

insure safety if the water be boiled for ten minutes. Boiling for one hour or even for one-half hour is not necessary.

Objection to the use of boiled water is sometimes made on the ground that unless the water be carefully protected after boiling a multiplication of bacteria will take place which will raise the germ content to a point higher than that originally obtained. Such an objection fails to take into account the really significant feature. A multiplication of the saprophytic bacteria present in a pure spring water may likewise occur, even at a low temperature, but there is no reason for supposing that the sanitary quality of such a water is in any degree impaired. In other words, it is not the number, but the kind of bacteria present that possesses sanitary significance. It is a relatively simple matter to guard against accidental introduction of typhoid bacilli or of cholera spirilla into a boiled water, especially since these germs rarely if ever occur floating in the atmosphere and then only in the immediate neighborhood of the sick.

The sterilization of water by the use of chemicals has also been frequently attempted, sometimes with a high measure of success. In recent years the purification of water on a large scale through impregnation with air containing a high percentage of ozone has been undertaken in certain German water works. The ozone is generated by electricity by special appliances and the amount introduced into the water is so adjusted on the basis of carefully controlled experiments as to afford a maximum of operative efficiency with a minimum output of ozone. In several places small ozone plants were installed in connection with water works, and the waters treated by this process are said to be very low in bacteria, the number in the raw water being sometimes reduced from 20,000-30,000 per c.c. to only 8-10. The matter of expense, however, is not reassuring for the future of the ozone treatment on a large scale and the wholesale treatment of public water supplies with ozone does not seem destined to wide extension. A plant established in Wiesbaden has been recently abandoned.

A number of other methods have been proposed for the sterilization of water by chemical means. Compounds that liberate chlorin (Moritz, Traube), bromin (Schumburg) or iodine (Vaillard) have been especially used for this purpose. The risk of imparting a disagreeable taste to the water seems, however, to be considerable and in practice these methods have usually failed to meet the expectations of their advocates.²⁶ Recently the use of copper sulphate has been championed as a means of freeing water supplies both from algal pests (Chapter III.) and from disease germs.²⁷ "At ordinary temperatures 1 part of copper sulphate to 100,000 parts of water destroys typhoid and cholera germs in from three to four hours. The ease with which the sulphate can then be eliminated from the water seems to offer a practical method of sterilizing large bodies of water, when this becomes necessary." Further experimentation seems desirable.

An effective mode of chemical treatment would possess obvious advantages. In tropical countries and among exploring expeditions or soldiers on the march the surer method of sterilizing water by boiling encounters overwhelming obstacles. The substances that have been proposed for use under such conditions have not, however, given very satisfactory results. Potassium permanganate is reasonably efficacious in destroying pathogenic bacteria in water under laboratory conditions, but in the field its value is problematical, especially in those cases in which the water contains much organic matter. Parkes and Rideal²⁸ have recommended sodium bisulphate in the proportion of fifteen grains to the pint, action of the chemical to continue for 15 minutes before use of the water. Other observers have failed to confirm altogether their statements, and it is obvious that natural conditions may vary so greatly as to make generalizations based on laboratory experiment of little value. The use of citric acid (lemon-juice) as a germicide may be looked on with even greater scepticism. On the whole, the employment of chemical substances for water purification can hardly be said to be as yet on a very sure foundation.

26. See for example Schüder on the bromin method, *Zelts. f. Hyg.* 1901, 37, p. 307.

28. *Trans. Epidem. Sec., London*, 1900-01, 20, p. 33, letin No. 64.

27. *Trans. Epidem. Soc., London*, 1900-01, 20, p. 33.

Clinical Notes

IMPROVED METHODS FOR THE GUAIAIC TEST FOR BLOOD AND THE OXIDATION TEST FOR INDICAN.

JAMES W. HOLLAND, M.D.

PHILADELPHIA.

The usual method for the guaiac test calls for an old sample of turpentine which has dissolved active oxygen from the air, or in lieu of it a fresh bottle of hydrogen dioxid. The turpentine of ripe age is not always at hand and, like the hydrogen dioxid that has been used through the summer, is of uncertain oxidizing power. An oxidizer of constant strength in any climate is much to be desired. In the usual process liquid reagents are employed in the test tube, which means a larger volume of the blood material than can always be obtained and a response not sensitive enough for small quantities. Sometimes a few threads of blood-stained linen are all that can be had.

THE MODIFIED GUAIAIC TEST.

To meet this difficulty the following modification is proposed: The oxidizing agent is sodium perborate as made by Schering from sodium dioxid and boric acid. It is better than sodium dioxid alone because it does not absorb water and carbon dioxid from the air and is, therefore, more stable. The sample I have used has been kept loosely boxed for a year and a half. Immersed in water this yields hydrogen peroxid and oxygen as freely as when first obtained. Because of its compactness the tablet form is preferred.

METHOD.

A solution is made of freshly broken pieces of guaiac resin by boiling them with alcohol in a test tube for a few minutes until the tincture is yellow. The suspected material, which may be a drop or two of blood or of bloody urine or of water in which a blood-stained fabric has been steeped, is cautiously mixed with a drop or two of guaiac solution to make a milky mixture. This is brought in contact with a fragment of sodium perborate on a white plate.

If the proportion of blood is large the white perborate turns blue in a few minutes and remains blue until the drying of the guaiac leaves a yellow residue which changes the blue to green. This blue-green color persists on and about the perborate and is well shown on the white background for at least a week. If the proportion of blood is small the white perborate takes on a pale blue hue which turns green as the guaiac dries. The next day a distinct green stain is left on the white plate. The test is simple and delicate, though it must necessarily be open to the fallacies that belong to the guaiac test in any form. A distinct reaction was obtained from a small five-year-old blood stain on linen.

THE INDICAN TEST.

Jaffe's test for urinary indican commonly employs a solution of chlorinated lime or of chlorinated soda or of hydrogen dioxid. Great care is enjoined lest excess of the reagent should carry oxidation beyond the desired point of indigo-blue to that of isatin, a yellow substance. All of these reagents are liable to be of indefinite strength, and, therefore, each must be added at first in amounts suitable for a strong specimen, though later it may prove to be lacking. Potassium chlorate has

been advocated because of its definite composition, but the reaction with it is often disappointing and tardy.

Because of its permanent strength and prompt action, sodium perborate stands us in good stead. From healthy urines, containing about 1 to 5 mgs. (.001 to .005) of indoxyl salts per liter, I obtained a distinct indigo-blue reaction, uniformly, by the following procedure:

METHOD.

To a test-tube filled one-fourth with urine an equal quantity of concentrated hydrochloric acid is added to liberate the indoxyl-sulphuric acid or urinary indican and then as oxidizer a piece of sodium perborate as large as a full-sized pea. The mixture, which immediately effervesces briskly, is gently agitated to dissolve the perborate. The urine promptly deepens in color and if the amount of indican be large, turns faintly blue. To concentrate the color, one cubic centimeter (16 minims) of chloroform is added, the tube closed with the thumb and the contents *gently shaken for at least two minutes*. The chloroform separates at the bottom as a layer varying in depth of blueness with the proportion of indican. Some pathologic urines yield a layer almost black in color. If the shaking is too vigorous the chloroform is emulsified and remains milky, though with a decided blue tinge.

If the patient is taking potassium iodid, Jaffe's test is always liable to a fallacy from the violet blue color of free iodine in chloroformic solution. If this complication is suspected, the acid fluid is poured off and to the blue chloroform potassium hydroxid is added. Color due to iodine disappears while indigo-blue remains.

RECOVERY FROM BROKEN NECK.*

ARTHUR AYER LAW, M.D.

Instructor in Operative Surgery, Medical Department of the University of Minnesota.
MINNEAPOLIS, MINN.

This case is of interest, not because a broken neck is especially rare, nor is recovery with partial restoration of function very unusual, but complete recovery following operative interference from fracture through the cervical vertebræ is almost unprecedented. I use the term broken neck advisedly—the conclusions of practically all observers have been that a dislocation of the cervical vertebræ without some fracture is impossible. If we are familiar with the bony contour of the vertebræ, with their articular processes placed nearly vertical, we readily understand how a dislocation without a fracture of greater or less magnitude is impossible.

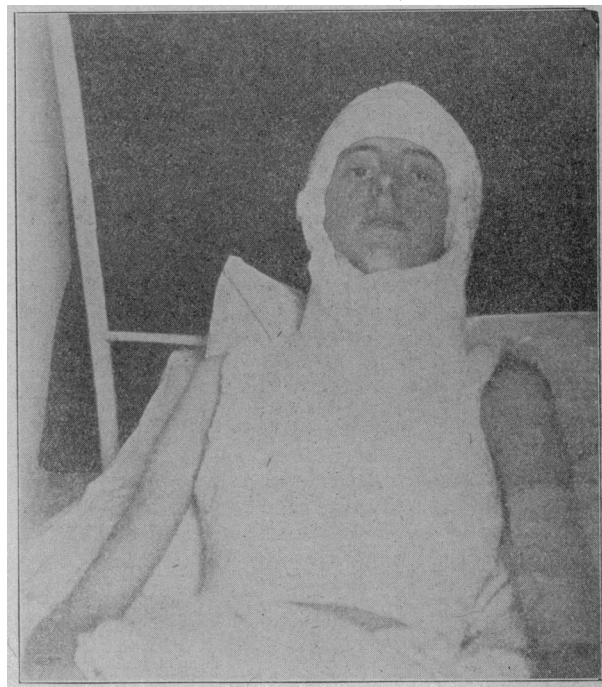
Medical literature contains report of a number of cases of fracture of the cervical vertebræ showing partial recovery with persistent deformity of the neck, greater or less pressure on spinal cord, possible paralysis, bed sores, etc., but I have been able to find but three cases where there was complete and absolute recovery following surgical interference in these cases. The case is as follows:

History.—Roger C., aged 16, weight 110 pounds. On March 6, 1907, he was looking over the gate of a freight elevator, had his chin over the same, the elevator descended, striking the back of his head, and at the same time the gate ascended, catching him at about the region of the larynx, the two lines of force exerting a peculiar shearing pressure on the boy's neck. He was hurried to the City Hospital, where I

saw him twenty minutes later, at which time he presented the clinical picture of pressure on the cord.

Examination.—The boy was unconscious. He was rigid, with violent incoordinate movements, the limbs markedly flexed, all the flexors predominating, complete anesthesia, greatly exaggerated knee jerk, ankle clonus, paralysis of sphincters of rectum and bladder. Breathing was diaphragmatic, shallow and slow. He was cyanotic, the pulse being 120 and thready. His head was slightly crowded back out of position; there was a dimple in the back of the neck over the spine of the third cervicle vertebra. The palpating finger in the pharynx could distinctly make out the prominence of the body of the second vertebra dislocated forward. The boy was *in extremis*, and I advised his parents that he would probably die on the operating table, but he was doomed in any event, and should be given the chance of surgical interference. Dr. J. E. Moore, whom I asked to see him, concurred in this opinion, and the lad's parents consented to the operation.

Operation.—He was placed on his back on the operating table, without anesthesia, his head and shoulders extending over the edge of the table. While the hospital internes held him by his shoulders and body, with one hand under his occiput and the other under his chin (my feet on the edges of the table for a leverage) I made powerful traction on his



head with no other result than twice to dislocate his lower jaw, which had to be reduced. Then with a folded towel over the teeth of his upper jaw to protect my hand, I made traction from here and the occiput. Dr. Moore meantime, with his fingers in the pharynx, crowded back on the vertebræ; this also was unsuccessful, and finally I had an interne grasp my wrists and pull with me; we used all our strength, first extended and then flexed the head on the neck sharply, when the vertebræ slipped into place. The relief to the patient was instantaneous, showing pressure on the cord was relieved; his pulse and respiration quieted down, the incoordinate movements ceased, and sensation returned. He was put to bed with the head of the bed raised, a ten-pound extension on his head pulling from the vertex through the medium of a Barton's bandage, pulleys and weights.

Further Treatment.—Bromids were crowded with the expectation of meningitis developing. He was catheterized for the first twenty-four hours, then voided urine involuntarily, while the bowels responded to enemas. His temperature for the first ten days ranged from 100 F. to 102 F., while his pulse continued high, averaging 120. He had no symptoms of effusion or pressure other than that he was unconscious for twelve days. He was fed by rectum for four days. At the end

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