

and make it stiff as a board. There was no question, therefore, of the power of chloroform to destroy any structure of the body if applied to it in sufficient concentration, nor do we attempt to deny that chloroform will destroy the contractility of the heart just as it would that of a voluntary muscle, provided always it reached the heart in sufficient concentration. But this was just the point at issue. If we drive chloroform into the trachea, or air very heavily loaded with chloroform vapor into the lungs by artificial respiration, it will be absorbed in sufficient quantities to paralyse the heart, but the question is an entirely different one if the chloroform be administered in the usual way, by inhalation. Our contention is that when chloroform is administered in this way it acts more readily upon the respiration than it does upon the heart, and from the respiration failing first, a sufficient quantity to paralyse the heart is never conveyed to it, and that therefore death from chloroform inhalation is respiratory death, death beginning with the respiration and not with the heart.

It will be convenient to take up, first, more fully the question of death from the anæsthetic, by which I mean death due to the action of the anæsthetic itself, and, later on, to discuss the question of death during anæsthesia—that is, death from operation or other causes than the anæsthetic, sometimes in spite of its action, and at other times, perhaps, aided by its action.

The experiments made by the first Chloroform Commission showed that in dogs subjected to its action the respiration invariably failed before the circulation. Those made by the second Commission confirmed this, but they brought out a new point—namely, the rapidity with which the heart fails from the combined action of asphyxia and chloroform. This action is of two kinds: First, asphyxia during chloroform stops the heart's action through the vagus nerve. This is the action which was looked upon by the Glasgow Committee as so dangerous, but which, as Dr. Bonfort pointed out, is rather a safeguard, tending to prevent the too rapid conveyance of chloroform vapor from the lungs to the medulla. The second action of asphyxia and chloroform combined is a paralysing one upon the heart itself. If an animal inhales pure chloroform vapor with free admixture of air its heart will go on for a long time—in fact, we might say, almost indefinitely. If an animal is asphyxiated, either by stoppage of the respiratory movements or by obstruction to the free entrance of air into the lungs, notwithstanding the continuance of respiration, the heart will go on for a certain time, but in the course of a few minutes will stop. This stoppage, however, occurs very much more quickly if chloroform be administered at the same time as an animal is asphyxiated, so that we may say that the great risk of death from

the action of chloroform lies in the occurrence of asphyxia during its administration.

I must here draw attention to what I believe to be a grave fallacy in some experiments of my friend Professor H. C. Wood, mentioned by him in his Address on Anæsthetics at the Berlin Congress. A tracing which he there showed seemed to indicate most clearly that the action of the heart failed long before the respiration. I here reproduce, as nearly as I can remember it, the general effect of this tracing. In it we seem to see clearly a stoppage of the beats of the heart while the blood pressure sinks, and yet the respiration goes on freely. Now I believe that the stoppage of the heart in this tracing is only apparent and not real, and that it is, in fact, due to a small clot of blood in the cannula which connects the artery of the animal with the kymograph. I have had many such tracings, and my experience has led me, whenever I got them, to disconnect the cannula and remove the clot. Had there been no clot, the stoppage of the heart would have caused the blood pressure to fall abruptly instead of gradually, as shown in the tracing exhibited by Professor Wood.

In comparing the action of ether and chloroform, we found that the great points of difference between them were, first, that ether was a less powerful anæsthetic than chloroform: and, secondly, that while neither of them paralyses the heart when giving plenty of air, the heart would continue to beat much longer during asphyxia when combined with ether than when combined with chloroform. Chloroform is thus a more powerful agent, and, as I have already said on a previous occasion, it is like a sharp knife in the hands of the surgeon as compared with a blunt one. It is more efficient for good if properly handled, it is more powerful for evil if misused.

Shortly before the Commission began its labors a most unfortunate case of death occurred in Edinburgh during anæsthesia from nitrous oxide—an anæsthetic which is usually supposed to be absolutely free from danger. The report of this case led the Hyderabad Commission to suppose that death in it was due, not to the anæsthetic, but to asphyxia from tight lacing, and accordingly they made some experiments to test the effect of compression upon the chest and abdomen. These experiments caused a storm of indignation amongst the antivivisectionists, who falsely stigmatised them as horribly cruel, whereas, in truth, there was absolutely no cruelty about them. The only thing that was done was to imitate upon monkeys already under chloroform that compression of the chest and abdomen which is daily exercised at the bidding of fashion by thousands of women in this country without chloroform. The Commission found, as was to be expected, that tight lacing greatly increased the risk of death from chloro-