CYSTIC FIBROSIS OR FIBROCYSTIC DISEASE

THE SWEAT TEST FOR FIBROCYSTIC DISEASE

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This condition which is also known as *mucoviscidosis* is an inborn or genetic disorder and shows a high familial incidence. Different manifestations of the condition may affect siblings—for example, in one child of a family the lungs may be more affected and in another, the small bowel and pancreas.

The earliest manifestation of the condition known as *meconium ileus* in the new-born, may present as intestinal obstruction and necessitate surgical intervention. The cause of the obstruction is the presence of viscid, sticky mucus in the small bowel. In the infantile type and in young children, chronic pulmonary fibrosis is more commonly seen. There is marked viscidity of mucus and sputum. Dyspnoea is common and repeated attacks of pneumonia, often with fatal results occur. Sometimes cavities occur in the lungs or bronchiectasis develops. In the older child the condition may resemble coeliac disease and the occurrence of bronchiectasis in this group is common. Children suffering from cystic fibrosis are often small and under-developed, although mentally normal.

Physiotherapy plays an important part in the treatment of these cases and the earlier it is started, the better; treatment must continue for the rest of their lives, and consists of intensive coughing and draining of the lungs to get rid of the viscid sputum. This must be carried out at least three times a day. The mothers of small children should be shown how to drain the lungs and so be of assistance to the physiotherapist.

The sodium and chloride content of the sweat, tears and saliva is increased and the mother will often report that the kiss of the affected child tastes "salty". This increase in sodium and chloride forms the basis of the "sweat test", the details of which are given below. It is said to be diagnostic of this condition. When involvement of the pancreas occurs, the stools are oily and foul smelling.

The prognosis of the condition is poor-pneumonia or some other intercurrent infection are the usual causes of death at a very young age. With intensive physiotherapy, children have been known to survive to fourteen or seventeen years or older—the oldest surviving individual in England today, with this condition, is twenty-five years—but perhaps with the development of aerosol penicillin and drugs to act on the sticky mucus, the outlook may become more hopeful.

THE TECHNIQUE OF THE SWEAT TEST

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The technique of sweat testing by ionotophoresis used at the Transvaal Memorial Hospital for children in Johannesburg, is based on that used at Great Ormond Street, London, with certain modifications.

Two metal electrodes are used, one 2 by 1½ inches and the other 2¼ by 1¾ inches, with leads firmly attached. The electrodes are covered by 16 thicknesses of lint, folded as usual for constant current, each pad is ½ inch larger than the electrode all round. The smaller of the two electrodes is the anode.

The anodal pad is soaked in a 0·2 per cent solution of pilocarpine hydrochloride. The solution is stored in a refrigerator when not in use. The cathodal pad is soaked in warm water. Both pads are squeezed out until damp only, and the smaller pad placed over the smaller electrode.

The sensory test and further preparation of the patient and apparatus is done as usual for constant-current treatments.

The anode (active) may be placed on the flexor surface of the forearm, adductor surface on the thigh, or lower back, according to the size of the child. These are the skin areas which sweat most profusely. The cathode is placed opposite on the limbs but higher up between the shoulders on the back.

The pads and electrodes are bandaged on with a firm even pressure throughout. The leads are connected to the terminals of a machine which produces a direct (galvanic) current taking care that the smaller electrode is connected to the positive terminal.

The apparatus is turned on and the intensity slowly increased, taking one minute to reach four milliamps.

It is maintained at this level for six minutes and then slowly reduced to zero, taking one minute to do so (8 minutes in all).

The machine is switched off and the electrodes and pads removed. The area of erythema under the anode should be cleaned using distilled water and dried with clean, dry gauze. The area should not be touched by hand. This area is then covered with a piece of gauze which has previously been weighed in the laboratory. The gauze is covered with a piece of polythene a little larger than the anodal pad. The polythene should also be cleaned, using distilled water, and thoroughly dried. The polythene is held in place and the edges sealed all round with strips of zinc plaster to prevent air from entering. This "patch" is left on for an hour, and then removed by the laboratory technician for analysis.

LABORATORY ANALYSIS

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A strip of gauze four layers thick is well washed in double glass distilled or deionized water and allowed to air dry in a clean, covered container. A 15 ml conical centrifuge tube, 25 ml conical (Erlenmeyer) flask and rubber bung to fit are well washed as above and allowed to drain dry overnight.

A section of the clean, dry gauze, approximately 1½ by 1½ inches in area is cut out and placed in the flask by means of a pair of clean forceps. The rubber bung is inserted and the flask is weighed to the fourth decimal place in grams.

After iontophoresis the sweat-soaked gauze is removed from the patient with clean forceps, replaced in the flask and the rubber bung re-inserted immediately to prevent evaporation.

The flask is accurately weighed as before. 5·00 ml deionized water is added to the flask, the rubber bung re-inserted and the flask swirled vigorously to mix the sweat with the water. When completely mixed, the diluted sweat is decanted into the centrifuge tube which is centrifuged at 3000 r.p.m. for a few minutes to sediment any gauze fibres present.

Duplicate amounts of 1·00 ml of the fluid is pipetted into test tubes, 0·025 per cent nitric acid (1 ml) and diphenylcarbazone indicator (0·3 ml) added and the chloride filtrated by Schales and Schales method, using half-strength mercuric nitrate. A further amount of 1·00 ml of the fluid is pipetted in duplicate into 5 ml volumetric flasks, which are then diluted to volume with deionized water. The flasks are vigorously shaken to mix the contents and the sodium and potassium content estimated by flame photometry, employing standards to cover the full range of possible readings e.g. sodium 0·1, 0·2 etc. up to 2·0 m.Eq/l.
Calculation: Chloride:

$$\frac{\text{Weight of sweat + 5 ml water (5 grams)}}{\text{Weight of sweat}} \times \frac{\text{titration of test}}{\text{titration of standard}} \times \frac{10}{1} \text{ mEq/l}$$

Sodium (or potassium):

$$\frac{\text{Weight of sweat + 5 ml water (5 grams)}}{\text{weight of sweat}} \times \frac{\text{equivalence of above standard values}}{20} \times \frac{100}{1} \text{ mEq/l.}$$

An increase in the sodium and chloride content of the sweat is present in cases of fibrocystic disease.

The Versatility of Farado-Galvanic Currents

To the Editor: Medical workers of all categories accept that there are also fashions in the field of treatment. World War I did much to popularize medical electricity, and many will remember that at the Radcliffe Infirmary, Oxford, 50,000 electrical treatments were administered to wounded soldiers.

After 1917 exercise therapy became increasingly popular and has apparently reached its peak at the present time. This is very commendable, because it is most desirable for the patient to use his own muscles actively, whenever possible. But the relative disuse into which many of the older techniques have fallen is regrettable.

The exponentially progressive treatment units have given a new impetus to the use of electrical stimulation in the treatment of enervated muscles.

With the recent advances in electronics, the use of transistors, etc., we now can build machines capable of achieving far more than could have been anticipated by the pioneers in electrotherapy.

In this connection it is interesting to recall that these techniques (progressive muscular stimulation) were practised by Lapicque[1], using the most primitive apparatus.

This short contribution draws attention to several uses to which faradic and galvanic currents can advantageously be put. Tumbrell Fisher, Mennel and more recently Cyriax have developed, co-ordinated and popularized treatment by manipulation. It is largely due to these and other workers in this field that orthodox practitioners of physical medicine and physiotherapy are able to provide an effective and safe alternative to the often drastic and dangerous procedures carried out by exponents of the various manipulative cults. These rational systems of manipulation without general anaesthesia are gaining the prominence and usage they rightly deserve.

It has been observed that in some cases in which faradic stimulation had been given, an anticipated manipulation had been rendered unnecessary, an alleviation of the ailment having resulted. It is, of course, possible that such cases were not due to spinal nerve pressure and exercise therapy has been known to produce a similar result.

However, if careful techniques of placement of electrodes are worked out, some excellent results may be anticipated.

These considerations may be applied not only to the spinal, but also to most other joints of the body. In particular, the articulations of the hand and foot appear to respond very well to electrically stimulated remedial movements.

Many of the most useful moves of the manipulative systems can be stimulated, not as a replacement for straight manipulation, but as ancilliary to such measures.

At the same time several other aims are achieved:

1. Improvements of muscle tone and strengthening of weak muscles.

2. Assistance to arterial and venous circulation; promotion of lymphatic drainage.

3. Stretching of adhesions with resulting improvement in joint movement where restricted.

For these treatments a reciprocating current may sometimes be desirable, bringing about alternate contractions of flexor and extensor muscles.

4. *Gynaecological Conditions.* It is common to give strengthening exercises to the abdominal and pelvic floor muscles. Re-education in the use of these muscles may be usefully assisted by skilful use of surged faradism. Contractions of the levator ani, the gluteal muscles and hip abductors may be stimulated.

Labour. The time to prepare weak muscles for the rigors of childbirth is before the confinement. The number of patients referred for ante-natal classes is negligible compared with the need; here again faradism in certain cases can play a part.

Much experiment may be necessary before we can assess the possibilities of faradic assistance *during labour.* This field should certainly be explored.

Machines with multiple outputs are now available, some with as many as 15 or more pairs of electrodes. Designed for use primarily as an aid to weight reduction, such machines, suitably modified and improved, should prove invaluable in the fields outlined.

Summary

Fashions in therapy influence the choice of treatment.

After 1917 exercise therapy tended to replace electrotherapy in some fields.

Exponentially progressive treatment units have revived interest in therapeutic electro-stimulation.

The techniques of Lapicque (1915) and modern advances in electronics, are compared. Farado-galvanic wave forms as an adjunct to manipulative procedures are mentioned. Use of these wave forms for ante- and post-natal treatment are outlined.

It is suggested that the use of electro-stimulation *during labour* in special cases should be investigated.

Reference

1. Lapicque (1915): Acad. Sci. Compr. Rend., 22 November.

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