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New York

Reprinted from the

AMERICAN JOURNAL OF SURGERY

October, 1913

TECHNIC OF THE INTRA-ABDOMINAL ADMINISTRATION OF OXYGEN.

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During the Clinical Congress of Surgeons of North America, held in New York City in November, 1912, I operated upon fifty-four cases, and presented one hundred and twenty-seven additional patients showing features of especial interest. Among these were several which illustrated the intra-abdominal administration of oxygen, by the method first employed by me in 1903, and reported in 1908[1] and 1909.[2 3] Especial interest was manifested in these cases by the attending surgeons, and repeated requests were made for a description of the technic as now employed. In view of the continued successful use of oxygen by this method, of the interest manifested in this particular therapeutic use, and of the general awakening of the medical profession to the therapeutic value of the gas administered for different purposes and by different methods, it has seemed not amiss to briefly describe the intra-abdominal method as now employed.

The therapeutic value of oxygen was recognized almost immediately after the discovery of the gas, in 1773. It was not established upon a definite scientific basis, however, until within comparatively recent years. In a previous communication (1), I traced the evolution of oxygen therapy, as utilized in the treatment of various conditions and by different methods. It is not the purpose of this communication to refer to the uses of the gas by other methods than intra-abdominal introduction.

In abdominal surgery and gynecology, two methods of administration have been employed:

(1) By *continuous current*, as first described by Thiriar in 1899, used by Javaux and others during the early years of the last decade, and latterly, with modifications, by Arnaud,[4] Ramond,[5] and others.

In the continuous administration, as suggested by

Thiriar, and employed by him in tuberculous peritonitis, the ascitic fluid is first evacuated through a button-hole incision, the oxygen being then sent into the cavity in a continuous stream for ten minutes, a free outlet being maintained.

The gas was also used by Thiriar and his followers for flushing out the abdominal cavity after laparotomies. The application of oxygen in this manner is made with the object of stimulating the tissues, preventing the extension of the inflamma-

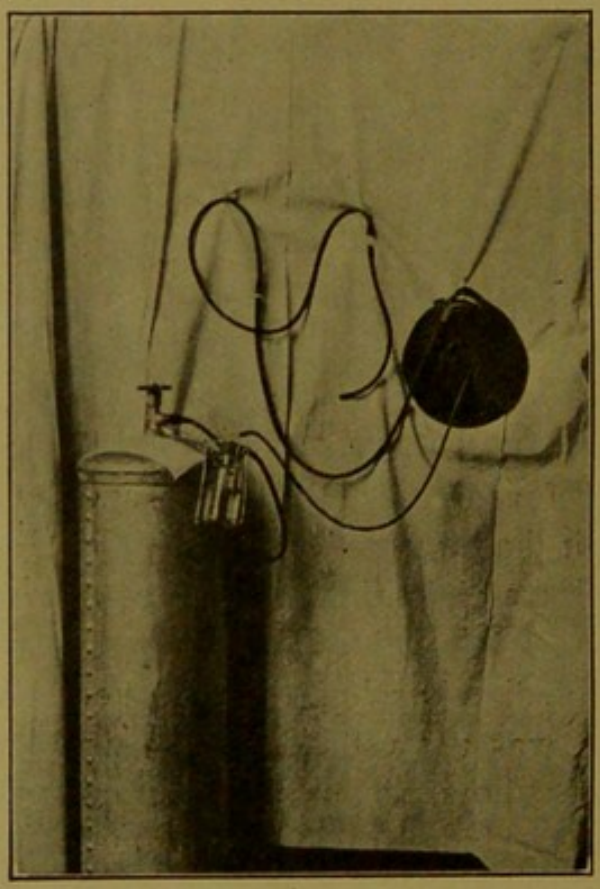

Fig. 1.—(1) Oxygen tank. (2) Wash-bottle. (3) Rubber tubing.

tion, causing increased phagocytosis, destroying the germs or diminshing their virulence, neutralizing their toxins, and "substituting an oxygenated emphysema for the microbian emphysema."

In the cases recently reported by Arnaud, the injections were repeated three times a day, in one case (30 liters at the time), and twice a day in the second case (50 liters per injection), while in the third case a continuous current (600 liters) for 36 hours, was employed.

(2) *By injection into the peritoneal cavity,* with *immediate closure of the abdomen,* and *gradual absorption of the gas.*

In this method, which I have employed since 1903, there is no repetition of the injection, nor is there a continuance of the current. The gas is merely introduced into the abdominal cavity, with greater or less degree of distention, according to circumstances, with immediate closure of the abdominal wound, the gas being left *in situ* to be gradually absorbed.

The experimental investigations by which our

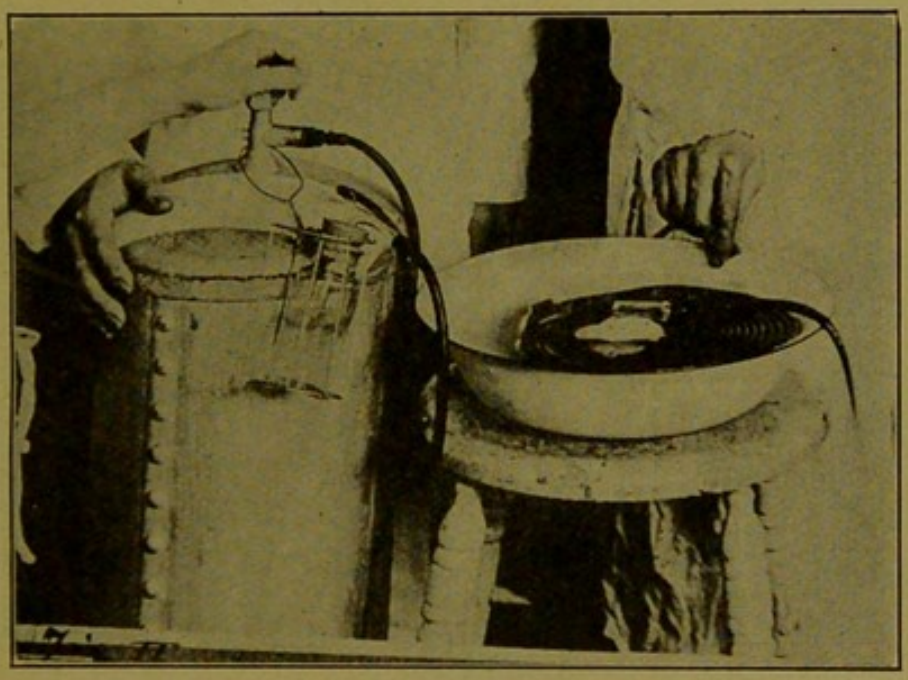

Fig. 2.—(1) Oxygen tank. (2) Wash-bottle. (3) Rubber tubing coiled in pan of hot water.

clinical observations and deductions were verified, were conducted for the purpose, specifically, of determining the following points:

(1) The absorbability of oxygen.

(2) The effects of oxygen upon (a) blood-pressure, (b) pulse, (c) respiration, (d) degree of anesthesia, (e) time of recovery after anesthesia.

(3) The comparative effects upon the above when oxygen is employed and when air is employed.

(4) The danger point of intra-abdominal pressure as manifested by a fall in blood-pressure, respiratory embarrassment, and cardiac failure.

(5) The effect of oxygen upon adhesions in the abdominal cavity.

From the experiments the following deductions were made:

(1) Oxygen is completely absorbed in the abdominal cavity. (2) It is a slight respiratory stimulant. (3) It is a slight cardiac stimulant. (4) It has but little effect on blood-pressure when the pressure of the gas is moderate. (5) It tends to bring an animal quickly from deep anesthesia. (6) It hastens the recovery of an animal after discontinuance of the anesthetic. (7) A pressure of more than 2,500 mm. of water may cause collapse. (8) Oxygen

Fig. 3.—Passing of oxygen from tank into abdominal cavity.

tends to prevent the formation of adhesions. (9) It quickly changes a dark blood to a scarlet in cases of anoxemia. (10) It stimulates intestinal peristalsis. (11) It is not an irritant to the peritoneum or abdominal viscera.

The purposes for which oxygen is administered intra-abdominally are as follows:

(1) To lessen shock, nausea, and vomiting.

(2) To overcome negative intra-abdominal pressure after removal of large tumors.

(3) To prevent the formation of adhesions.

(4) For its effects upon tuberculous peritonitis of certain types.

(5) For its effect upon pus-producing organisms and their toxins.

The oxygen employed for these purposes must, naturally, be as nearly "pure" as it is possible to obtain. The gas which I have employed for a number of years, has been shown, by careful analysis, to contain from 94.3 per cent. to 97 per cent. oxygen; 2.37 per cent. to 4.5 per cent nitrogen; a trace of carbon dioxid; no chlorin; no nitrous oxid.

The gas is warmed, usually to a temperature of from 90° to 100° F. This is accomplished by pass-

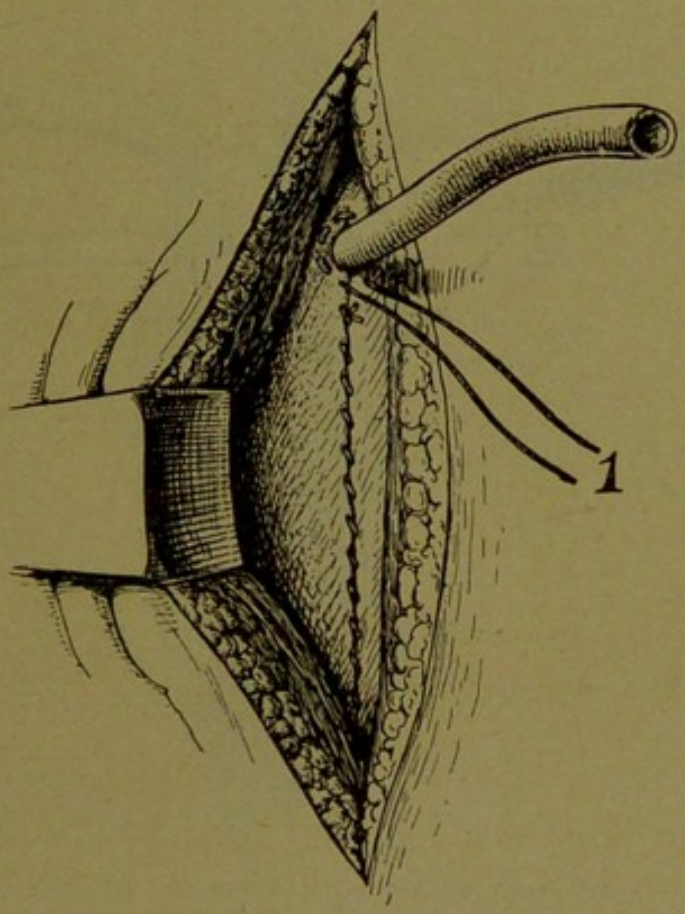

Fig. 4.—(1) Showing suturing of peritoneum; continuous stitch to inserted tube, purse-string stitch encircling tube.

ing it through a rubber tube from the tank in which it is compressed into a wash-bottle filled with hot water. From this bottle the partially warmed gas passes through the exit tube, which is coiled in a basin of hot water. This long exit tube is again connected to a piece of glass tubing, and to this, in turn, is attached a piece of sterile rubber tubing through which the gas is introduced into the abdominal cavity. (Figs. 1, 2 and 3.)

The technic of closing the wound and withdrawing the rubber tube is shown in figs. 4, 5, 6 and 7.

The amount of oxygen to be administered depends upon the exigencies of the case. Where there is abdominal distention from ascites or tumor the girth of the abdomen should be measured before operation, and after removal of the fluid or the tumor, the abdomen should be distended to the same or perhaps a little less degree by the admission of oxygen. In the case of shock, hemorrhage, etc., a crude, yet practical, test in the average case is

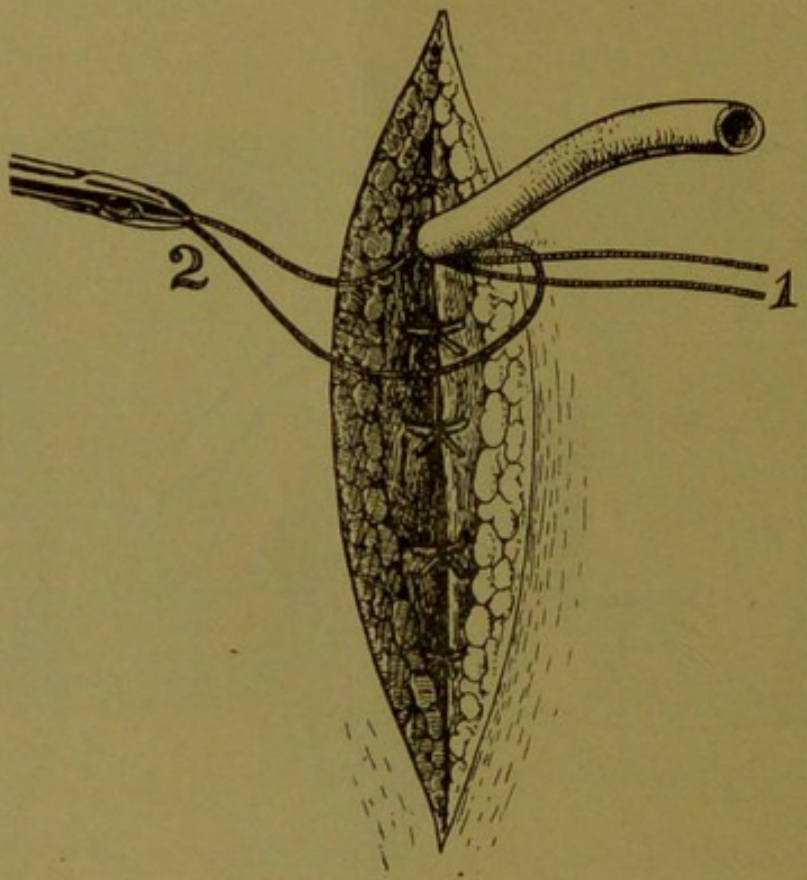

Fig. 5.—Aponeurosis united with interrupted sutures, the muscle having been previously sutured. (1) Untied ends of peritoneal purse-string. (2) Untied suture through aponeurosis, passing half way around tube.

found by first determining that the liver is not adherent to the chest wall and is of approximately normal size, then administering enough oxygen to obliterate liver dulness.

The abdominal wound is closed, except at the lower or upper end, as the case may be, where the free end of the tube is placed within the abdominal cavity. One stitch is introduced above and one below the tube, and these are tied. An inter-

rupted stitch is placed in the peritoneum at this point, ready to be tied, and a purse-string suture is introduced around the tube in the peritoneum, left long but not tied. All layers of the abdominal wall are closed, up to the skin, and the stitches tied, with the exception of those in juxtaposition to the tube. These, layer by layer, are tied after the purse-string stitch has been fastened.

When the desired amount of gas has been introduced the tube is carefully withdrawn and the purse-string stitch tied, all the others being fastened

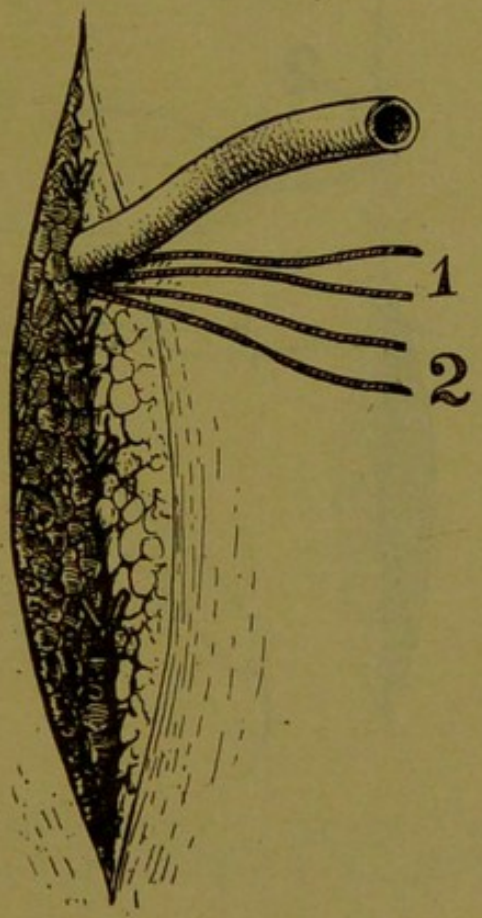

Fig. 6.—Superficial fascia united. (1) Untied peritoneal purse-string. (2) Untied aponeurosis suture.

layer by layer. Care should be taken of course, to prevent intracellular emphysema, which, while not harmful, may be a source of some discomfort to the patient.

I have used oxygen by the method described in more than 125 laparotomies, with uniformly favorable results. Experience continues to verify my earlier contention that oxygen, intra-abdominally administered, has a distinct field of usefulness in

lessening shock, nausea, and vomiting; in overcoming negative intra-abdominal pressure after removal of large tumors; in tending to prevent the formation of adhesions, or, when adhesions have been broken up, lessening the liability of their return; in influencing favorably certain types of tuberculous peritonitis; and in exerting a beneficial effect upon septic peritonitis.

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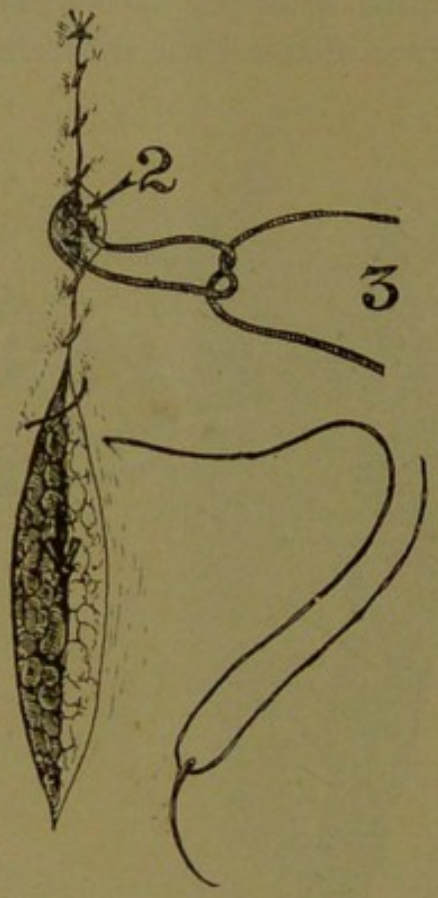

Fig. 7.—Tube withdrawn. (2) Peritoneal purse-string tied, knot beneath aponeurosis. (3) Aponeurosis suture. Figure illustrates practicability of placing skin stitches while tube remains in the abdomen.

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[1] Bainbridge,—Oxygen in Medicine and Surgery—A Contribution, with Report of Cases.—*New York State Jour. of Med.*, June, 1908.

[2] Bainbridge,—The Intra-Abdominal Administration of Oxygen, —A Further Contribution, with Reports of Additional Cases.—*Annals of Surgery*, March, 1909.

[3] Meeker,—The Intra-Abdominal Injection of Oxygen as Studied in Animals. Report of Cases in the Human Subject.—*New York Med. Jour.*, April 10, 1909.

[4] Arnaud,—Intraperitoneal Injection of Oxygen in the Treatment of Acute Diffuse Peritonitis.—*Lyon Chir.*, 1912, VII, p. 411. See also: Abstract of Arnaud's paper in *Surg., Gyn. and Obst.*, February, 1913, p. 23.

[5] Ramond,—Indications and Technique of Oxygen Injection.—*J. d. Med.*, Paris, 1912, XXXII, October.