has become available since the clinical study was begun. Thus Widenbauer and Heckler (1939) found that cows' milk varied from 13 to 57 γ per 100 grammes, with an average figure of 32 γ , and human milk from forty-two working-class women varied from 2 γ to 36 γ per 100 grammes. Morgan and Haynes (1939) similarly found that the milk of two women on very different B₁ intakes contained 11 and 32 γ per 100 grammes, and that 5 mg. daily of crystalline B₁ given to both mothers for a month resulted in an increased B₁ content of the milk which had previously contained 11 γ but no increase in the other milk.

From these considerations and from the clinical results recorded it therefore appears probable that supplements of vitamin B₁ derived from natural sources and providing not less than 100 units daily can usefully be given to infants whose progress is unsatisfactory.

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POST-OPERATIVE PULMONARY COMPLICATIONS

BY

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AND

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In the course of a lecture one of New England's leading surgeons recently said: "Post-operative pulmonary complications are in the majority of cases embolic and not anaesthetic. The anaesthetist and the anaesthetic are very seldom, if ever, the cause of post-operative complications." This generous attitude is in marked contrast to that of the surgeon who is willing to lay every post-operative pulmonary complication at the feet of the anaesthetist. We feel that when considering the post-operative pulmonary complications it is difficult to dissociate the responsibilities of anaesthesia from those of surgery, since both surgeon and anaesthetist work upon the patient.

Aetiological Factors

The common types of post-operative pulmonary complications are bronchitis, bronchopneumonia, lobar pneumonia, lung abscess, pulmonary oedema, and atelectasis. In order to avoid post-operative pulmonary complications the following aetiological factors have to be considered.

The Patient.—Every patient should be considered individually. The ability to withstand physiological insults varies according to age, type, the state of general health, etc.; it being greatest in young healthy adults and least in elderly patients and young children.

Sex.—Post-operative pulmonary complications occur more often in males than in females, a possible explanation being that men tend to breathe more with their diaphragm and women more with their thorax; thus when the movements of the diaphragm are restricted after upper abdominal operations the males suffer more from lack of expansion of the lungs.

Season.—Operation during the winter and spring months carries a greater risk of respiratory complications than if performed during the summer months.

Operation.—The type of operation has more influence than the anaesthetic agent upon the tendency to develop post-operative pulmonary complications. Abdominal operations, especially in the upper region, give rise to a greater proportion of post-operative pulmonary complications than do operations in other parts of the body.

Pre-operative Medication.—Routine dosage should be avoided. Each patient must be considered separately to avoid respiratory depression during anaesthesia. The tendency to give basal narcosis to all patients carries with it the danger of respiratory obstruction (incomplete or complete) before anaesthesia starts, too great respiratory depression and difficulty of gauging the depth of anaesthesia during operation, and respiratory depression and risk of obstruction after anaesthesia. It is essential to have a competent person to supervise the airway and general condition throughout the whole period of unconsciousness.

Points in Anaesthesia

Agent.—The relation of the anaesthetic agent to the development of post-operative pulmonary complications can be evaluated only when a series of similar operations are performed with each agent, other factors being the same. Ether has been blamed for causing a high rate of post-operative respiratory complications. It is our impression, however, that, given adequate premedication, the skilful administration of ether to patients without pre-existing pulmonary lesions does not lead to a larger proportion of post-operative pulmonary complications than any other anaesthetic agent. In patients already suffering from a pulmonary lesion it is advisable to employ a non-irritating agent such as nitrous oxide or cyclopropane, but it is by no means certain that ether cannot be used with safety in these patients also.

Depth of Anaesthesia.—It is a well-established fact that the deeper the plane of anaesthesia the greater the liability to post-operative pulmonary complications. This is due to (1) depression of the respiratory centre, resulting in shallow breathing; (2) intercostal paralysis; and (3) general loss of muscular tone. The frequency of respiratory complications following "high" spinal anaesthesia can also be explained by the above factors. Even a short period of deep anaesthesia carries with it a much greater risk of subsequent respiratory complications than a much longer period of light anaesthesia.

Duration.—This is of little importance provided a light plane is maintained. Surgeons who insist on deep anaesthesia throughout the period of operation expose their patients to a greater risk of post-operative pulmonary complications.

Management of Anaesthetic Period.—The anaesthetist must keep a careful watch over his patients for untoward signs and symptoms during the anaesthetic period so that these can be corrected as soon as they appear. The most important factors in the production of post-operative pulmonary complications are an obstructed airway, either partial or complete during or immediately after the period of anaesthesia, and the inhalation of vomitus or other foreign material. Respiration may be hampered by awkward positions required for certain operations. We have seen embarrassment of respiration and even partial collapse of the lung occur as immediate sequels to the use of the bridge in gall-bladder or kidney operations. The bridge should be wound up gently to minimize the above complications. After its use the anaesthetist should satisfy himself that adequate lung expansion is present on both sides before he allows the patient to return to the ward.

The Post-anaesthetic Period

Post-operative Sedatives.—Adequate respiratory movements are essential in the post-anaesthetic period to minimize the risk of pulmonary complications. Diminution of

respiratory movements may result either from pain due to inadequate sedation or from depression of the respiratory centre by excessive sedation. Post-operative sedation should therefore be such that adequate relief of pain is obtained with the minimum of respiratory depression.

Prophylaxis.—The management of the patient in the post-anaesthetic period can have an important influence on the avoidance of post-operative pulmonary complications. Respiratory obstruction must be avoided either by the use of an artificial airway or by the maintenance of a suitable position until the reflexes have returned sufficiently to safeguard the patient from asphyxia or from the inhalation of foreign material. A depressed patient must not be allowed to lie in one position for any length of time. Frequent change of posture is necessary for adequate ventilation of all parts of the lungs. In an unconscious patient this "stirring up" may be aided by adding carbon dioxide (not with oxygen) to the inspired air to stimulate deep breathing. The virtue of air is that the nitrogen is not readily absorbed, and so pulmonary collapse is prevented. It is inadvisable to hyperventilate with carbon dioxide-oxygen mixtures or to leave rapidly absorbable gases (nitrous oxide, oxygen, cyclopropane, etc.) in the alveolar spaces at the finish of an inhalation anaesthetic, especially in depressed patients. Neglect of this precaution may lead to pulmonary collapse.

Tracheo-bronchial Toilet

Certain cases of pulmonary complications are due to the collection of viscid secretion or foreign material in the tracheo-bronchial tree. Cough and ciliary action are the normal means of removing such collections. If the cough is depressed by drugs it must first be stimulated in every possible manner. It can often be made effective by active encouragement, change of position, and simultaneous manual support of the abdominal wall.

Finally the tracheo-bronchial tree can be cleared, if necessary, by suction applied directly by means of a small catheter passed through an intratracheal tube. The latter can be inserted either blindly through the nostril, or through the mouth by direct vision with a laryngoscope. In the conscious patient the base of the tongue and larynx must first be anaesthetized with a fine spray of cocaine solution. As this procedure causes paralysis of the protective laryngeal reflex the patient should not be allowed anything by mouth for two to three hours afterwards. Even an unsuccessful attempt at the toilet manoeuvre is sometimes beneficial since it stimulates the cough reflex to action.

Summary and Comment

We have tried to show the various factors which contribute towards the production of pulmonary complications. It is the duty of every anaesthetist to use his judgment to prevent these complications. Proper choice of premedication, careful selection of agents and technique in accordance with the type of patient and the nature of the operation, skilful management of the patient during the anaesthetic period, and adequate after-care will contribute greatly towards the prevention of these complications.

A. M. Wolf and S. O. Levinson (*Proc. Inst. Med. Chicago*, 1940, 13, 99) compared 1,279 cases of scarlet fever treated with scarlet fever convalescent serum with 205 treated with sulphanilamide in addition to convalescent serum. The drug was given on the second or third day of disease for an average of five to nine days—that is, through the febrile stage—and for several days afterwards in a daily dose of 0.55 grain per pound of body weight. Like other observers the authors found that the drug had no ameliorative effect on the acute symptoms, and the complication rates in the two series were almost identical.

CONGENITAL ATRESIA OF THE OESOPHAGUS

BY

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Cases of congenital atresia of the oesophagus appear to have received greater attention in American literature than in the British journals. Some of the more recent reports have indicated that the number of cases recorded during the past few years proves that the condition is not so rare as was formerly assumed. It is quite possible that some cases may have been diagnosed as bronchopneumonia, the primary lesion having been overlooked because its symptoms were masked by those of the sequelae.

Case Report

The third child of a healthy mother was born after a normal labour on October 11, 1939. There was excess of liquor amnii, which was at first regarded as the cause of the child's cyanosed and choked condition. Much mucus was removed from the pharynx by means of a catheter. The heart sounds were normal, but rales could be heard over the lungs shortly after birth.

During the day the nose and throat were repeatedly cleared of fluid and the foot of the cot was kept raised. Next day mucus still oozed from the nose, and the chest signs persisted, there being indrawing of the lower costal margin. On putting the child to the breast it was found that after sucking for a few minutes it became distressed as a result of regurgitation of the milk. Later in the day occurred attacks of cyanosis associated with the regurgitation of bile and blood-stained fluid. Attempts to feed with a pipette or spoon were unsuccessful, and a provisional diagnosis of atresia of the oesophagus was made.

During the second and third days meconium was passed. The abdomen became increasingly distended, suggesting the presence of communication between trachea and oesophagus. All attempts at feeding by mouth were stopped. The child was given rectal glucose salines, and atropine and coramine were administered. Regurgitation continued, the fluid becoming purulent and the signs of pneumonia more marked. Death occurred on October 14.

Necropsy

The body was that of a rather wasted male child with a distended abdomen. The upper two-thirds of the oesophagus ended in a blind pouch, while a fistulous communication existed between the lower portion and the trachea. The gut and stomach were distended with gas, the stomach containing only a little mucus. Liver and spleen were congested. Both lungs were the site of extensive bronchopneumonia, the lower lobes showing almost complete consolidation. The pericardium contained a little fluid. No other congenital abnormality was found.

Discussion

Rosenthal in 1937 reported on three cases occurring in two years in Long Island College Hospital, and raises the question whether this frequency is unique or whether the diagnosis is overlooked. The case recorded above is the second that I have seen in two years. The other case, that of a female child, was seen by me two days after birth, when attacks of cyanosis and regurgitation of food were causing the medical attendant anxiety. The baby was admitted to a children's hospital, where the diagnosis was confirmed. Death took place on the fifth day.

In all the reports the presence of excessive mucus at birth has been noted. This condition, rapidly followed by the development of pneumonia, may easily result in the diagnosis of aspiration pneumonia being made without the true cause of the aspiration being established, the distress on feeding being attributed to the severe lung infection.