Wywodzoff

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# EMBALMING THE DEAD.

On a Method of Embalming of the Dead, by the use of Thymol. By Dr. Wywodzoff, of St. Petersburg, Russia.

DURING the present year I published a history of embalming as practised in ancient and modern times, including an account of my own experiments in the art, with a description of the material used and the apparatus employed for embalming the dead.

The following pages are a synopsis of that part of the work which relates to some of my own experiments, and is designed to explain the apparatus, and material used.

Embalming the dead was largely practised anmong the ancient Egyptians, as a religious rite. At the present time embalming is but little resorted to, and only for the purpose of preserving the bodies of eminent men, or the temporary preservation of bodies for anatomical purposes.

The process of embalming, as performed by the ancients, and also as performed by moderns, is in many respects a failure. In order that it may become practicable at the present day the following requisites are necessary, viz.: 1st. That the body shall be preserved in a soft, flexible condition, at least for the period of three months. 2d. The tissues should not be changed in color. 3d. The material used should be neither injurious to the health, nor spoil the instruments employed in the operation. 4th. The material used must either be free from odor, or it must have an agreeable odor. 5th. The material must be cheap.

It has been discovered in modern times that salicylic acid and thymol possess the above mentioned properties. The first has no odor whatever; the last has a pleasant odor.

Thymol was discovered by Gerard. The only history we have of thymol is contained in articles published during the past six years. Packe become convinced that thymol could be used in all cases where carbolic acid was used. Peshabodoff has described the influence of thymol upon certain animal ferments. Sulemo-Sumoilo determined the action of thymol upon milk and other animal ferments. Levin

described thymol as "anticepticum" and "antifermentioum." Thymol, or acidum thymicum, is obtained from ol. Thymo. It presents camphor-like crystals, possessing an aromatic odor, and, in concentrated solution, has a strong, pungent taste. The formula is $C_{10}H_{14}O=(C_{10}H_{13})HO$. It melts at 440° R., boils at 200° R., is soluble in alcohol, ether, fatty oils, and in 333 pts. of water. The opinion of the above-mentioned authors is that thymol, like carbolic acid, combines with animal tissues, preserving them from decay by retarding fermentation.

Levin's experiments showed that milk mixed with thymol decomposes from five to twenty days later than milk diluted with water. Milk standing in an open vessel generally decays in from ten to twelve days. That with which thymol has been mixed can be kept in perfect condition for five weeks.

Experiments were also performed with egg albumen. Filtered white of an egg decays after standing three to four days; but when mixed with thymol, it does not show the slightest sign of decomposition even after eleven weeks.

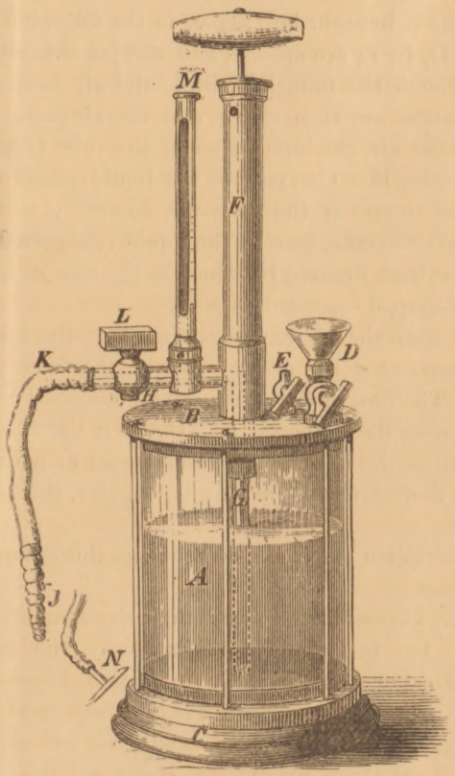
The above mentioned authors also stated that thymol has the property of deodorising. Levin proved that the most offensive pus mixed with thymol loses its repugnant odor.

Experiments also showed that thymol taken internally is harmless in its action, and its medicinal value depends upon its property of arresting pernicious fermentation of the stomach.

The substance possessing such remarkable antiseptic properties can be procured at a moderate price. One pound of thymol costs in Russia, nine roubles and ninety kopeks (seven dollars and twenty-five cents). This, however, is twelve times the cost of carbolic acid; but the very small quantity of thymol used to obtain the same effect makes it, after all, a cheaper material, as a disinfectant or antiseptic.

In using thymol for the purpose of embalming, I dissolved it in different proportions in alcohol, in glycerine, in glycerine and water; also in water, adding to the solution gum-arabic. These various preparations I used as an antiseptic liquid for injecting separate organs, and also whole bodies. The results of these operations I give in subsequent pages, with a description of each experiment. But as a survey of these experiments depended as much upon the apparatus used for embalming as upon the liquid itself, I will first describe my injector. The apparatus consists of a glass jar, A, seventeen centim. in length, eleven centim. in diameter, having the capacity of four pounds (pints). This jar is hermetically closed by a brass cover, B, which is connected to a heavy brass stand, C, by six brass rods secured by nuts. Through the cover

passes a glass funnel, D, with a stop-cock for passing the liquid into the jar. A brass tube, E, with a cock, permits the exit of the air, when the




fluid is poured into the jar; an air-pump, F, for the condensation of air, has a piston with a spiral spring. Through the barrel of the pump, besides the channel for the passage of the air, there is also a glass tube, *G*, which arises from the bottom of the glass jar, and is continuous with the channel of the cylinder, which is bent at a right angle, and connected to the horizontal tube H. The horizontal tube H, at its termination, affords an attachment to the rubber branch, K. The tube H, has also a stop-cock, L, for controlling the flow of the liquid, and a manometer, M, by which the pressure of the liquid is determined, and the flow regulated. The glass manometer is enclosed in a brass

tube, which has divisions indicating the atmospheric pressure. The only part of the apparatus that remains to be described is the T-shaped canula N, which is designed for introduction into the artery, and to be connected with the rubber branch, K.

The apparatus is brought into action in the following manner. All the stop-cocks D, E, L, are opened, and the jar is filled with the antiseptic fluid through the funnel D, while the air escapes through the tube E. The cocks are then closed, and the air-pump used. Under the pressure of the air, the liquid rises in the tube G, and passes into the horizontal tube H. One part of the liquid passes into the manometer, and rises to one of the divisions, according to the amount of pressure exerted; the other part of the liquid (the cock L, being open) passes into the rubber branch, K, which at the time of injection is connected to the T-shaped canula, N.

It is evident from the above description, that the higher the liquid arises in the manometer the greater will be the force and volume of liquid ejected. The flow of the liquid can be increased or diminished at pleasure by turning the stop-cock L. But if it should be necessary to keep the column of the liquid in the manometer at a certain hight, in order that the flow of the liquid may be regular, the pumps must be constantly used.

From the description given it is evident that this apparatus is simple, strong, and cheap.

In making my experiments I gave particular attention to the following questions: 1st. Is it sufficient to introduce the canula into one carotid, as was commonly practiced by Ganna, Dupres, Sugnet, and others; or it is necessary to introduce it into both carotids? 2d. Is it necessary to introduce the T-shaped canula, or will an ordinary tube answer as well? 3d. Is it necessary to drive out the blood from the veins, or not? 4th. What quantity of the fluid is necessary for a complete injection?

September 4, 1875, I injected a right arm which had been amputated at the *shoulder*, with the following solution:

R. Thymolis, two scruples.
Glycerine, lb. iv.
Aq. lb. ij.

The weight of the arm after the injection was 2700 grammes. After a month, 2660 grammes. On the 4th of November, (two months after the injection was made), I demonstrated the arm before the Medical Society of St. Petersburg, and it was acknowleged by all the present members that it did not differ in external appearance from the arm of

a living man. The tissues had not changed in color, were normally soft, flexible, and had the pleasant odor of thymol. After the fourth month the arm was not changed in appearance, only diminished in weight 60 grammes.

This experiment proved, 1st, that thymol is a true antiseptic. 2d. That a mixture of glycerine and water is superior to glycerine and alcohol, because it does not evaporate so quickly, and is equally preservative.

September 5, 1875, I injected the body of an infant, three months old. Its weight was 3570 grammes; its length 58 centm.; its chest measure, 30 ctm; circumference of the head, 37 centm. The injection was made by both carotids, with the following solution:

| | |
|---|---|
| R. Thymolis, | two scruples. |
| Glycerine, | lb. iv. |
| Aq. | lb. ij. |

The T-shaped canula used in this injection was introduced into the common carotid at that point where it divides into the internal and external carotids. At the same time I made an incision in the internal jugular veins, and proceeded to inject the antiseptic fluid. The weight of the body after the injection was 5300 grammes. This experiment proved to me that the quantity of fluid necessary for the injection of a body is equal to the half of the weight of the body.

For the first month or so after this injection, the skin retained its original color and the muscles and joints were in their soft and flexible condition. In this condition the body was presented before the Medical Society of St. Petersburg. Four months later the body was found in the same condition, except that it had lost in weight—the weight now being 5100 grammes—a decrease of 200 grammes. This experiment showed that thymol could be used for preserving a whole body as well as separate organs.

November 4th, of the same year, I injected the right foot of an infant, four months old, using the same solution as in the other experiments. The injection was made by the femoral artery. When all the liquid had been injected, the canulas were left in the artery and vein, and the rubber branches tied with ligatures. In this condition it was left for one month, and the rubber branch was then removed, and fluid allowed to escape for forty-eight hours from the limb. An injection with a syringe and with ordinary red material was made. On dissecting some muscles and exposing to view main arteries and nerves, I found the muscles and nerves in a perfect condition, very much resembling the preparations of Laskovsky and Brusso, which were exhibited at the

Paris Exposition in 1867. This preparation, which is in my possession, was found after several months in most desirable condition.

June 12, 1875, I injected the kidney of a calf with solution—

R. Acidi Salicylici, drachm (*B.*)
Glycerine (hot), lb. j.

I kept this kidney in my room in an open jar (the temperature of the room + 14°R.) for seven months. At the beginning of the third month it had diminished in size, and the liquid was escaping through the capsule, and the whole surface was covered with mould. At present it is very much diminished in size, the whole surface is covered with a thick layer of mould, resembling white down. When cut, it shows dark red color, with fatty gloss. I placed a piece of the kidney in alcohol for microscopical dissections. Next day I noticed that the piece became white, but all elementary tissues could be easily detected under the microscope. The same experiment was performed with the solution of thymol in glycerine. In this case the kidney was not covered with mould; and even after seven months, the pleasant odor of thymol could be detected. The elementary tissues were seen as well as in the first case.

23d of October, 1875, I injected the livers of two children, one, (*a*) with the solution of

R Ac. salicylici,
Boracis venet. *aa* two drachms.
Gumm. Arab. one ounce.
In Aq. com. ounce xj.

The other (*b*) with solution of

Thymolis, gr. rj.
Gumm. Arab. one ounce.
In Aq. ounce xj.

Each liver was injected under very low pressure, through the hepatic artery. The rest of the blood vessels I tied with ligatures. After the injection both livers presented a pale pink color. I kept them in a warm room, at + 14° R. In this case I used neither glycerine nor alcohol, on account of their antiseptic properties. On the contrary, I added gum arabic, a substance which hastens fermentation when in contact with organic tissues. The liver was taken for this experiment as an organ which, in contact with air, decomposes very soon. All this was done by me to prove the antiseptic property of Acid. Salicylici in comparison with Thymolis. Two weeks after the experiment (No. 4) the liver (*a*) looked dusky, and was diminished in size: the other liver (*b*) kept its previous color, and also was diminished in size.

Six weeks later the liver (*a*) was very much darkened, and had now diminished to one-half of its original size, and was covered with mould; had no odor; its consistency appeared soft. The liver (*b*) preserved its pink color; its surface remained free from mould, had same consistency as liver (*a*). At the close of the following four months liver (*a*) was entirely covered with mould; liver (*b*) had darkened a little, but no mould was seen. Both livers were diminished in size. When cut, the parenchyma was found in good condition; only at the surface liver (*a*) was darker than liver (*b*).

This experiment shows that Thymol is to be preferred to Salicylic Acid. We also learn from these experiments that preparations injected with Salicylic Acid were covered with mould, while those injected with Thymol had nothing of the kind. Like experiments were performed by me with spleens, kidneys, lungs, etc., giving always the same results. This is the reason why I think that Salicylic Acid could be used as an antiseptic only when the organ is immersed in the solution, so that all the parts come in contact with it. Thymol, like Carbolic Acid, soon evaporates, so that even parts not injected may be brought in contact with it.

To be more certain, I made the following experiment:

22d of November, of the same year, the livers of two children were injected—liver (*a*) with a solution of Salicylic Acid in water, 1:700: liver (*b*) with solution of Thymol, in water, 1:333. The injection was made in the same way as before. Each liver was immersed in a jar containing the solution of material injected, covered with paper, and placed in a room at + 14°R. Two weeks later I took the livers out of the solution. Both were in the same condition: the only difference was, one had no odor whatever; the other the odor of Thymol. I kept both livers in the open air in my room during two weeks. After that time I noticed that both were a little dried; the upper surface of the liver (*a*) was covered with a thin mould; the surface which was in contact with the bottom of the jar had only mould in three points; the liver (*b*) had no mould whatever.

This experiment convinced me that my opinion regarding the use of acids, salicylici, and thymolis, was correct. My researches on this subject lead me to the following conclusions:

1st. Thymol, diluted with water and glycerine,

(℞ Thymolis two scruples,
Glycerine ℔ iv.,
Aq. ℔ ij.,)

is the best liquid which could be used for injection of a whole body, as

well as separate organs. Like Carbolic acid, it evaporates, which enables it to come in contact with the parts which begin to dry after the injection.

2d. Salicylic Acid is also a good preservative, but only when it is in contact with all parts of the injected tissues.

3d. The quantity of the liquid used must be half the weight of the body.

4th. The success of the injection can be best attained when the cavities are not opened, the viscera left in, and unnecessary incisions avoided.

5th. The complete injection of a body must be accomplished by slow filling of the blood-vessels; and this could be very readily done by the above-described apparatus, with the manometer.

6th. For complete injection of a separate part of a body, it is necessary to put the cut end in boiling water, and then to cork the ossious canal.

7th. One or more veins should be kept open until all the blood is driven out from the body. Then the veins must be tied with double ligatures, when the injected fluid begins to run over through the openings of the veins.

8th. In embalming bodies of adults T-shaped canulas must be introduced, not only in both carotids, but also in one or both femoral arteries.

9th. The wind-pipe should be opened and a cork placed, when during the injection the fluid will escape through the mouth.

10th. Injection should be stopped only when the capillaries of the integument are filled, and when the manometer shows five atmospheric pressures. When under such pressure the capillaries of the integument are not quite filled, the injection should be continued through some other artery.

11th. When injection of a body, or of a separate organ, is performed, this operation should be stopped even, in the first case at three atmospheric pressures; in the second when the manometer shows two to three atmospheric pressures.