eyeballs in which the operation was performed, illustrating advanced glaucomatous processes of directly opposite types, but each absolutely opposed both to any theory or practice that the operation might pretend to support.

One word in conclusion regarding the so-called absolute glaucoma where radical measures have to be adopted. It is quite unnecessary for me to acquaint you with the cause of absolute secondary glaucoma. Hæmorrhage, retinal detachment, thrombosis, ruptured vitreous, tumours, all spell blindness and ultimately suffering. Conditions are oftentimes so marked from lenticular changes, hæmorrhages in the vitreous, or, more likely, from corneal œdema, that intra-ocular tension cannot be detected, though possibly suspected. Such eyes, when recording even a fragment of light, but with pain and faulty projection, are better in a bottle.

I have tried to make the exception in three cases of dislocated lenses which went on to an advanced glaucomatous condition associated with keratitis bullosa when trephining was resorted to. Two ultimately came to enucleation. In the first case the trephine hole was blocked by the iris which was pushed forward by the lens which occupied the anterior chamber. The second was unsuccessful because of the prolapse of the vitreous into the anterior chamber and against the root of the iris. The third case was operated upon by me in 1916, and when seen less than four months ago the patient was in absolute comfort and still in possession of his eye.

THE NEED FOR PROLONGED ARTIFICIAL RESPIRATION IN DROWNING, ASPHYXIATION AND ELECTRIC SHOCK

BY GORDON BATES, M.B., R. E. GABY, M.D., F.R.C.S.(C.) AND WILLS MACLACHLAN, B.A.Sc., M.E.I.C.

Members of Committee on Artificial Respiration, Health League of Canada

"The importance of getting to work with artificial respiration without a moment's delay has been emphasized by those who have had much experience in electrical accidents. No less important is the necessity for continuing artificial respiration until *it is certain* that death has occurred; nothing less than cooling of the body or the onset of rigor mortis should be considered to be evidence of death here." This most important statement appeared in the Goulstonian Lectures by A. J. Jex-Blake (*British Medical Journal*, March 8, 1913).

THERE are several widespread misconceptions concerning the possibility of resuscitation in cases of drowning. Most outstanding are these.

1. That immersion for more than four or five minutes is invariably fatal.

2. That in an apparently drowned person absence of the ordinary signs of life, notably pulse beat, respiration and audible heart sounds, means death, and that if these are absent artificial respiration is unnecessary.

3. That artificial respiration need only be kept up for a limited time, half an hour to an hour. As a matter of fact these ideas are all ill-founded. *It is possible for a person to have been under the water for up to half an hour and still live.* All signs of life may be absent in these cases even for hours. Life under these conditions may still be present, and the person may be revived. Artificial respiration should be kept up for many hours in cases of apparent drowning, just as in the case of electrical shock, carbon monoxide poisoning, etc. The only really safe plan is to continue efforts until rigor mortis has set in.

In this connection it is interesting to note that in Reese's "Jurisprudence and Toxicology", printed over thirty years ago, the statement is made that a person may be under the water for fifteen minutes and still live, although in such cases the suggestion is made that there has been syncope.

With reference to drowning there are many stories of persons who have been submerged for long periods of time. In many cases exact records are not available. The following are of interest.

1. A doctor reports that in Newfoundland a man fell into the water and was submerged for half an hour. He was revived after prolonged artificial respiration.

2. A doctor in Ontario reports the case of a man who was under the water for from 20 to 30 minutes and was successfully revived.

3. The American Red Cross reports a case in which a man was in the water for 32 or 35 minutes and was revived by artificial respiration.

4. In June, 1938, a boy fell into the Kingston Harbour and was submerged for 9 minutes. He was successfully brought around by prolonged artificial respiration.

5. In June, 1938, a child fell into the water in Halifax. Newspaper reports stated that this child was revived after submersion for 10 minutes.

6. A doctor practising in Ontario near Lake Erie reports a case in which a boy sitting on a log fell into the water as the result of a swell from a passing speed-launch. This boy sank in deep water and his body was not recovered for 15 minutes. He was revived as a result of prolonged artificial respiration.

Experimental work on animals carried out by Dr. Ian Urquhart and, later, by Dr. G. H. Ettinger, and reported in the *Journal of Industrial Hygiene,* proved that the passage of an electrical current through an animal causes paralysis of the higher nervous centres, preventing normal reflex responses and hence preventing normal reflexes from various tests for death. An investigation into a considerable number of electrical shock cases by one of the present authors showed that where artificial respiration was started within one minute of the electrical shock, 90 per cent of the victims were resuscitated; where there was a delay of six minutes, only 10 per cent were resuscitated.

Experience has shown that what has been found in the case of electric shock can be applied to cases of drowning and of carbon monoxide poisoning. There is no doubt that many lives could be saved by the prompt application of artificial respiration by well trained persons, and the continuation of this artificial respiration until the patient breathes of his own volition or there are specific signs of death, such as the onset of rigor mortis.

Based upon the evidence that has been developed, a committee under the auspices of the Health League of Canada has been developed with the object of giving wide publicity to the benefits of artificial respiration, collecting field data in regard to drowning, electrical and gas poisoning cases, and carrying out physiological experiments on animals, with a view to perfecting these remedial measures.

In view of the fact that an electric shock accident is one of the most severe hazards in electrical public utilities for a number of years all employees of electrical public utilities in Canada have been thoroughly trained in artificial respiration by the standard technique, based upon the work of Sir Edward Sharpey-Schafer. This training has included a demonstration and explanation of artificial respiration, and the fieldmen of these utilities are required to practise artificial respiration at least once a month, acting as patient and as operator, during these practices. As a result of the training so given many lives have been saved from electric shock, drowning and gas poisoning. The following are simply examples of case histories of these resuscitations.

CASE 1

On May 20, 1927, a young lineman came in contact with 26,000 volts at 2 o'clock in the afternoon. He was unconscious and not breathing. He was lowered to the ground and artificial respiration started by fellow employees; this was continued on the floor of the ambulance while he was being transported to hospital, also on boards on top of a cot at the hospital. Communication was established between the local doctor and consultants in a large city and it was not until 10 o'clock at night that the man was breathing by himself.

In this case it required 8 hours of artificial respiration until the man was safe. This is the longest case of resuscitation from electrical shock of which there is any record.

CASE 2

On May 21, 1926, a young man in carrying out cleaning in a power house, received a shock of 22,000 volts. In this remote power house fellow employees immediately started artificial respiration, and in about 45 minutes the man was breathing. His burns were so severe that he could not be moved and a doctor and nurses were brought to the point, where he was kept for four days. He was removed to a large city hospital where his injuries were found to be so severe that a large piece of his skull had to be removed. He has made a thorough recovery, and is carrying on a useful life with the same organization.

CASE 3

On July 7, 1937, a little girl was playing on a raft near a power house. She fell into the water and sank. Two boys swimming near the spot dived 17 times before they found the child on the bottom near the wall. She was brought to shore, artificial respiration started by a lineman, and after 35 minutes she was breathing normally but was unconscious. After 24 hours in the hospital she made a complete recovery.

CASE 4

On November 18, 1934, a young man was at his home and heard a commotion in a nearby house. On going in, it was found that the lady resident in the house had been overcome by gas. She was unconscious and not breathing. The young man had been trained by his father, and immediately started the application of artificial respiration; after a lapse of some time, and with the assistance of the father, natural breathing was restored and the woman made an uneventful recovery.

CASE 5

On March 18, 1936, a wife went out to the garage to see why her husband was delayed, and on opening the garage found him unconscious and not breathing and she screamed. Two young boys were in the next yard and went to find out what was the trouble. One was the son of a lineman and immediately pulled the man clear of the garage and started artificial respiration while the other boy went for help at the Fire Department and for a doctor. When this help arrived the young man had the patient breathing.

It is quite obvious that prolonged artificial respiration is applicable to all of the types of cases mentioned above. It is quite evident that if artificial respiration is started promptly by will trained personnel and continued without moving the patient, there is the greatest chance for the recovery of the patient. Much valuable

time is frequently lost by endeavouring to move a patient to a hospital, whereas if the artificial respiration were continued on the spot where the patient is, the patient could no doubt be revived and later taken to a hospital. The details of artificial respiration are shown in an appendix to this paper, prepared by the Electrical Employers Association of Ontario.

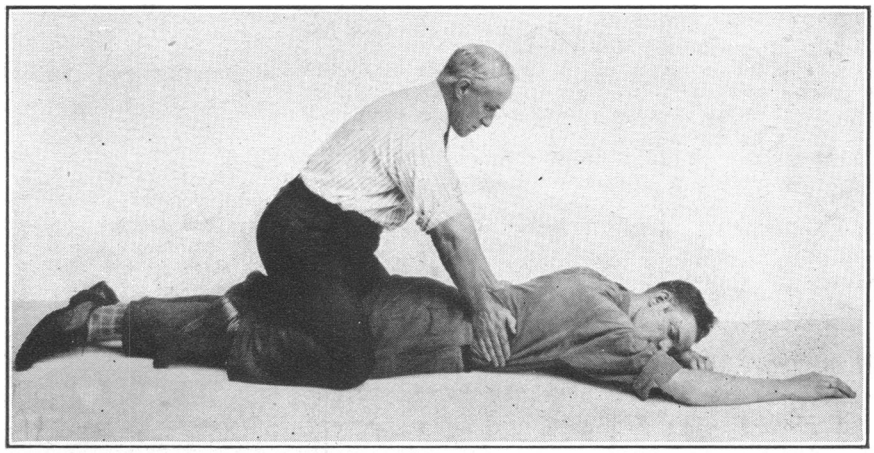

Fig. 1.—Position in which patient should always be placed and kept until conscious, also first position for operator starting artificial respiration.

THE STANDARD METHOD OF RESUSCITATION

The following are the explicit instructions for carrying out the method by what is known as the standard technique:

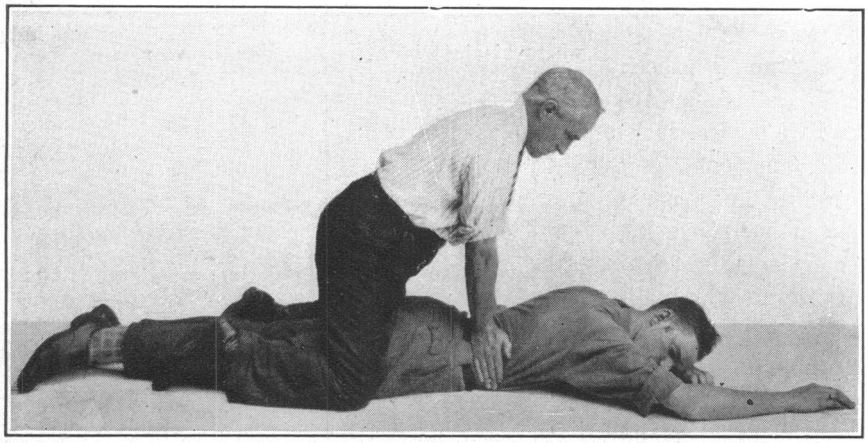

Fig. 2.—Second position of operator giving artificial respiration.

Follow these instructions even if the victim appears dead.

ELECTRICAL SHOCK

Free the victim from the electrical contact as promptly as possible. Use a dry stick, dry rope, dry coat or other non-conductor. The use of your own hands without protection is dangerous and may add another victim to the accident.

GAS ASPHYXIATION

Remove the victim from the gas atmosphere into fresh air. Do not breathe the gas yourself even for a short time. If it does not overcome you it will cut down your strength.

DROWNING

Quickly remove the victim from the water and place on ground or other hard surface. Start artificial respiration at once. The pressure you must exert is the best means of forcing water out of the lungs and breathing passages.

Instantly attend to the victim's breathing.

As soon as victim is clear rapidly feel with your finger in his mouth and throat and remove any foreign body (tobacco, false teeth, etc.). If mouth is tight shut pay no more attention to it until later. Do not stop to loosen patient's clothing, but immediately begin actual resuscitation. Every moment of delay is serious. Proceed as follows:

1. Lay the patient on his belly, one arm extended directly overhead, the other arm bent at elbow and with the face turned outward and resting on hand and forearm, so that the nose and mouth are free for breathing (see Fig. 1).

2. Kneel straddling the patient's thighs with your knees placed at such a distance from the hip bones as will allow you to assume the position shown in Fig. 1. Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib with the thumb and fingers in a natural position, and the tips of the fingers just out of sight (see Fig. 1).

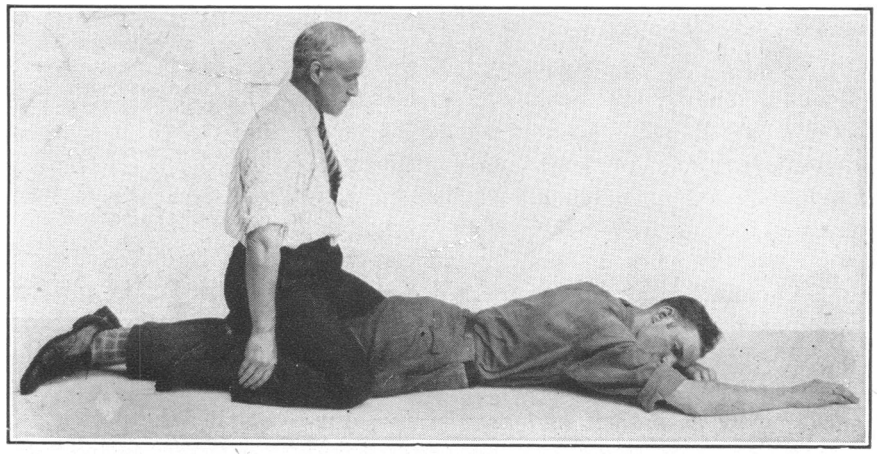

Fig. 3.—Third position of operator giving artificial respiration.

3. With arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing (see Fig. 2). Do not bend your elbows. This operation should take about two seconds.

4. Now immediately swing backward so as to completely remove the pressure (see Fig. 3).

5. After two seconds swing forward again. Thus repeat deliberately twelve to fifteen times a minute the double movement of compression and release, a complete respiration in four or five seconds.

6. Continue artificial respiration without interruption until natural breathing is restored, if necessary, four hours or longer, or until a physician declares the patient is dead.

7. As soon as this artificial respiration has been started, and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest or waist. KEEP THE PATIENT WARM. Do not give any liquids whatever by mouth until the patient is fully conscious.

8. To avoid strain on the heart when the patient revives he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the patient has revived he should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in a small glass of water or a hot drink of coffee or tea, etc. The patient should be kept warm.

9. Resuscitation should be carried on at the nearest possible point to where the patient received his injuries. *He should not be moved from this point until he is breathing normally of his own volition*, and then moved only in a lying position. Should it be necessary, due to extreme weather conditions, etc., to move the patient before he is breathing normally, resuscitation should be carried on during the time that he is being moved.

10. A brief return of natural respiration is not a certain indication for stopping the resuscitation. Not infrequently the patient after a temporary recovery of respiration stops breathing again. The patient must be watched and if natural breathing stops artificial respiration should be resumed at once.

11. In carrying out resuscitation, it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. By this procedure no confusion results at the time of change of operator and a regular rhythm is kept up.

If alone with the victim, do not neglect immediate and continued resuscitation in order to call a doctor. Start at once—the first few minutes are valuable. If other persons are present, send one of them for a doctor without a moment's delay.

The ordinary and general tests for death should not be accepted and any doctor should make several very careful and final examinations and be sure specific evidence is present before pronouncing the patient dead.

In view of the careful study and extensive experiments carried out under the late Professor MacLeod's direction this statement from him is extremely important.

"Paralysis of the nerve centre which controls breathing is the cause of death in many cases of electrocution and, provided the heart has not been directly affected by the current, natural breathing can often be restored by artificial respiration. This allows the still circulating blood to be aerated in the lungs. The only method to employ is Schafer's Prone Pressure Method and a pulmotor or any other form of apparatus should never be used. Since the paralysis of the breathing may last for some time it is necessary to continue artificial respiration sometimes for hours and it should never be discontinued until it is absolutely certain that the heart has ceased beating. As far as can be judged by observations on electrocuted animals, no advantage is gained by using oxygen or carbon dioxide during the artificial respiration, or by administering heart stimulants. It is important to see that the body is kept warm. After natural breathing returns the patient must be kept lying down and he must be carefully watched for several hours to see that the paralysis of breathing does not return. If it does so, artificial respiration must be reapplied."

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THE PERCUTANEOUS TUBERCULIN REACTION*

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THE only certain way of combating tuberculosis, with our present knowledge of the disease, is by early detection and careful supervision. Early detection implies discovery in childhood. The usual method of screening groups is by intradermal tuberculin testing (Mantoux). This test when properly performed by graded dosage is 100 per cent efficient.

Quite apart from the fact that some knowledge of technique is required for doing the intradermal test, this causes a slight amount of pain to the recipient. To an adult the intradermal test suggests no difficulty but to the oft-pricked, pain-protected modern child with over-solicitous parents the thought of another injection is often sufficient to lose for the physician the chance of discovering an early case of tuberculosis. Add to this (*a*) the nuisance of sterilizing needles and syringes and obtaining standard dilutions of old tuberculin or purified protein derivative (P.P.D.) and (*b*) the well-recognized fact that early cases must often be detected by the general practitioner or public health nurse. Although these objections to the intradermal test may appear to be unimportant they are far from being so in practice and actually they have a serious detrimental result. It is obvious that tuberculin testing is not carried out with nearly sufficient frequency today.

* From the Department of Pædiatrics, McGill University, Montreal, and the wards of the Children's Memorial Hospital.

Read at the 16th Annual Meeting of the Canadian Society for the Study of Diseases of Childhood, June 3, 1938, Kingston, Ont.