

CHEST COMPLICATIONS

including pulmonary embolus and decubitus thrombosis

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Pulmonary complications remain a hazard to surgical patients and especially those undergoing an abdominal operation. At the best, the patient may suffer from a productive cough which although it may be counted of little significance by his medical attendants may be to him a serious cause of distress after operation. At the worst, a patient recovering satisfactorily from a major operation may suddenly die from a pulmonary embolus.

These complications can be divided into respiratory, i.e. those affecting the bronchial tree and lung tissue, and vascular, i.e. those affecting the blood supply of the lungs.

Respiratory Complications

Incidence

It is difficult to determine the incidence of respiratory complications from reported series because of the lack of uniformity among authors of a definition of these complications and also because of the varying proportions of the types of operations performed.

They are rare after non-abdominal operations and especially following operations on the extremities. Respiratory complications occur most commonly after operations in the upper abdomen, so that with the relative increase of these operations, chest complications are becoming more frequent—the total incidence has risen from 9 per cent. in 1914, to 38 per cent. in 1954 (Anscombe, 1957).

Men are more liable to respiratory complications than women, although the ratio is steadily falling. Complications are more likely in heavy smokers and this may be the cause of the difference between the two sexes.

Aetiology

An incision through the anterior abdominal wall produces a reduction in the volume of the lungs and in the maximal flow rates of inspiration and expiration. This effect is more related to the site of the incision than to the amount of intraperi-

toneal damage produced, for incisions in the upper abdomen produce twice the effect of those in the lower abdomen (Figs. 1 and 2), while inguinal herniorrhaphy and combined syndronous abdomino-perineal excision of the rectum have approximately similar effects (Fig. 2).

Bronchial secretions are not expelled because of the reduced ventilation. The resulting stagnation causes an acute bronchitis and the severity of the infection depends upon the virulence of the organisms already present. If the mucus is viscid, the pellet tends to cling to the bronchial wall and has been seen through a bronchoscope to pass distally until it blocked a bronchus of sufficiently small diameter (Band and Hall, 1931). The entrapped air is then slowly absorbed and atelectasis results.

Acute Bronchitis

There are few abnormal signs apart from a productive cough, and even when producing over 5 oz. of purulent sputum a day the patients, apart from their abdominal condition, are usually well. Fever is unusual and temperature rarely rises above 100°F. without the signs of pneumonic involvement. X-ray examination may show no abnormality beyond an increase in the bronchial pattern. There are two features which demonstrate the effect of the decreased ventilation on the causation of post-operative bronchitis. Firstly, the patient rarely starts to cough or feels a desire to cough upon recovering consciousness, but instead, a productive cough commences 12 to 48 hours after operation. Secondly, before the patient starts to expectorate, the rattle of the viscid sputum in the trachea and the main bronchi can often be heard at the bedside. In the first 24 hours, the sputum consists of discoid pellets of thick mucus stained in city dwellers varying shades of grey or black. In the second 24 hours, its nature changes to a green-grey pus but the viscosity and pellet nature remain unaltered. As the condition resolves, the sputum becomes more fluid, appearing in the sputum pot as a frothy mucoid fluid, and whereas

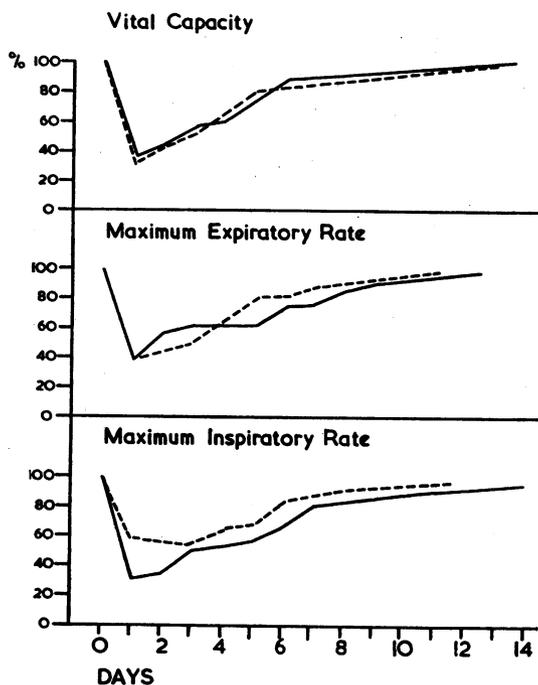


FIG. 1.—Partial gastrectomy. — via upper paramedian incision (8 cases). - - - via upper midline incision (8 cases).

previously each separate fragment of sputum had remained discrete, they now become confluent. The time taken for complete resolution depends on the pre-operative state of the respiratory tract and of the nature of the abdominal operation and is usually about four to five days.

Atelectasis

Classically this condition comes on rapidly within 48 hours of operation and within a few hours the patient becomes acutely ill and dyspnoeic with a rapid rise in temperature and corresponding increases in the pulse rate and respiratory rate. The patient often complains of pain or discomfort in the chest, usually retrosternal in position. On examination, the patient appears lethargic and worried with a perspiring face and usually cyanosis of the lips. Inspection of the chest reveals diminution of movement over the affected part with narrowing and retraction of the intercostal spaces. Mediastinal shift is shown by displacement of the apex beat and the trachea towards the affected side. The apex of the heart is said to tilt upwards and outwards so that the apex beat may be felt in the axilla (Jackson and Lee, 1925). Occasionally there is marked atelectasis of one base with less marked affection of the opposite side, and in these cases there may be only slight displacement of the trachea. Dullness to per-

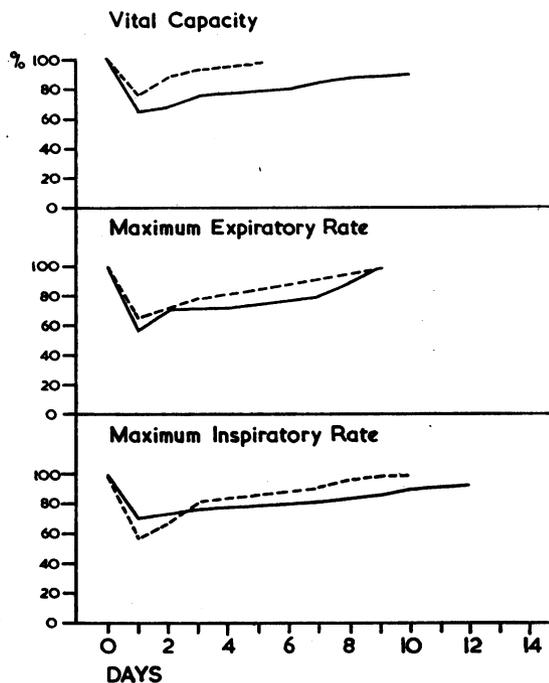


FIG. 2.—- - - Inguinal herniorrhaphy (10 cases). — Abdomino-perineal excision (2 cases).

cussion is present over the affected site more marked posteriorly, with hyper-resonance over the rest of the chest. There is no classical pattern on auscultation—typically the various sounds over the affected area varying not only from area to area, but also during short periods of time. Places are found with diminished or absent breath sounds, fine rales and crepitations, and diminished or absent vocal fremitus, whilst at others increased breath sounds often tubular or amphoric in character, together with bronchophony and pectoriloquy give evidence of patency of the bronchi. A diagnostic sign is the appearance of bronchial breathing in a previously silent portion of lung following a bout of coughing and the expectoration of thick sputum.

Radiology. The taking of a radiograph is not only beneficial in confirming the clinical diagnosis and revealing the amount of atelectasis present, but also because of the increased activity caused to the patient. The radiological appearances, although typical, may give rise to confusion unless the possibility of atelectasis is borne in mind; the area affected may be lobular or lobar, according to the size of the affected bronchus.

Treatment. Once atelectasis has been diagnosed, treatment must be instituted at once before the lung tissue becomes infected and irreversible changes occur.

Dislodgement of the obstructing plug of mucus may be attempted at first by postural drainage and heavy clapping percussion to the chest wall. A bout of coughing may be induced by a breath of strong ammonia or the instillation of a few drops of sterile water through the crico-thyroid membrane.

If these conservative measures fail to lead to expansion of the lung, recourse should be made to early bronchoscopy and aspiration of the bronchial tree. The poor general condition of the patient must be no contra-indication to this procedure, for a dramatic improvement occurs as soon as the affected lung becomes re-aerated.

Aspiration Pneumonia

It is now rare for an unfortunate patient to drown in his own vomit during the induction of anaesthesia or more tragically while recovering consciousness from an otherwise successful operation. The use of a Ryle's tube to empty the stomach, especially in emergency operations for intestinal obstruction, together with the use of pharyngeal packing and cuffed endotracheal tubes, have greatly reduced the risk of aspiration pneumonia. However, a few cases still occur, due mainly to the silent aspiration during operation described by Culver *et al.* (1951). A typical example is the patient undergoing laparotomy lying in the lateral position who develops after the operation signs of a severe unilateral bronchopneumonia. This is more often on the right side owing to the increased risk of gravitational emptying of the stomach.

Lung Abscess

Lung abscess has become a very rare complication and usually follows an operation on the upper respiratory tract so that in most cases it is secondary to the inhalation of infected material. The commonest sites are the axillary and sub-apical part of the upper lobes and the apical part of the lower lobes, for inhaled material is more likely to pass into these areas when the patient is lying in the supine and lateral positions. The rarity with which the lower lobes are affected is of great importance in differentiating the condition from massive atelectasis and consolidation.

The treatment of an established lung abscess consists of postural drainage and the administration of the appropriate antibiotic, depending on the infecting organisms. External drainage or lobectomy is now rarely necessary.

Pulmonary Embolus and Decubitus Thrombosis

Aetiology

Although at one time there was doubt whether

the obstruction of the pulmonary artery was due to a primary thrombosis of the vessel or its blockage by an embolus from the systemic circulation, it is now generally accepted that embolism accounts for all or almost all of the cases of pulmonary infarction.

Infarction is more likely to follow the lodgement of a pulmonary embolus if the segment of affected lung tissue is already the site of infection, venous congestion, or is poorly aerated—conditions which are commonly present after operation.

The site of formation of the thrombus is usually in the veins of the pelvis or the perforating veins of the muscles of the calf (de Takats, 1938). The left leg is more commonly involved than the right and it has been suggested that this is secondary to the obstruction to venous return caused by the common iliac artery on that side and to pressure by the descending colon. The factors involved in the formation of the thrombus are the general immobility of the patient, the age of the patient, the site of the operation, the general effects of operation on the coagulation of the blood and the influence of sepsis.

General Immobility. Virchow, in 1846, emphasized the importance of slowing of the blood stream in the formation of primary thrombosis. Such stagnation resulting from the restricted movements of patients confined to bed, occurs especially in the veins of the leg where decrease in muscular contraction leads to reduction in the power of the 'muscle pump.' Bors, Conrad and Massell (1954) found evidence of venous occlusion in the legs of 59 per cent. of paraplegic patients investigated by means of phlebograms, but despite these findings, none of these patients developed pulmonary emboli. Recently, Fontaine (1957) has produced evidence that the thrombus which separates is one which does not occlude the lumen completely and has found such thrombi at operation floating in the affected vein. Complete occlusion such as occurs in phlegmasia alba dolens rarely produces a pulmonary embolism.

Age. The incidence of pulmonary embolism rises with age, and is most frequent over the age of 40 years.

The Site of Operation. Pulmonary embolism is most frequent after abdominal operations. This may be due to the interference with the mechanical function of the lungs causing a reduction in the efficiency of the 'thoracic pump' and secondary venous stagnation.

The Effect of Operation. A surgical operation produces changes in the blood, which tend to increase the risk of spontaneous thrombosis. The plasma fibrinogen rises in the first three days after operation, the total white cell count increases, and the sedimentation rate is raised. The platelet

count does not show any invariable change but there appears to be a tendency for the number of platelets to rise between the sixth and tenth post-operative days (Atkins, 1939), the time of greatest risk from pulmonary embolism. Any major operation may cause venous stagnation following the effect of shock causing haemoconcentration and localized hypoxia of the vein wall, and by the decreased activity of the patient in the immediate post-operative period.

Sepsis. It is generally believed that infection is necessary before a thrombus becomes separated from the vein wall and that the original condition in cases of pulmonary embolism is a thrombophlebitis. This is supported by the rarity of pulmonary embolism after the aseptic thrombosis produced by the injection treatment of varicose veins, and by the occurrence of a low-grade fever in patients with evidence of venous thrombosis after operation.

Clinical Picture

Patients with pulmonary embolism fall into two main groups—those in whom death occurs rapidly and those who collapse and who later show signs of infarction of the lung.

Group 1. These patients, usually on the eighth to twelfth day after operation, suddenly collapse and die within a few minutes, cyanosed and apparently from medullary failure. The generalized venous engorgement resulting from the obstruction to the pulmonary arteries may give rise to the urge for defaecation, said to be the classical symptom of this condition.

Post-mortem examination may show a large thrombus blocking one of the main branches of the pulmonary artery. Occasionally no embolus can be found or may be small and may not have obstructed any of the larger branches of the pulmonary artery. These patients before death are often not cyanosed but are pale and sweating. In this group death may be due to the reflex nervous effects described by Jesser and de Takats (1941).

Group 2. Although the severity of the symptoms and signs varies with the size of the infarct, the clinical picture is fundamentally the same. The patient is suddenly seized with a severe pain in the chest, usually over the lower ribs, often becomes shocked and may become cyanosed. The pain is continuous and is made worse by an increase in the respiratory rate and a pleural rub may be heard. After a few hours the temperature becomes raised. If embolism occurs in the first few days after operation, the patient's condition may be confused clinically with acute massive atelectasis. However, in atelectasis the mediastinum is markedly shifted to the affected side and the pain is rarely pleuritic in character.

After an interval of several hours, the patient starts to cough up the characteristic blood-stained sputum. This appears as dark red pellets in contrast to the bright red frothy sputum produced in pulmonary congestion. Later a clear effusion often develops associated with the disappearance of the pleuritic pain. The infarct usually heals by fibrosis and more rarely becomes infected to form a lung abscess. Occasionally the size of the infarct is large and the patient's general condition slowly deteriorates, death occurring after a few days.

Prevention

The risk of pulmonary embolism can be reduced by the prevention of venous stagnation, by attempts to decrease the coagulability of the blood and by the ligation of veins if thrombosis has occurred. More often these measures may not be instituted until the patient has already suffered a small embolus. Any patient with an area of tenderness in the calf or a positive Homan's test, especially if this is associated with slight pitting oedema of the ankle and foot and an unexplained low grade fever, should be considered especially liable to a pulmonary embolus and the appropriate treatment instituted.

Prevention of Venous Stagnation. Both before and after operation, the venous return can be improved by general exercises assisting the 'muscle pump' and by breathing exercises which enable the 'thoracic pump' to function with greater effect. During operation, stasis in the veins of the calf can be prevented by placing a sandbag under the tendo Achilles so that the calf does not rest on the operating table (Rogers, 1942).

Decreasing the Coagulability of the Blood. The clinician now has the choice of a variety of anti-coagulants, differing only in the rapidity and duration of their action. It has been suggested that the administration of relatively small dosages of these drugs to patients before and after operation might reduce the coagulability of the blood sufficiently to decrease the risk of thrombosis and yet not endanger the life of the patient from primary haemorrhage. Preliminary results from several controlled series in America have shown that the prophylactic use of anticoagulants has a beneficial effect in surgical patients.

Vein Ligation. The consideration of vein ligation arises in any patient with evidence of venous thrombosis or who has already suffered from one or more pulmonary emboli. The main problem is the difficulty in deciding the exact source of the embolus and thus which vein to tie. To overcome this, ligation of the inferior vena cava has been advocated so that any possible site of origin in the legs or pelvis is blocked from the

lungs. This operation should not be undertaken until after serious consideration, for it causes oedema of the legs, which may predispose to later ulceration. Bowers and Leb (1955) followed up 33 patients who had had a ligation of the inferior vena cava and found that 66 per cent. developed undesirable late sequelae. Inferior caval ligation should be reserved for those patients who have suffered multiple pulmonary emboli and in whom there is strong presumptive evidence that the site of origin is in the lower limbs.

Patients with varicosities of the superficial vein of the legs present a special problem. Thrombosis is more readily diagnosed and its progression up the vein can be noted. If the thrombosis extends above the knee despite conservative treatment, the internal saphenous vein should be tied at its junction with the femoral vein. If the thrombosis extends to the groin, a temporary occlusion of the external iliac vein will prevent the risk of pulmonary embolus during the operation. Prophylactic ligation should be considered in patients with gross varices before an abdominal operation is performed.

Treatment

When there is clinical evidence that a pulmonary embolism has occurred, treatment must be started at once to deal with the affected lung and to prevent further emboli from separating. Pulmonary embolectomy as described by Trendelenberg is rarely possible to perform and of doubtful value, for it has been shown that severe shock can be caused by the reflex effects of a small embolus in the pulmonary vessels. A paravertebral block of the upper thoracic nerves can be performed in an attempt to counteract these effects. Such a procedure is simple and rapid to perform and its

possible beneficial effects are soon evident in a condition in which time is all important.

Anticoagulant therapy should be started using heparin in the first 48 hours until the other drugs become effective. By these means the formation of secondary thrombus is prevented so that a small embolus cannot increase to a serious size.

The infarcted lung may become secondarily infected and a prophylactic course of chemotherapy should also be commenced.

The risk of further emboli can be decreased by ligation of the appropriate vein as discussed above.

Summary

1. Chest complications may be either respiratory or vascular.

2. Respiratory complications are more common after abdominal operations and may be due to interference with the mechanical function of the lungs.

3. Pulmonary embolism is discussed and measures for prevention and treatment are proposed.

Figs. 1 and 2 are printed from my book mentioned below and with the permission of Lloyd-Luke Medical Books Ltd., London.

BIBLIOGRAPHY

- ANSCOMBE, A. R. (1957), 'Pulmonary Complications of Abdominal Surgery,' Lloyd-Luke Medical Books Ltd., London.
- ATKINS, H. J. B. (1939), *Guy's Hosp. Rep.*, **88**, 92.
- BAND, D., and HALL, I. S. (1931), *Brit. J. Surg.*, **19**, 387.
- BORS, E., CONRAD, C. A., and MASSELL, T. B. (1954), *Surg. Gynec. Obstet.*, **99**, 451.
- BOWERS, R. F., and LEB, S. M. (1955), *Surgery*, **37**, 622.
- CULVER, G. A., MAKEL, H. P., and BEECHER, H. K. (1951), *Ann. Surg.*, **133**, 289.
- DE TAKATS, G. (1938), *J. Amer. med. Ass.*, **110**, 1075.
- FONTAINE, R. (1957), *Surgery*, **41**, 6.
- JACKSON, C., and LEE, W. E. (1925), *Ann. Surg.*, **82**, 364.
- JESSER, J. H., and DE TAKATS, G. (1941), *Arch. Surg. (Chicago)*, **42**, 1934.
- ROGERS, L. (1942), 'Medical Annual,' edited by H. Lethby Tidy and A. Rendle Short; Bristol, J. Wright & Sons.

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Chest Complications: Including Pulmonary Embolus and Decubitus Thrombosis

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Postgrad Med J 1957 33: 601-605
doi: 10.1136/pgmj.33.386.601

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