The Management of Acute Poliomyelitis in Hospital

BY

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The Salisbury City Council's Infectious Diseases Hospital and the Red Cross Polio Centre possess up-to-date equipment for the treatment of cases of poliomyelitis.

The key to the successful treatment of poliomyelitis is skilful nursing and carefully planned and well graded physiotherapy. The nursing of these patients is not easy and at times can be most trying, as they can be most exacting in the "iron lung" and will require the sister's constant vigilance throughout the day and night. In the treatment of poliomyelitis the doctors, including orthopaedic surgeon, ear, nose and throat surgeon and anaesthetist and the nursing staff and physiotherapists, must work as a unit. This team-work is fundamental to the successful treatment of poliomyelitis. From the patient's point of view the psychological effect of a cheerful optimistic atmosphere in a hospital and at a physiotherapy clinic is of the greatest importance to strengthen and maintain the patient's morale. The will to recover is the greatest asset a poliomyelitis victim can have.

The Place of Drugs in the Treatment of Poliomyelitis

It is well known that there is as yet no known specific drug for the treatment of this disease. Drugs are used either symptomatically or to prevent secondary bacterial infection.

"Etamon" which induces muscle relaxation was tried by us five years ago, but without success, and it was not employed in this outbreak. A long-acting penicillin preparation was employed intramuscularly for all cases who required treatment in the "iron lung," and sulphonamides and antibiotics for those with urinary retention requiring an indwelling cathater.

The alleviation of pain and inducement of mental relaxation is of special importance in the treatment of poliomyelitis. For the relief of pain we use the usual analgesics such as aspirin, phenacetin and codein compound, pethidine, and omnopon in severe cases. The excessive use of barbiturates in cases with any form of respiratory embarrassment is to be strongly deprecated. The respiratory centre in this type of case is unusually sensitive to the depressant action of the barbiturates which, however, have a place in the treatment and are most effective in allaying mental anxiety. Our limited experience with chlorpromazine has been disappointing. Paraldehyde is a safe drug to use in cases with respiratory embarrassment when rest and sleep are of paramount importance. It can be given subcutaneously in doses of five c.c. for an adult.

Nursing Treatment

On admission to hospital, all cases are nursed flat on their backs without a pillow and the feet are propped up against a bed board at the foot of the bed. Bed boards are used under the mattress to prevent sagging of the mattress and resulting "drag" on the spinal nerve roots. Soft sandbags are used to place paralysed limbs in the position of maximal relaxation for the affected muscles and to prevent the development of contractures and deformities.

Hot Packs

The use of hot moist hot packs is of considerable importance in the treatment of poliomyelitis, as they help to alleviate muscle spasm, pain and tenderness. These woollen hot packs are placed as a covering over the entire back when there is spasm of the lumbar muscles, or are wrapped round a paralysed limb, an electrically heated cradle being placed over the patient and the packs left *in situ* for about thirty minutes. This procedure is repeated three times a day.

The hot packs are prepared in the special Hot Pack Apparatus which, being mounted on wheels can be easily moved from patient to patient (Fig. 1). The

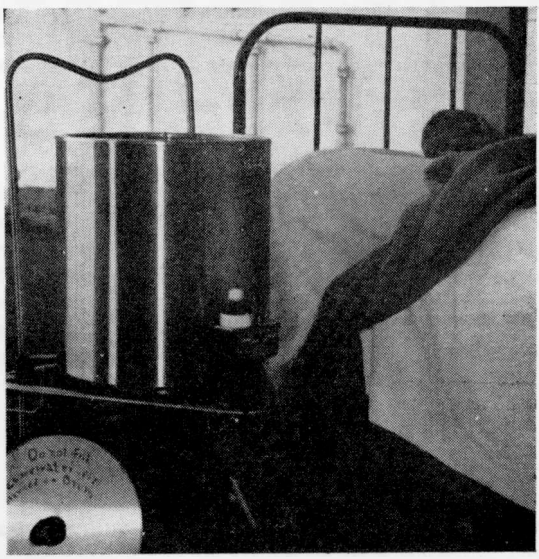

Fig. 1—Hot Pack Apparatus.

water at the bottom of the cylinder is heated electrically and the steam is allowed to enter the upper portion of the cylinder, where the woollen packs are placed on a platform which revolves all the while at high speed, much in the same way as a spin-drier in a domestic washing machine. The packs, although hot, are not sodden and can be applied directly to the patient.

Physiotherapy

Once the temperature has settled and spontaneous pain has all but disappeared, the physiotherapists from the Red Cross Poliomyelitis Centre, which is situated in the grounds of the hospital, attend the patients in the wards daily during the infectious stage, i.e., in the first to four weeks of the illness, to carry out passive movements, gentle massage and to give the patients suitable, simple remedial exercises if these are possible. Later, the patients visit the poliomyelitis centre for more advanced exercises in its well-equipped gymnasium and for hydrotherapy in the Hubbard Tank or in the large swimming bath, where the water is thermostatically controlled and maintained at a temperature of 90° F. and is filtered and chlorinated. The buoyancy and warmth of the water help the affected muscles, and this form of treatment is of great psychological value.

It is also our policy to call in an orthopaedic surgeon early on in the course of the disease. The patient is thus ensured of continuity of treatment once he is discharged from hospital.

Respiratory Failure

Respiratory embarrassment in poliomyelitis falls into two categories:—

(1) Paralysis or weakness of the muscles of respiration (intercostal and diaphragmatic muscles), which may occur with high spinal involvement.

(2) Involvement of the respiratory centre itself.

Intercostal and Diaphragmatic Paralysis

The early signs and symptoms of involvement of these muscles are—

(a) rapid and shallow breathing, rising pulse rate, poor chest expansion and poor abdominal movement;

(b) a diminution in the patient's vital capacity, which can be easily and conveniently measured with a spirometer (see Fig. 2).

It is important to detect these early signs and not wait for the patient to develop cyanosis or to have to call into play his accessory muscles of respiration.

The fundamental principle of affording rest to weak muscles is as important in the case of respiratory muscle involvement as in paralysis or paresis of skeletal muscles.

The patient with respiratory failure must be helped to breathe by means of some form of mechanical respirator.

The following types of mechanical respirators are available in the Salisbury Infectious Diseases Hospital:—

(1) The Tank Respirator (Iron Lung).

In this type of respirator a large leather bellows, which is operated by an electrically-driven motor, creates a negative pressure inside the "tan" or "iron lung," the paralysed chest wall expands, inspiration occurs and then, with the folding together of the bellows, the pressure returns to normal or to a slight positive pressure, and the chest wall "collapses" by its own inherent elasticity and expiration follows. Artificial respiration is induced by the effects of an external negative pressure on the chest wall.

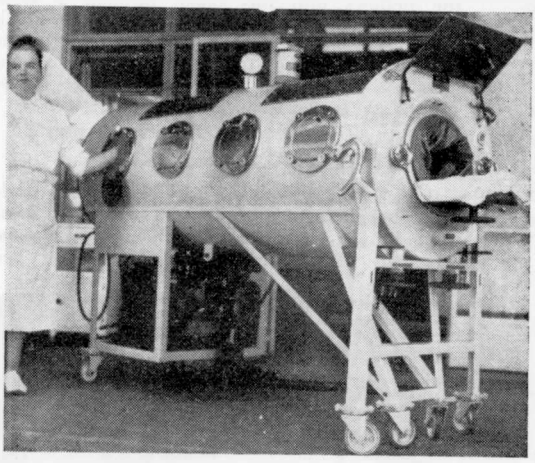

Fig. 2—Emerson Respirator.

The machine, shown in the accompanying photograph, is called an Emerson Respirator, as it is made by the Emerson Company in North America, and costs twelve hundred pounds landed in Salisbury (Fig. 2). The hospital is equipped with two such machines which were imported three years ago to replace the older type of Nuffield or Both Respirator.

The advantages of the Emerson Respirator over the Both type are many, and the following points of this American machine are worthy of special mention:—

(i) The silence and efficiency of the electric motor.

(ii) The relative mobility of the machine, as it is mounted on wheels.

(iii) The ease by which the respiratory rate and degree of pressure, both negative and positive, can be accurately adjusted or controlled. (The normal rate and pressures used for an adult is 18 breaths per minute and —15 to +5 cmm. of water.)

(iv) The ease and speed by which postural drainage can be attained by means of a simple jack which elevates the motor end of the machine.

(v) The generous number of portholes, one of which is oblong in shape and large enough to admit a bed-pan.

(vi) The automatic bell, operated by an electric current from a dry cell battery, which rings as a warning when the pressure falls for any reason, e.g., a leak from an inadequately closed port hole, or main power failure.

(vii) The easily adjustable rubber or plastic neck piece, the adjustable head rest and the easy side-to-side adjustment of the Dunlopillo mattress.

(viii) The ease with which the bellows can be manually operated in the event of a major electric power failure.

(ix) The ability to open the "lung," pull the bed and mattress on which the patient lies, and carry out nursing procedures, e.g., hot packing, catheterisation whilst the patient's head is enclosed in a transparent light plastic dome. Respiration is maintained by air being forced by the bellows into this dome through a metal tube which runs along the floor or underbelly of the machine from the bellows at the motor end to the inside of the dome. The positive pressure within the dome can be easily controlled by means of a simple valve.

(2) THE BRAGGE PAUL APPARATUS.

Artificial respiration is attained in this apparatus by means of an electrically-driven motor working a small rubber bellows which inflates a rubber bag encasing the chest wall (Fig. 3). Positive pressure is here

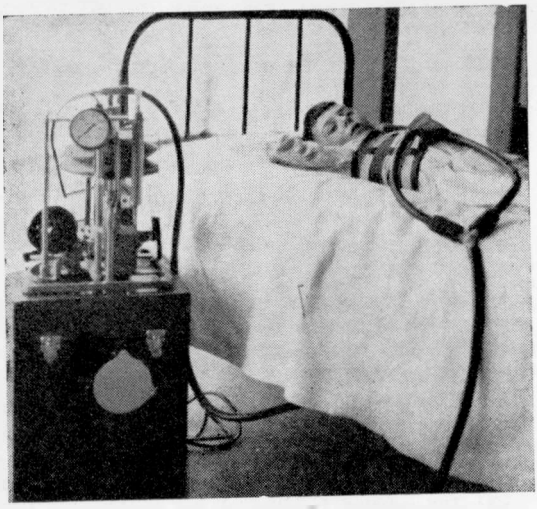

Fig. 3—Bragge Paul Apparatus.

applied directly to the chest in the same way as artificial respiration is given in the first aid Schafer's method. Here too the rate and amount of pressure can be regulated.

With the exception of one case in a teenage girl, we have not found this apparatus useful and the patients usually complain bitterly of a feeling of constriction in the chest.

(3) THE ROCKING BED.

This bed is tilted in a see-saw manner by an electric motor. Both the angle of inclination and the speed can be easily adjusted (Fig. 4). The principle is that

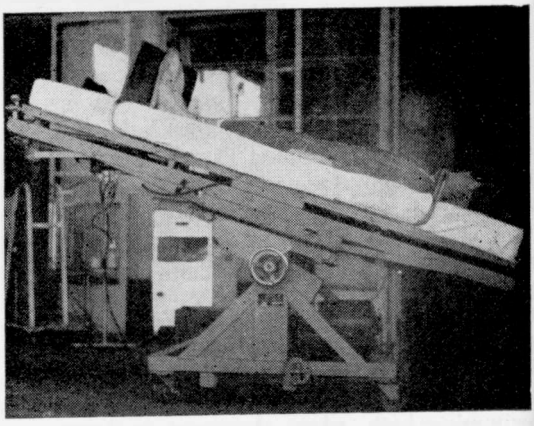

Fig. 4—The Rocking Bed.

when the feet are inclined downwards the liver and abdominal organs drop, thus allowing the diaphragm to move down; and when the patient's feet are tilted upwards, the abdominal organs push the diaphragm upwards.

The rocking bed is used mainly to wean the patients from the iron lung and may also be used in cases with less serious respiratory failure due to poor movements of the diaphragm.

(4) THE ELECTRO-PHRENIC RESPIRATOR.

With the patient lying flat one electrode is placed behind the shoulder and the other, which is attached to a plastic thimble to fit the index finger, is applied to the phrenic nerve where it crosses the scalenus anterior muscle in the posterior triangle of the neck. An intermittent electric current sends an impulse down

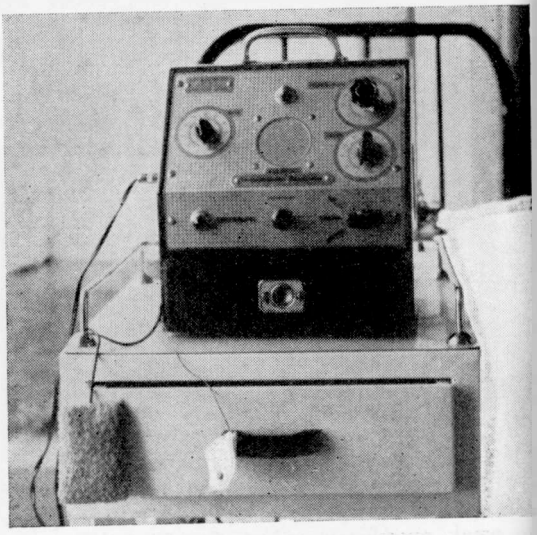

Fig. 5—The Electro-Phrenic Respirator.

the phrenic nerve to the diaphragm causing it to contract (Fig. 5).

The one electrode may also be tied to the phrenic nerve, and this necessitates a surgical operation.

This apparatus is indicated where respiratory failure is due to involvement of the respiratory centre itself and demands an intact phrenic nerve.

(5) THE INTERMITTENT POSITIVE PRESSURE APPARATUS.

This is used in cases where there is a spinal type of respiratory failure and simultaneous inability to swallow.

RESPIRATORY EMBARRASSMENT WITH LOWER CRANIAL NERVE INVOLVEMENT

The patient who has respiratory embarrassment and who unfortunately at the same time develops lower cranial nerve involvement with inability to swallow, with subsequent pooling of mucus and saliva in the posterior pharynx, should not be treated in a tank respirator. The negative pressure induced by the iron lung only sucks these secretions into the lungs, with consequent atelectasis and lung infection. During the extensive outbreak in Copenhagen last year, Professor Lassen evolved a system of treating these patients by tracheotomy and inserting into the trachea a cuffed endotracheal tube through which an oxygen-air mixture is delivered under intermittent positive pressure. The pharynx is thus shut off from the respiratory tree and the secretions are unable to enter the lungs. These secretions are sucked off intermittently through the mouth.

There are on the market for intermittent positive pressure respiration two types of British machines—the Radcliffe and the Beaver Mark 4. Recently we acquired a modified German type through a firm in the Union of South Africa. This machine, which is called a Poliomat, differs from its British counterpart in that there are no bellows, the whole mechanism depending upon the pressure and rate of flow of oxygen from a large oxygen cylinder. In addition to a positive pressure there is a negative pressure phase, regulated automatically, to facilitate the venous return to the right heart. The oxygen air mixture is also warmed and moistened before entering the trachea.

Acknowledgment

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