EMERGENCIES IN GENERAL PRACTICE

ANAESTHETIC EMERGENCIES

BY

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A considerable number of preventable deaths occur every year directly due to anaesthesia. In circumstances of emergency the occasional anaesthetist may be uncertain of the proper action to take in order to avert an accident. That such emergencies occur, with a frequency in inverse proportion to the experience of the anaesthetist, confirms that most are preventable. This paper draws attention to some of the main emergencies and to a number of points which, if attended to, will go a long way to preventing others from arising.

Respiratory Obstruction

The need for a clear airway has always been emphasized by teachers of anaesthetics, yet obstruction of the airway remains one of the chief causes of difficulty and danger during inhalation anaesthesia. A clear airway is denoted by silent breathing, free expansion of the chest at each inspiration, a bright pink colour of the lips and ears, and a complete absence of those certain signs of obstruction—sucking in of the intercostal and supraclavicular spaces, and working of the *alae nasi* muscles.

The obstruction is commonly due to relaxation of the tongue, secretion, laryngeal spasm, or a foreign body. Obstruction due to the tongue is recognized by the typical sound of snoring; that due to laryngeal spasm is shown by a voice sound or phonation. The first indicates too deep anaesthesia, the second too light. There should be little difficulty in distinguishing between them. The common foreign body to cause obstruction is a swab or sponge originally placed in the tonsillar fossa or pharynx which has become lodged in the glottis. Its removal is easy with the aid of a laryngoscope.

Respiratory obstruction characterized by snoring is relieved by lifting the jaw so that the lower teeth protrude in front of the upper. By shifting the mandible in this way the tongue, which is attached to the back of the bone, is also moved the small distance necessary to separate it from the posterior pharyngeal wall. A rubber or metal artificial airway should always be inserted whenever an inhalation anaesthetic is administered. It will help to prevent this type of obstruction.

Laryngeal spasm is reflex in nature. The exciting cause may be the anaesthetic vapour itself, a foreign body in the shape of an airway, or perhaps a drop of gastric content on the cords, or stimuli from the operation area. If the operation is temporarily suspended, the strength of anaesthetic vapour reduced, and any foreign body stimulating the larynx removed, the laryngeal spasm will cease and the anaesthetic can then be continued with ease.

Inhalation of Vomit

This is now known to account for a high proportion of the deaths attributable to anaesthesia. Vomiting is a not infrequent accompaniment of inhalation anaesthesia during both induction and light anaesthesia, and also during recovery, particularly if ether is used. Vomiting is also a feature of certain pathological states, notably pyloric obstruction and intestinal obstruction.

Except for emergency operations, an inhalation anaesthetic should on no account be administered within four hours of a meal. No considerations of expediency should overrule this. In emergencies the anaesthetist should not

hesitate to pass a large-bore (that is, 1 cm. outside diameter) stomach tube so that the stomach may be emptied and any further vomitus may have a ready passage to the exterior. A large tube should also invariably be inserted *before* the anaesthetic is started in all cases known to have pyloric obstruction, and in every case where intestinal obstruction is suspected. If a patient should vomit during or after operation, the proper treatment is to turn him on his side (if he is not already in that position) and lower his head. Gravity allows the vomit to run out of the patient's mouth on to the floor, and not into his respiratory tract, where it may have lethal consequences. Patients known to have pyloric or intestinal obstruction, or who are liable to vomit, should be anaesthetized from the start in a head-down tilt. It is best to have them on the operation table so that the tilt can be increased if necessary. Diabetics should not be given glucose by mouth in preparation for an anaesthetic, but by intravenous injection, otherwise a large volume of water will collect in the stomach as a result of osmosis; its inhalation has caused the death of many diabetics.

Respiratory Arrest

"Physiological apnoea" is the result of hyperventilation in the early stages of the anaesthetic. Cessation of respiratory movements due to complete respiratory obstruction is recognized without much difficulty. The dangerous form of respiratory arrest (because sometimes it is not recognized and treated promptly enough) is that due to overdose of the anaesthetic. It is particularly likely to happen with ethyl chloride, cyclopropane, thiopentone, and chloroform. In the case of thiopentone, overdose is generally the result of certain misconceptions. There is no "dose" of thiopentone. Each patient should receive the dose which produces the desired effect and no more. This effect must therefore be known beforehand. Thiopentone is chiefly used to put the patient to sleep, and as soon as this occurs, as indicated by his ceasing to answer questions, the injection must stop. Thiopentone is not an "anaesthetic." Like all the barbiturates, it has little or no effect on pain or on reflexes arising from it. Even though a patient is unconscious, he may still respond to pain by movement. If further thiopentone is administered to obliterate these motor responses, respiration will almost certainly cease simultaneously with their abolition. It is therefore dangerous to use thiopentone as the sole anaesthetic unless the administrator is prepared to perform artificial respiration in a high proportion of cases. The treatment of respiratory arrest due to overdose of any anaesthetic consists in stopping any further administration of the drug, and performing artificial respiration, so that oxygenation continues until sufficient anaesthetic has been excreted for the respiratory centre to start activity spontaneously.

Of the various methods of artificial respiration which are described in books the only one suitable for clinical circumstances is inflation of the lungs. This is done either by rhythmically squeezing a bag full of air or oxygen in communication with the respiratory tract, or by applying the lips to those of the patient and inflating the lungs after the manner of Elisha. An elegant but simple way of performing this latter manœuvre is to place a rubber face-mask on the patient's face and, with a piece of gauze as a crude filter, to blow into the patient's chest. The expiratory gases are adequate for resuscitation, and this simple manœuvre will undoubtedly save many lives in the future as it has in the past. Artificial respiration must be main-

tained until the patient begins to breathe spontaneously. The efficacy of the manoeuvre will be shown by a pink skin and contracting pupils.

Cardiac Arrest

Cardiac arrest, that most dire of all the emergencies of anaesthesia, is indicated by pallor or lividity of the skin, a dilating pupil, and an absence of carotid pulse or heart sounds. Cardiac massage offers the only chance of survival and must be carried out within a minute or two if it is to be successful. Naturally someone experienced in surgical technique is likely to be more successful than one who is not, but it is better to try and fail than not to try at all. In spite of recent strictures anaesthetists are urged to attempt cardiac massage in these urgent circumstances if no one else better qualified is within easy call.

Every anaesthetist should make himself familiar with the technique of at least one method of performing cardiac massage. The now classic method of massaging the heart through the diaphragm, via an epigastric incision, cannot be regarded as wholly satisfactory. It is probably essential to open the pericardium in order to perform massage efficiently, as well as to establish definitely whether the heart is beating satisfactorily or not and whether it is fibrillating. An incision through the fourth intercostal space from the sternum outwards provides a direct, rapid, and comparatively simple approach to the heart and pericardium. Time should not be wasted in attempts at making injections of drugs directly into the heart. There is little reliable evidence that such injections have ever restarted a heart which has really stopped. Perhaps the needle prick may act as a stimulus, but by the time this has been tried and abandoned valuable minutes will have elapsed. In any case, attempts at injections and punctures of the heart can give rise to haemopericardium and bruising of the muscle, making eventual success even more remote.

Thiopentone

The three grave hazards of thiopentone administration are overdose, already discussed, intra-arterial injection, and extravascular injection. The needle must be placed with certainty within a vessel known to be a vein and the point of injection watched throughout the procedure so that extravascular leakage will be immediately detected. Before the needle is inserted, the vessel should always be palpated without the tourniquet, to be certain that it is not pulsating. In view of the frequency of an aberrant artery lying just under the skin in the region of the antecubital fossa, it is better to avoid this region altogether if easily accessible veins are present elsewhere. If the bend of the elbow must be used then the vein on the outer side of the biceps muscle should be chosen, since an artery is not likely to be encountered in this situation.

Intra-arterial injection is followed by immediate, agonizing, burning pain in the hand, accompanied by discoloration of the skin of the forearm and hand. Sometimes urticaria-like weals appear and the radial and ulnar pulses may become impalpable. If the error is recognized at the time some procaine hydrochloride (10 ml. of 1%), papaverine hydrochloride ($\frac{1}{2}$ to $\frac{1}{4}$ gr.—11 to 32 mg.), or tolazoline hydrochloride (5–20 mg.) should be injected immediately into the artery. This should be followed by either a brachial-plexus block or stellate-ganglion block to dilate as many vessels as possible in the limb. Thrombosis probably plays a great part in addition to arterial spasm in causing gangrene in these cases. Heparinization should therefore be maintained for a few days. The arm should be kept at room temperature and there should be no hesitation in repeating the nerve blocks or injections of vasodilators.

Extravascular injection of thiopentone may be followed by little more than local soreness or, at worst, ulceration. The solution, however, may come in contact with one or other cutaneous nerve or even with the trunk of the median

nerve, resulting in areas of anaesthesia with some weakness. Immediate infiltration of the area with 10–20 ml. of physiological saline containing hyaluronidase will dilute the irritant and hasten its absorption.

Convulsions

Convulsions still occasionally occur, and the tendency on the part of the inexperienced anaesthetist is to underestimate the gravity of this condition. A common combination of factors leading to convulsions is warm humid weather, an ill toxic child with a high temperature and an infective process such as peritonitis, poor heat loss because of liberal mackintosh coverings, a large dose of atropine, and deep ether anaesthesia. Twitching is first noticed in the face, and rapidly the convulsions spread to the rest of the body, ultimately becoming quite violent. The respiratory spasm leads to cyanosis, and the patient may quickly die unless the spasms are lessened and adequate pulmonary ventilation carried out. In these circumstances the administration of the anaesthetic is stopped immediately, the mackintosh coverings removed, the temperature of the room lowered by every means possible, and a small dose of thiopentone injected intravenously. The latter should be made up in dilute solution—say, $\frac{1}{2}$ to 2%—and administered very slowly so that overdose is avoided. In a child, as little as 15–20 mg. of thiopentone may be all that is required; in an adult 200 mg. is usually more than enough. The administration of oxygen should be maintained throughout, and, as soon as the convulsions lessen, inflation of the chest will be possible, the patient will become pink, and another calamity has been averted.

Opening of a Pleural Cavity

A pleural cavity may be opened unwittingly during a number of operations, those on the chest wall, the root of the neck, and the kidney region in particular. Such an event may lead to collapse of whole or part of one lung and grave respiratory embarrassment. The latter should be immediately counteracted by assisted ventilation. The reservoir bag is gently squeezed at the end of each inspiration, so as to expand the tidal volume a little. This helps to prevent paradoxical breathing, and the accompanying respiratory and circulatory embarrassment, until the opening in the pleura is closed and the operation completed.

Patients with Respiratory Obstruction

It has long been known that anaesthetizing patients with respiratory obstruction—for example, that due to submaxillary cellulitis—is a very hazardous procedure and carries with it a great risk of the patient dying within a few minutes of the start of anaesthetic. The reason why this happens is now well understood. Such patients may depend for their very life on the use of their accessory muscles of respiration. When the patient is made unconscious these muscles cease to be effective; the respiratory muscles may not be sufficiently strong themselves to overcome the increased resistance of the respiratory tract due to the obstruction, and the patient dies of respiratory insufficiency. No particular anaesthetic agent will prevent this calamity. All are equally dangerous. The only way to ensure survival of a patient with marked respiratory obstruction is to relieve the obstruction before he is made unconscious. Such relief may take the form of tracheotomy, or, more commonly now, the insertion of an endotracheal tube through the larynx. This is not a difficult procedure. The pharynx, larynx, and nasal cavity are well cocaineized. The tube can now be passed under direct vision, by means of a laryngoscope. If trismus is present, the tube may be passed quite easily through one nostril into the larynx. Once the obstruction has been relieved the anaesthetic then presents no difficulty, and any anaesthetic with which the practitioner is familiar may be used.

General Precautions

Care should be taken that gas cylinders are not mixed up. Deaths still occur because cylinders of carbon dioxide are confused with those of nitrous oxide, and both of these with oxygen. Recently the distinguishing colours of gas cylinders were changed, and, although every operating theatre in the country probably still has on its wall the colour chart supplied by the Ministry of Health at that time, the occasional anaesthetist may still be uncertain of the present distinguishing colours. They are:

Oxygen	—White top on a black cylinder
Nitrous oxide	—Blue
Cyclopropane	—Orange
Carbon dioxide	—Grey

These colours may be seen in British Standard 1319: 1946, amendment number 1, June, 1952. A check should also always be made before an anaesthetic session that each gas cylinder is correctly connected by its tubing to the flowmeter which bears its name.

Just occasionally it may not be fully appreciated that a reservoir bag is essential if a Boyle's apparatus is used. Without this bag in the circuit, the patient cannot fill his lungs readily at the proper rate. Needless to say, the greatest care should be taken with ampoules to see that no errors are made over their contents. The same vigilance should extend to bottles of liquid anaesthetics. Chloroform and ether are both colourless liquids, but are readily distinguished from each other by their smell.

The patient's face should always be left uncovered unless this seriously interferes with the surgery. For one thing, this avoids trauma to the cornea by such things as towels, gamgee, or instruments, which can lead to the most serious form of "anaesthetic eye"—that due to corneal ulceration. It is unlikely that ether itself would cause anything worse than a smart conjunctivitis. No attempt should be made to protect eyes by putting oil in them before the start of the anaesthetic, but great care should always be exercised to see that no anaesthetic gets near the eyes. Direct mechanical trauma to the cornea is the real danger. If a patient has unusually protuberant eyes and the operation is on the upper half of the body, the eyelids should be closed and held down by pads of lint thickly smeared with petroleum jelly. If the face must be covered up throughout the operation, the occasion is probably not suitable for the "occasional anaesthetist." Deaths still occur because respiratory obstruction or arrest was not noticed until it was too late. An easily visible face might have prevented this accident.

Ether and ethyl chloride are highly inflammable, and it is best that they should not be used at all in the presence of an open fire or diathermy. If ether must be used in the presence of a diathermy, it is better to mix it with air than with oxygen. There is no excuse for open fires in these circumstances. If ether is going to be used the fire should be put out first.

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Refresher Course Book.—Copies of the second volume of collected articles from the Refresher Course for General Practitioners are still available at 25s. (postage—inland 1s. 6d., overseas 1s.) each. The first volume is now sold out.

Clinical Pathology Book.—"Clinical Pathology in General Practice," a collection of 39 articles on clinical pathology that appeared in the *Journal* as part of the Refresher Course for General Practitioners, is now available, price 21s. (postage—inland 1s. 3d., overseas 9d.).

Both these volumes are obtainable from the Publishing Manager, B.M.A. House, Tavistock Square, London, W.C.1, or through any bookseller.

VACCINATION AGAINST POLIOMYELITIS

ADMINISTRATIVE ARRANGEMENTS

The British poliomyelitis vaccine will at first be made available through local health authorities, according to a letter sent to them last week by the Ministry of Health.¹ Enough vaccine for 300,000 to 500,000 children aged about 1-9 years is expected to be ready for injection before the end of June. These constitute less than one-tenth of the number of children in the selected age-group—namely, those born during 1947-54. Children whose parents wish them to be vaccinated but who are unable to be vaccinated before the end of June will receive priority later in the year after the poliomyelitis season. The vaccine will be released in batches as they pass the safety tests, and two injections spaced at least three weeks apart will be given.

The Ministry has asked local councils to inform parents of how to register consent to the vaccination of their children. By April 14 each council has to send a statement of the total number of acceptances for children in each month of birth in each age group to the Statistical Research Unit of the Medical Research Council. The children to be vaccinated will be chosen in accordance with a centrally made plan "designed to maintain an even spread throughout the eligible age groups which will be based on the month of birth." As each batch of vaccine becomes available "it will be divided between all participating local health authorities having regard to the number of children registered in that area." When more vaccine is available later on, general practitioners will be asked to help in vaccinating.

The manufacturers will send the vaccine direct to the medical officers of health, who have been asked to arrange in advance for the vaccine to be used as soon as possible and to ensure that none remains unused. After vaccination has started, each local authority will send to the M.R.C. Statistical Research Unit reports on all notified cases of poliomyelitis in its area, giving details of the patients' vaccination status. This Unit will also obtain confirmatory clinical information from hospitals.

The cost of the vaccine will be borne on the Ministry of Health Vote. Local health authorities will be offered the vaccine without charge, and expenditure incurred by these arrangements will rank for Exchequer grant.

CONSTITUTION OF VACCINE

At the time of going to press we were able to secure the following details of the two vaccines against poliomyelitis:

The vaccines being prepared by Burroughs Wellcome and Glaxo differ slightly in the strain of poliomyelitis virus used. The Type 1 strain Mahoney used in the preparation of the Salk vaccine is considered to be unsuitable in Britain, and it has been replaced by a modified Brunhilde strain. In the Burroughs Wellcome vaccine both Type 1 and Type 2 strains are now different from those in the Salk vaccine, and the Type 3 strain will be. The Glaxo vaccine's Type 2 and Type 3 strains are as in the American vaccine—namely, M.E.F.I. and Saukett. Both vaccines will contain antibiotic. In the Glaxo process 200 units of penicillin and 200 µg. of streptomycin per ml. are added to the initial fluid; during the subsequent processing the penicillin is largely inactivated, the streptomycin less so. Thus the final product will contain about 50-100 units of penicillin and something under 200 µg. of streptomycin per ml. In the Burroughs Wellcome vaccine the amount of antibiotic is likely to be similar, and work on the possibility of using other antibiotics is in progress.

¹Circular 2/56 to County Councils and County Borough Councils.