The immense benefit of being able to leave the administration of the gas and air to a nurse is even more noticeable in general practice.

At the Wellhouse Hospital the sisters and nurses are enthusiastic supporters of the use of gas and air, since they find it helps them in their work and makes the patients more easy to manage. The superintending sister-midwife of Wellhouse Hospital states:

"(1) Unlike my experience with other anaesthetics gas and air rather tends to increase the contractions. (2) Even after long labours, there is no evidence of any harm to the child. (3) The patients are enthusiastic. (4) The patient is happier, less excitable, and more controllable. (5) I would prefer my patients to have gas and air in future. They can manage it quite well themselves after a little help and advice."

Expense

The cost of the complete machine fitted into a convenient carrying case is at present 17 guineas, but there does not appear to be any reason why this cost should not be very much reduced should the demand justify the manufacture of the apparatus on a large scale. It is readily portable, and the consumption of gas is about forty gallons an hour, intermittent flow. The actual cost in hospital practice has worked out at about 2s. per case. In private practice the cost is a little higher.

Comparison with Gas and Oxygen

Lastly it would be well to consider how gas and air compares with gas and oxygen for everyday midwifery.

1. The gas and oxygen apparatus at present on the market is rather expensive, and because one must carry oxygen cylinders as well as gas cylinders it is heavier to carry.

2. To administer gas and oxygen in maternity work with satisfactory results does require considerable experience and skill in anaesthetic technique. For the use of gas and air very little skill is required. The method is self administrative: the patient is given the face-piece and simply told to breathe in and out when a pain comes on. The only requirements are a well-fitting face-piece and a patient who will co-operate.

3. With gas and oxygen vomiting frequently occurs; with gas and air this vomiting is but rarely seen. Patients can, and do, take fluids freely during their confinements.

4. Excitement and cyanosis of the mother can readily occur when gas and oxygen is used, but these troubles are not found to any marked degree with gas and air. The absence of excitement is indeed an important and pronounced feature.

5. With gas and oxygen we can certainly guarantee absolute relief from pain in 100 per cent. of cases, but to do this we must again have a really expert anaesthetist. Our experience is that with gas and air we get 44 per cent. of patients who, without any premedication, have no pain whatsoever; 53 per cent. experience great relief; and 3 per cent. some relief. With premedication a much higher percentage of patients have no pain, and no expert anaesthetist is required.

The nursing staff at the Wellhouse Hospital has assisted us to its utmost to make the investigation a success, and the patients themselves have co-operated. Our sincere thanks are due to Mr. Rutherford, chairman of the Hertfordshire Public Assistance Committee, and to Lord Knutsford, a member of the Hertfordshire County Council, for their unflinching assistance and support.

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THE POST-OPERATIVE MANAGEMENT OF ACUTE EMPYEMA THORACIS*

BY

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Acute empyema thoracis is a common disease, for which operations are frequently performed, yet the importance of careful post-operative care does not appear to be generally appreciated. Operation usually consists of some form of drainage, either open or closed. Blockage of, or ulceration around, the tube often necessitates the conversion of a closed drainage into an open one. The tube is less likely to become obstructed if all visible masses of lymph have been removed through a relatively wide thoracotomy incision when establishing drainage, provided that the condition of the patient permits. It is not intended to embark upon a discussion of the relative values of these operations—each having its own uses—but it is obvious that while open operation would be disastrous in certain cases, it is quite possible that some of the bad results attributed to this method may be partly due to faulty after-treatment.

General Treatment

The patient should be placed in the sitting position as soon as possible after returning to bed from the theatre. These cases are best nursed in the open air. Opiates may be given, if needed, during the early post-operative period to facilitate sleeping and to relieve pain. Fluids should be imbibed freely until the temperature has fallen to normal. Appetite returns as toxæmia diminishes, and full diet is permitted as soon as desired. Purgatives are administered as required. Massage should be given to the arms and legs to improve the general muscle tone, and the patient should be encouraged to move about the bed as much as possible. If the haemoglobin index is low, iron is beneficial. If the general condition has sufficiently improved, and the temperature has been normal for a fortnight, improvement is often accelerated by allowing the patient to get up.

Care of the Wound

Where a "closed" or, as I prefer to call it, a "siphon" system of drainage is used, the wound may be smeared with bipp and covered with a layer of sterilized dry dressing arranged round the tube fastened by adhesive strapping or elastoplast. Usually such a wound need not be disturbed for several days, the sutures being removed about the eighth or tenth day. The tube should be long enough to enable the patient to move about the bed without pulling it off or upsetting the bottle. Redundant coils of tubing are undesirable: lying on the floor, they are apt to become occupied with stagnant discharge.

It is advisable to have the drainage tube connected to a glass tube passing through the cork to the bottom of a bottle containing coloured antiseptic fluid (flavine), rather than to allow the rubber tube itself to be freely beneath the surface of the fluid. In the latter case the tube is only too often found gaily suspended above the level of the liquid. The attendants should, of course, be warned that the tube must be first clamped before it is

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disconnected from the bottle for any purpose. Movement of the coloured fluid up and down in the glass tube in the bottle is evidence that the siphon system is working satisfactorily. In unfavourable cases, infection of the wound or blockage of the tube may make continuance of the siphonage undesirable or impossible in such circumstances, and later, in the more favourable cases, where only a small residual cavity remains, the tube should be withdrawn and a shorter clean one inserted—that is, the system of drainage should be changed to the ordinary "open" method.

Where "open" drainage is employed, frequent antiseptic dressings are required, one of the most satisfactory being gauze wrung out in corrosive sublimate (1 in 1,000), unless the discharge is fetid or the wound foul, when eusol should be used. Dressings should be changed as soon as there is any evidence that they are saturated with discharge, or at least once a day. Tubes should be changed at least every second or third day, or more frequently if blockage occurs. To secure and facilitate this, it is my custom to suture a safety-pin, attached to the tube, by its two ends to the edges of the wound. After opening the pin, the dirty tube can be easily detached, removed, and replaced by a new one.

In foul infections, gross thickening of the pleura, or loculation, it is advisable to irrigate the cavity with eusol. The eusol should be warmed by the addition of a little hot water, actually at the bedside, so that it does not disintegrate before entering the chest. A convenient way of avoiding excessive intrapleural pressure during irrigation is to keep two tubes, of different sizes, in the wound, connecting the smaller by means of a catheter to a funnel; fluid can thus escape both around the tubes and along the larger one. Syringing should be avoided.

Persistence or recurrence of temperature after drainage, in the absence of other explanations, is another indication for irrigation, and under these circumstances warm flavine (1 in 1,000) is useful and safe. Rather too much has been made of the supposed dangers of irrigation. If the simple precautions already mentioned of warming the fluid and avoiding undue increase of pressure are adopted, reflex collapse and air embolism are unlikely to occur. There has been cerebral abscess in only two of my cases, and in neither had irrigation been employed. The presence of a bronchial fistula, unless minute, is a definite contraindication to irrigation.

Re-expansion of Lung

The degree of lung collapse found after evacuation of an empyema varies, complete collapse being associated with the large diffuse type, and partial collapse with small and more localized collections. In the latter case, collapse is limited by adhesions between the parietes and the lung at the periphery of the cavity.

Natural obliteration of pleural cavities by re-expansion of the lung follows the establishment of adequate drainage if the general health improves and infection subsides. Raising the intrabronchial pressure causes the lung to expand. As it expands it comes into contact with, and becomes adherent to, the chest wall. Further expansion facilitates the formation of more adhesions around the periphery of the cavity, and so the expanding lung steadily creeps outwards. To assist these processes, within a day or two of the operation, unless the general condition is too poor, the patient is instructed to blow fluid from one Woulfe's bottle to another. Small bottles of about a pint capacity are used; later a larger size may be substituted. Five minutes' blowing during each waking hour is not too exhausting, and suffices. Children prefer to blow up balloons. If the services of a masseuse are available, carefully graduated breathing exercises undoubtedly hasten

re-expansion, and minimize the risk of flattening deformity of the thorax and scoliosis. The "pull" of the sub-atmospheric intrapleural pressure present where siphon drainage is employed is an additional help to re-expansion. Continuous suction by a water vacuum pump is used in some clinics for the same purpose, but of this I have no personal experience.

Drainage is sometimes abandoned when the discharge is no longer profuse, or is thin, or if the temperature has been normal for a number of days, irrespective of whether there is any evidence of complete re-expansion of the lung or not. This rule-of-thumb method leaves too much to chance; it may succeed—probably in the majority of instances it does—but where it is adopted a number of patients are certain to develop a chronic empyema sinus. Drainage must be maintained until the lung has expanded to the parietes and completely obliterated the empyema cavity. If the parietal wound is permitted to close earlier, a residual cavity is left in which pus is almost certain to accumulate; this gives rise to toxæmia, evidenced by wasting, muddy anaemia, sweating, pyrexia, loss of appetite, and ultimately lardaceous disease. There is no constant rate of re-expansion of the lung; that is why there can be no constant interval after which it is safe to abandon drainage. It is sometimes stated that prolonged retention of a drainage tube gives rise to a chronic empyema. A chronic empyema due to this is speedily and simply avoided by removal of the tube, but if it is due to premature stoppage of drainage it is often only cured, if at all, by serious operative procedures.

Breath sounds and vocal fremitus in the vicinity of the wound show that the lung is in contact there with the chest wall. An x-ray picture is the best way of showing the degree of lung expansion that has occurred. If there is a cavity between the lateral chest wall and the lung it will be clearly shown in the film; if, however, the cavity is behind or in front of the lung its extent can be more accurately demonstrated by inserting a length of fine rubber tubing through the wound, the coils of tubing being easily seen through the lung substance. Lipiodol may be used for the same purpose. There need be no hesitation in retaining the tube for prolonged periods; apart from slight discomfort it need be the cause of little disability, and patients can even follow their employment while waiting for obliteration of their cavities. Actually at present a patient of mine, with a tube in a thoracic cavity, is working in a coal mine, and has even played in a game of football!

In a few cases expansion of the lung may come to a standstill before the cavity is completely obliterated. The lung may remain completely collapsed in very rare cases. If drainage is adequate and there is no foreign body in the cavity, failure to re-expand is probably due to thickening of the pleura. Occasionally a bronchial fistula may be the cause, but in my experience, unless the fistula is large, it usually has little, if any, adverse effect on expansion. Repeated irrigations with Dakin's solution or eusol apparently dissolve the layers of fibrin—pleural rind—which, thickening the visceral pleura, imprisons the lung. Failure of this chemical decortication necessitates either the surgical removal of this rind or an extensive thoracoplasty.

Operations for acute empyemata, being simple and easy to perform, are often done by relatively inexperienced surgeons in small hospitals or even in the patient's own home. Similarly, in the larger hospitals their performance is often left to the residents. If the principle is recognized of maintaining drainage until the cavity is obliterated by expansion of the lung, no matter how slow the process is, the incidence of chronic empyema will be much less.