

without studying its rhythm. Thus a murmur which is heard in the right second intercostal space close to the sternum, and is transmitted in the direction of the greater blood channels, is always an aortic direct murmur.

A murmur heard in the left intercostal space close to the sternum, and often distinctly heard at the xiphoid cartilage, is always an aortic indirect murmur. Again, a murmur heard over the fourth rib, on the left side, at its junction with the corresponding costal cartilage, is always a mitral direct murmur. This murmur is not transmitted, but is heard only within the limited area here described.

Finally, a murmur heard at the apex and transmitted below and to the left, as far as the anterior axillary line, is always a mitral indirect or regurgitant murmur.

Having become familiar with the location of these areas, and bearing in mind the direction of transmission of the different murmurs, their diagnosis is extremely simple.

Two, three or even four of these murmurs may be found in combination, but having become familiar with the above points in their diagnosis, their differentiation is not difficult.

There is another class of murmurs, of considerable importance, to which we will briefly refer. These murmurs are not produced by endocardial lesions, and are called inorganic or chlorotic murmurs. Their cause is somewhat theoretical. They are due, however, to changes in the blood produced by anæmia, and probably also in part to innervation of the heart muscle from the same cause. These inorganic murmurs may be present at the mitral or aortic orifices, and may be either direct or indirect.

Indirect murmurs are far more common than direct, and of these a murmur at the base is oftener present than one at the apex. This indicates the preponderance of the aortic indirect over any other variety of chlorotic murmurs. These murmurs are heard over the same areas, and are transmitted in the same manner as organic murmurs.

A chlorotic murmur is usually soft, and blowing in character, and is accompanied by the general signs and symptoms of anæmia. These murmurs usually disappear under treatment directed to the general condition.

Dilatation of the ventricles is sometimes produced in connection with these chlorotic conditions, as evidenced by changes in the location of the apex beat. This dilatation of the ventricles sometimes causes organic lesions, principally at the mitral, and occasionally also at the aortic orifice. In other words, and finally, the cardiac condition in chlorosis sometimes culminates in permanent organic lesions.

### CARBONIC ACID AN INDEX OF DANGER IN GIVING CHLOROFORM, AND HOW TO LESSEN THE DANGER.

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We assume in this brief paper, from several analogies, that the activity of the respiration as shown by the amount of CO<sub>2</sub> exhaled, is an index of danger in administering chloroform, and renders the production of anæsthesia more difficult.

Hence, we argue the comparative safety and ease

of administration to weakly persons, and the danger and frequent difficulty to the mechanic.

For this reason doubtless its safety in military life has been much overrated.

The more muscle the more CO<sub>2</sub> generated, greater seems the danger, and greater the amount of chloroform required.

The latter statement is well proven in dogs and rabbits, they being chloroformed with much difficulty.

The majority of deaths from chloroform are probably superinduced by asphyxia, not, however, commencing in the lungs, as the older physiologists taught, but in the systemic capillaries.

We will consider the administration of chloroform, with respect to greater safety, under the conditions of age, sex, digestion, etc.

*Age.*—The ages which seem most obnoxious are adolescence and the adult age, twelve to sixty. In the first there is an absolute increase in CO<sub>2</sub>, as the muscular system is attaining its highest development, and in the second the muscular development being complete, the danger is greater.

As all medical men of experience know, infants, children, and old persons take the anæsthetic with comparative impunity.

*Sex.*—It is conceded that more than twice as many men are killed by chloroform as women, but during pregnancy and in the absence of menstruation the danger to the woman increases.

For Flint states "that the absolute increase in the evolution of CO<sub>2</sub> with age in the female is arrested at the time of puberty and remains stationary during the entire menstrual period, provided the menstrual flow occur with regularity."

Women are not as quickly killed by gases and vapors as are men.

*Digestion.*—CO<sub>2</sub> is greatly increased during digestion, but there is no necessity for *waiting* longer than *four* and a *half* hours after the patient has taken food *before commencing* with the *inhalation*, for Dr. Edward Smith found the CO<sub>2</sub> as much diminished after that interval as after twenty seven hours of fasting.

*Foods and drinks.*—Dr. Smith divides these into excito-respiratory and non-excito-respiratory.

The excito-respiratory foods and drinks are as follows: The nitrogenous ones, the cereals, potato, sugars; milk and its components, tea, coffee, cocoa, chicory, rum, beer, stout, and the ales.

The non-excito-respiratory are starch and fat. Hence, the propriety of not allowing a patient to partake of articles of the first class within an hour of chloroforming.

The vomiting which such allowance may produce is a minor evil, in fact is conservative, diminishing CO<sub>2</sub> by its sedation, and putting an end to digestion.

Prout demonstrated that CO<sub>2</sub> was diminished by a concentrated infusion of tea, and this accounts for the success of certain German surgeons who prefer tea given before chloroforming, to alcoholics—tea possessing the convenience over alcohol of not being so likely to produce vomiting.

But stimulants have not been given with the view now advocated in this paper, to lessen the formation of CO<sub>2</sub>, but with the purpose of stimulating the heart and lungs.

Fortunately, this purpose as concerns the respiration is contravened by the teaching of physiology.

Flint states "that the most constant effect of alcohol, such as wines and spirits, is to diminish the

exhalation of CO<sub>2</sub>. This effect is almost instantaneous when the articles are taken into the stomach fasting."

The vapor of alcohol also lessens the exhalation of carbonic acid, and it is probable that the A. C. E. mixture, now justly becoming popular, owes its comparative safety to this fact, and not so much to the fact that the alcohol favorably influences the evaporation of the more volatile constituents.

*Time of Day.*—The early morning hours, and the earlier before eleven o'clock the better, is the most favorable time for chloroforming. About 11 A.M. and 4 P.M. are the most unfavorable times. At these times the temperature of the body naturally increases, and of course, the activity of the respiration.

The obstetric hours of the night, between twelve and three o'clock, A.M., are the most favorable times in the twenty-four hours, and this is one of the several causes of the safety of chloroform in labor.

These are no merely physiological fancies, but are substantiated by many surgeons, that they have less trouble with chloroform in the forenoon than in the afternoon.

*Seasons.*—"It has been well established that spring is the season of the greatest, and fall the season of the least activity of the respiratory functions." (Flint.) Had we statistics as to the time of the year as affecting deaths from chloroform, it would probably be seen that the majority of them occur in spring and winter, and this irrespective of the comparatively larger number of administrations at those times.

*Temperature.*—But if it were true, as some writers and a Commission allege, that deaths from chloroform are due to over-dosing, there would be more deaths during the summer.

For at a temperature of 85° F., air will contain and carry twice as much of the vapor as at 65°.

But as if to neutralize the greater volatility there is much less CO<sub>2</sub> exhaled in warm weather.

Chloroform is the favorite anæsthetic in southern Europe, and in the progressive, yet conservative Southern States of North America, and most of the reports of deaths from chloroform seem to come from the Northern States of the United States, where comparatively little chloroform is used.

*Pure Air.*—"It has been noted," says Packard in his *Minor Surgery*, "that chloroform acts more speedily when administered in the open air."

It not only acts more speedily, but more safely in the open air.

This is well proven by the good results from military surgery, which is largely conducted in the open air, and during the warm months.

When the inhalation is begun, as it should not be, in the presence of a large clinic, and with the usual CO<sub>2</sub> saturation of the amphitheater, we often have heard the expressions, "the patient does not take the anæsthetic," "well, doctor, please give it to him," etc.

The anæsthetizer's lot, under those circumstances, as he has often experienced, is not a happy one. And thus is illustrated the incompatibility between carbonic acid and chloroform.

*Moisture.*—When possible chloroform should be given in dry weather, as the system furnishes more CO<sub>2</sub> in damp weather.

#### CONCLUSIONS.

It is the brawn of a subject, irrespective of his

weight, that makes chloroform dangerous for him.

To the man with "muscles of brass," and to the sturdy, scantily menstruating domestic, ether and not chloroform should be given, and more especially in northern latitudes.

Should Mr. John L. Sullivan be chloroformed while in his prime, and during a northern spring or winter, America would be in great danger of losing her champion.

The *fatty heart*, which we used to hear so much about, and which is impossible of diagnosis, is as nothing in the scale of danger to the *fatless muscle*, which is both the manufactory and storehouse of carbonic acid.

For this reason it is not the drunkard nor the opium habitué, nor the user of tobacco, and decidedly not the average sedentary and professional man who is a bad subject for chloroform, for all of these exhale a lessened amount of CO<sub>2</sub>, but the active and muscular man in the prime of life.

To him it is dangerous and when he is killed by it, it is frequently before he is thoroughly anæsthetized.

### HOW AN ELECTRIC CURRENT MAY BE ABSORBED INTO THE LIFE CURRENT OF HUMAN BEINGS BY INDUCTION, AND WITHOUT VISIBLE CONNECTION WITH ANY ELECTRICAL APPARATUS OR CONDUCTOR.

THE EFFECTS WHICH MAY BE PRODUCED BY MEANS OF THE ELECTRO-MAGNETISM UPON THE BRAIN.

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The phenomena of electrical action by absorption and induction is just now awakening the attention of the scientific world. In Johnson's *Universal Cyclopædia*, latest edition, Vol. v, p. 188, he says: "The most important phenomena of magnetic action is that called induction, or the magnetizing action of a magnet on distant substances, animate and inanimate. We also find that this phenomena was discovered and put into practical use by Mesmer, a Vienna physician, in 1774, who found that he could influence and communicate at will to his patients, even at a distance from them, by means of electro-magnets generating a magnetic fluid or electric current."

The *International Cyclopædia*, Vol. ix, says: "By induction we mean the power that an electric current has to excite, to magnetize and to draw into actual contact with itself, properties and bodies near or in range with the current, but not in connection with the same, thus forming a closed current as long as the current of induction is kept up or lasts."

"By absorption we mean the power or force which an electric current has of absorbing or drawing into itself by suction any body near, but not in contact with the current."

In *Lessons in Mechanics of Magnetism*, p. 29, Edmund Shaftsbury published in 1888, he says:

"The phenomena of induction and absorption by electrical currents is just now awakening the attention of the scientific world."

"Induction is the process by which another person or object is influenced. That actual contact or near approach is *not* necessary is proven by the magnetic needle, which feels an influence exerted thousands of