the procedure repeated in right and left lateral and Trendelenberg positions. Five hundred ml of the solution is used in volumes of 30–50 ml. The whole procedure takes 30–40 min. The patient is then established on a mechanical ventilator with the aid of a muscle relaxant.

This comparatively simple procedure allows easier control of ventilation. A wider bore suction catheter can be used to remove the fluid and trauma to the larynx is minimized; this is especially important as ventilation via the endotracheal tube may be necessary for up to 4 days. Usually 200–300 ml of the lavage fluid is recovered, containing mucus plugs demonstrable both microscopically and macroscopically.

A long-term review of twenty-three of these cases has been carried out (Beach & Williams, 1970), and no residual harmful effects have been demonstrated. Eighteen cases admitted to varying degrees of improvement, and the majority experienced less overt chest infection, and their daily sputum production was decreased.

At my own hospital, regular out-patient supervision of the asthmatic cases plus an 'early warning system' for hospital admission in acute attacks, have almost completely prevented the patients getting into such desperate states. Strict medical control, and the advent of newer and safer drugs will probably make bronchial lavage less necessary, but not, I think, completely obsolete.

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