

THE FIRST TWENTY-FOUR HOURS: ITS HAZARDS AND THEIR PREVENTION

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It is during the first 24 hours following operative interference that the most lethal hazards of surgery occur.

Modern anaesthetic technique has greatly improved this immediate post-operative period and indeed for many cases today the first 24 hours present no problem whatsoever. On the other hand, some of these new anaesthetic techniques have produced problems of their own, which may give cause for alarm in the immediate post-operative phase.

Generally speaking, the hazards that can occur in the immediate post-operative period cause respiratory or circulatory failure and unless adequately and promptly treated will lead to death. Some of these problems can be avoided in the pre-operative period and by giving supportive therapy during the operation itself. Where any such therapy is indicated it should be instituted at once.

Many of the hazards are complementary and failure to institute supportive therapy at the correct time may well result in a fatal outcome. This may be precipitated by some relatively minor disturbance which, occurring by itself, would have but little effect, but when superimposed on a background of other post-operative stresses it may well prove to be the 'last straw.'

Hazards Associated with Recovery from Anaesthesia

Modern anaesthesia has greatly reduced the time which elapses between leaving the table and the return of consciousness with its protective reflexes, but post-operative respiratory obstruction is still a major hazard in the immediate post-operative period.

Respiratory Obstruction due to Pharyngeal Relaxation

A recent report on deaths associated with anaesthesia (*Anaesthesia*, 1956, **11**, 194) showed that post-operative respiratory obstruction due to pharyngeal relaxation was a cause of death in 23 out of 1,000 cases and probably in 11 more. It is generally accepted that the care of the patient from the operating theatre to the ward comes reasonably

within the province of the nursing staff, but it must still remain the responsibility of the anaesthetist to ensure even at the risk of causing offence that those who are undertaking this onerous responsibility fully understand their duties.

Respiratory Obstruction due to the Inhalation of Blood and Vomit

This hazard is particularly prevalent after operations on the mouth, nose and throat, and nine fatal cases occurred in the Report by the Association of anaesthetists (*Anaesthesia*, 1955, **10**, 218) due to the inhalation of blood. The inhalation of vomit post-operatively may also occur with fatal outcome should the protective reflexes not have returned.

It is important, therefore, that the patient be transported and nursed on the side, the so-called 'tonsillar position.' In this position with the head slightly dependent and the patient turned into the lateral position, knees and elbows flexed, all secretions, blood and vomit will fall away from the unprotected larynx. In any case where a local anaesthetic technique has been used to anaesthetize the larynx, it is doubly important to ensure that no foreign material may enter the tracheo-bronchial tree, and all those concerned with the patient's recovery must be aware of this danger in order to avoid the soothing, if somewhat dramatic, effects of a cup of tea.

'Collapse' of the Lung

This term is generally applied to two distinct conditions: absorption collapse, due to the inhalation of a plug of mucus or blood, and compression collapse, due to the presence of fluid or air in the pleural space. Occasionally both these states may be present at the same time. The clinical picture is, of course, classical; cyanosis, shock, rapid respiration and rising pulse rate are present in both types of 'collapse' but the distinction between the two is most easily made on the displacement of the mediastinum and trachea. Radiography is of great value and once such a condition is suspected the problem must be pursued with speed and thoroughness. Occasion-

ally it may be suspected that a tension pneumothorax has arisen following thoracotomy before the patient has left the theatre. A diagnostic needle puncture at the time will be of considerable value, but probably an even greater safeguard is the routine employment of an intercostal drain and under-water seal.

The treatment of these conditions is urgent. Bronchoscopy should be performed in order to remove the plug of mucous or blood under adequate local anaesthesia. This is easily performed in the bed with the patient sitting up and will produce dramatic relief. Aspiration of air or fluid with a large-bore needle and the application of negative pressure via an under-water seal and Roberts pump will produce rapid relief in a case of a pneumothorax or large effusion. The presence of a haemothorax may produce a considerable problem since the blood invariably clots and cannot be aspirated. The decision to re-open the chest must depend on the patient's general condition, but it should not be left too late. A gradually increasing degree of anoxia will considerably hinder the successful outcome of such a procedure and the risk of the second operation must be assessed against the risk of permanent damage due to anoxia.

' Bronchospasm '

This term is frequently applied when respiration is impaired and a wheezing noise is heard in the chest. It is, however, a very real condition which may occur and which may prove fatal in the immediate post-operative period following extubation, over-enthusiastic bronchial suction, or bronchoscopy in the patient too lightly anaesthetized. The condition must be distinguished from atelectasis as further bronchoscopy in the former would be fatal. Aminophylline-0.24 g. intravenously will help, but rapid recovery may be obtained by the use of hydrocortisone, 100 mg. being given into an intravenous saline infusion.

Respiratory Depression due to Anaesthesia

Overdosage of anaesthetic drugs will, of course, cause collapse in the post-operative period and patients should not leave the care of the anaesthetist until the patient is able to maintain adequate ventilation of his own accord.

There are, however, two problems which may not be immediately appreciated and which may present after the patient has left the theatre.

Resistant Curarization

The use of the relaxant drugs has added much to the scope of modern-day anaesthesia. Their use has permitted surgery in states where this was previously not possible. It is, however, im-

portant that these compounds be adequately and fully reversed before the patient returns to the ward. The depolarizing agents have no effective antidote, but curare and its compounds may be antagonized by neostigmine. This drug acts by increasing the amount of acetyl choline available at the myoneural junction and so overcomes the block instituted by curare. It is possible for resistant curarization to occur with failure of response to neostigmine and particular reference has been made to disturbances of potassium metabolism (Hunter, 1956) and depression of the acetyl choline cholinesterase system in the very ill patient in this respect (Burchell, 1957). When large doses of tubocurarine have been used it may be impossible adequately to reverse the paralysis by administering neostigmine, which itself can produce a paralysis. This may not appear until later when the patient has returned to the ward. Respiratory depression of a central nature may lead to the misguided use of neostigmine or an excessive dosage of this drug, which, as has already been pointed out, may of itself produce a muscular paralysis, probably by prolonged depolarization.

Carbon Dioxide Retention

This may occur due to inadequate ventilation during anaesthesia or to respiratory depression following anaesthesia. Clinically the patient shows a full, bounding pulse with a raised blood pressure, sweating and a tracheal tug. The condition is extremely liable to occur where there is any deterioration of respiratory exchange as, for example, in the chronic bronchitic and emphysematous patient.

Respiration must be controlled and the retained carbon dioxide removed by soda-lime absorption. It is imperative that such patients be reintubated and hyper-ventilated, the most efficient method probably being some form of mechanical respirator.

Where inadequate ventilation with cyclopropane has occurred the syndrome of 'cyclopropane shock' may be seen. This is due to failure of adequate carbon dioxide absorption during the period of anaesthesia, allowing a large build-up to occur. The removal of this hypercapnoea produces a marked fall in blood pressure with peripheral circulatory failure. Similarly, when treating a case of carbon dioxide retention considerable care should be exercised, to avoid going from one extreme to the other.

These, then, are some of the problems which affect the respiratory exchange during the first 24 hours of the post-operative period. All tend to produce hypoxia and are frequently additive so that a minor upset may well develop into a major catastrophe. Prevention is many times better than cure and watchfulness will obviate these

problems. No patient should be returned to the ward until the anaesthetist is satisfied that an adequate airway is maintained, that respiration is fully recovered and that those to whom the patient is returned are fully able to maintain the airway until recovery is complete and are able to observe any change that may take place.

Wherever possible, post-operative patients should be nursed on their sides so that the danger of aspiration is minimized. Adequate lighting is of paramount importance—green shading can easily allow anoxia to occur by masking a colour change.

Bedford (1955) attributes personality changes observed in elderly patients to the use of nitrous oxide, but it would seem far more likely that some hypoxic or acute hypotensive episode had occurred during the immediate post-operative period. Where this has taken place, after rectifying the cause, treatment with 50 per cent. sucrose solution should be instigated at once in order to minimize or prevent the cerebral oedema, which occurs following a hypoxic attack (Argent and Cope, 1956).

Circulatory Disturbance During the First Twenty-four Hours

The most lethal hazard of the first 24 hours affecting the circulatory system is surgical shock. This syndrome, which has attracted much thought over the years, may best be defined as a peripheral circulatory impairment due to a fall in blood volume (Elman, 1951). This implies that degrees of shock may exist and that such a state is not irreversible, as some animal experiments would suggest. The phenomenon of irreversible shock is one where the patient fails to respond to therapy, due to permanent damage induced by the initial syndrome. Some workers have postulated the release of certain biochemical substances from the liver and muscles following circulatory impairment, which inhibits vasomotor tone and permits the escape of plasma due to increased capillary permeability (Shorr *et al.*, 1948).

There are three main factors in the causation of surgical shock; haemorrhage, tissue trauma and neurogenic disturbances.

Haemorrhage

This is the most easily understood problem in the production of shock and is the easiest to prevent and treat. With modern transfusion techniques there is no indication for withholding blood transfusion. It should be used to prevent the occurrence of surgical shock and should be instigated much earlier than is often customary.

There is no place in modern surgical technique for the view that blood transfusion is unnecessary

to certain operations. It may be necessary at any time for any case in the hands of any surgeon and the rapid transfusion of half a pint of blood at the appropriate time may well shorten the patient's stay in hospital by many days.

It is not generally appreciated that the amount of blood lost at operation is considerable, nor is it appreciated that a pint bottle of blood contains only 440 ml., of which some 40 ml. may be wasted. Thus the loss of two pints of blood on the table (1 l.) is not replaced by two pint bottles of transfused blood. The work of Ruscoe Clark and his colleagues in reference to traumatic surgery has demonstrated these points most convincingly (Ruscoe Clark *et al.*, 1956).

Rapid intravenous transfusion is the method of choice to replace blood in the acutely shocked patient and is dramatic in its response. The rate of transfusion should be fast, special care only being required in the very young and the very old. Intra-arterial transfusion has no place except where there is actual haemorrhage from the heart, where transfusion into the aorta will perfuse the coronary system.

Traumatic Shock

Whilst in the majority of cases that have suffered trauma there is a ready explanation for the degree of shock produced, in some instances where there is tissue damage, the degree of shock cannot be explained on the amount of blood or fluid lost. For example, in crush injuries or gas gangrene. Similar observations have been made experimentally with strangulated loops of intestine, where it has been shown that some other factor is released when tissue is damaged, which itself will produce a considerable degree of shock.

Neurogenic Shock

The stimulus of operative interference sets up neurogenic disturbances which, whilst they do not alone account for surgical shock, will play an important auxiliary role and in this respect the gentle handling of the patient after operation and the adequate relief of pain will play an important part in the control of post-operative shock.

The removal of the patient from the theatre should be gentle and if possible, after major procedures, the patient should be transferred directly from the table into his bed, thus avoiding a separate move in the ward. The value of warming the patient is the subject of controversy, but extremes of heat and cold should be avoided. The hazards of burning the unconscious patient with hot water bottles are well known and indeed there seems little point in instituting such a dangerous form of therapy when its benefits are in considerable doubt.

Postgrad Med J: first published as 10.1136/pgmj.33.386.618 on 1 December 1957. Downloaded from http://pmj.bmj.com/ on October 24, 2020 by guest. Protected by copyright.

The Pressor Amines

The value of these drugs in the treatment of shock is of some doubt. Generally speaking, it is better to treat the cause of the condition rather than to attempt to increase constriction where vasoconstriction has already occurred physiologically. However, in those cases where response to other methods of therapy has failed there is a place for pressor agents. Of these l'nor adrenaline is the most suitable despite the technical problems of administration, whilst methoxamine (vasylax) and mephenteramine (wyamine) are useful where it is wished to reverse the hypotension produced by spinal or extradural anaesthesia.

Plasma Expanders

These agents are a useful method of temporarily restoring the volume of circulatory fluid. They remain in the circulation longer than dextrose or saline, because of the large size of their molecule. They are of value where it is desired to combat shock whilst blood is being crossmatched, though it is important to remember that further cross-matching is difficult once plasma expanders have been used.

Adrenocortical Deficiency

Patients who have been receiving cortisone for any length of time pre-operatively may show signs of acute post-operative deficiency in the first 24 hours, as their response to the stress of operation is impaired due to the depression of the adrenal cortex by cortisone. The clinical picture is one of acute circulatory collapse, hypotension and tachycardia. Loss of consciousness and fever may supervene and a raised eosinophil count is normally indicative of the condition. Treatment is both prophylactic and remedial. Prior to operation any patient who has been having corticosteroid therapy should be given cortisone in the pre-operative period. Post-operatively they should be carefully watched and should the signs of cortical insufficiency develop, intravenous hydrocortisone should be given in a normal saline infusion and l'nor adrenaline may also be indicated.

Post-operative Pain

The individual response to pain is very varied, but where pain exists it should be treated adequately. The routine practice of prescribing post-operative analgesics before surgery has even taken place cannot be condemned too highly. Should pain be severe it can easily lead to neurogenic shock, which may augment some minor degree of haemorrhagic shock and produce dramatic results.

When post-operative medication is indicated I believe that morphine in small doses is the drug of

choice. Generally it is well tolerated, apart from some individual instances of vomiting, and it will provide not only analgesia but sleep, a factor which I believe is too often overlooked. The respiratory depression which is noted with morphine is exactly the same as that produced by pethidine in equi-analgesic doses, when both the rate and volume of respiration are measured (Flintan and Keele, 1954), whilst the degree of hypotension induced by pethidine hydrochloride is a considerable disadvantage. Other drugs of a synthetic nature are constantly being produced, of which amidone and its derivatives are perhaps the best known, but the criticisms of pethidine hold good for the majority of these other compounds and personal experiment over a large series of patients has led me to the belief that morphine holds pride of place in the immediate post-operative period.

Conclusion

The hazards that occur during the first 24 hours are always potentially dangerous; they are often cumulative, and superimposed upon a prolonged and severe surgical procedure may well prove fatal. It is essential, therefore, that these hazards are recognized and treated promptly.

The majority are due to an error of technique or foresight and in order to prevent the occurrence of these dangers and to treat them adequately when they do occur, the employment of a post-operative ward is an essential. Unfortunately, owing to the topography of most hospitals it has not yet been found possible to employ such a unit, but these units should be installed wherever a new building is planned or it is possible to extend or renovate some existing structure.

They should be situated close to the operating theatre so that they may be under the close supervision of anaesthetists and surgeons. They should be staffed with highly trained personnel, both day and night, and fully equipped with all the necessary needs for resuscitation with piped suction and oxygen to each bed.

Where such a unit exists it is not difficult to envisage a multitude of uses apart from routine post-operative care, as in the great majority of cases it would not be necessary for patients to be kept for more than a short period before being returned to their own ward. Any case requiring resuscitation could be sent to this unit directly from the casualty department, which in the majority of hospitals is not equipped to deal with such cases as gross traumatic injuries.

This, then, is the ideal, but until such units become universal, watchfulness must remain the key word. No patient should ever be returned to the ward until the anaesthetist is satisfied with

the airway and that he is fit to be moved. Gentle handling, adequate transfusion and relief of pain will ensure that the first 24 hours after operation place the patient well on the road to convalescence and discharge from hospital.

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