ETHER: A VINDICATION

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I found Dr. Samson's short article *Cyclopropane: a Vindication*,[1] which appeared in our *Journal* of 25 February, most interesting and full of common sense. With cyclopropane anaesthesia his veiled battle cry appears to be 'Oxygen! More oxygen!' I fully endorse his views and here wish to repeat his battle cry of 'Oxygen! More oxygen!' in association with ether.

To my mind he rightly concludes that where there is a sufficiency of oxygen in the system—I prefer an excess of oxygen—there can be no symptoms of hypoventilation—no slowing of the pulse and raising of blood pressure, no ventricular fibrillation—irrespective of what anaesthic is used, even in moderate excess.

My interest, however, is not in Dr. Samson's cyclopropane, but in his logical reasoning, which I apply to ether; I never use cyclopropane. Except where there is an explosion hazard I always use ether and pure oxygen, with a flow of 6 litres per minute, after induction with N_2O *plus* O_2 *plus* Tritene or pentothal *plus* a relaxant. Where I have not used this excess I have on a few occasions had reason to regret that oversight.

When cyclopropane came into fashion I soon found out that there is nothing you can do with it that you cannot do equally well, or better, with ether, when once your patient is safely induced with say, Pentothal *plus* a relaxant or by N_2O *plus* O_2 *plus* Tritene. The optimum flow of oxygen in the semi-closed system is 6 litres to the minute. If you use more—say 10 or 12 litres—there is the possibility of too little rebreathing, resulting (theoretically) in an accumulation of CO_2 in the lung alveoli in spite of a good colour in your patient—a combined excess of oxygen and CO_2. If you use too little—say 2 litres—there is the danger of an excessive accumulation of CO_2 in the system as well as an excess of ether, neither of which gets sufficiently blown off. Your patient will, to start with, breathe too deeply but eventually the breathing centre will become exhausted and natural breathing will cease.

I was brought up in the Edinburgh school of open chloroform and ether. Subsequent advances I had to pick up in the hard way—by trial and error. I fully appreciate Dr. Samson's suspicions that ventricular fibrillation is brought on by an insufficiency of oxygen rather than by the anaesthetic *per se*—even with chloroform.

DIFFICULTIES OF THE CLOSED TECHNIQUE

To my mind an unavoidable evil with cyclopropane is the necessity of the difficult closed technique, for the sake of economy—a technique which lends itself so easily to hypoxia and excess of CO_2 in the hands of the less experienced. Economy, to my mind, is the only advantage in the closed technique. A similar opinion was recently expressed by Sir Robert Macintosch when he visited us in Pretoria.

Dr. Samson states that innumerable patients of his manifested varying degrees of 'cyclo shock' because of his initial inexperience of the closed circuit technique. This condition he ascribes to lack of oxygen. I am sure that with ether and a 6-litre flow of oxygen such collapse would not have occurred in the semi-closed technique. I use this 6-litre flow even in infants with the Ayres tube or a completely open valve—a valve held open by a thick safety pin. In both these instances the bag is only used as an indicator with minimum rebreathing.

I am told that it is bad practice to give pure oxygen, 6 litres to the minute, with ether because there is a possibility of oxygen intoxication. Although I have given about 35,000 anaesthetics, of which well over half were with oxygen and ether, I have never yet come across this dangerous oxygen intoxication. To give pure oxygen in a closed circuit necessitating controlled respiration is a different matter. Here the oxygen pressure in the alveoli rises considerably, varying with the pressure applied to the bag or bellows. One can imagine the possibility of an excessive absorption of oxygen here. It is stated, by those who are supposed to know, that you require a continuous oxygen pressure of 3 atmospheres before such intoxication can be induced. At our altitude the atmospheric pressure is considerably less than 1 atmosphere as measured at sea level.

Again, we are told one is apt to get an excess of CO_2 in the system and alveoli. This I maintain is impossible with a 6-litre flow to the minute. With that flow you get the optimum blow-off to keep the CO_2 concentration down, yet sufficient rebreathing with normal excursions. If the excursions are subnormal there must be obstruction or other reasons.

I know of a case in which a flow of 2 litres per minute of oxygen with ether caused an anaesthetic death, following on 12 hours of artificial respiration and many stormy recoveries. With a 2-litre flow there is the very definite danger of an excessive accumulation of CO_2 as well as of ether—not enough blow-off. On the other hand with a 12-litre flow insufficient rebreathing may ensue, resulting in shallow breathing insufficient to empty the alveoli of their CO_2 which, theoretically, in spite of a good colour in the patient, may cause an excessive retention of CO_2 in the blood, sufficient to upset the nerve centres and heart. This I maintain cannot happen with an unobstructed flow of 6 litres—the happy medium between 2 and 12. It has certainly never occurred in my 20,000 cases.

I maintain that in the past we were in the habit of giving ether in far too high a concentration. Not many years ago I saw a senior anaesthetist bubbling his gases through two bottles of ether! What a safe anaesthetic we have in ether! The more I use ether the less of it I use! I remember reading an account of the first occasion when ether was administered in South Africa. The patient had to have a leg off. After the operation he stated that he could recollect much of the conversation going on during the operation, yet felt

no pain! History, however, does not relate how much morphia and alcohol he had before the operation.

I fully agree with Dr. Samson that the complicated method of administration very greatly mitigates against the safe use of cyclopropane. To my mind the only advantage of cyclopropane over ether lies in its more pleasant induction. This advantage is of no account nowadays with the almost universal use of intravenous induction.

OVER-ESTIMATING THE VENTILATION

Dr. Samson concludes with these words: 'It appears that the extent of ventilation is too often over-estimated with the result that weird phenomena make their unwanted intrusion. It is high time, therefore, that there was a change in the teaching of anaesthesia in this respect. The normal tidal volume must be maintained with adequate oxygen intake, and excess CO_2 must be prevented at all times. This is a cardinal rule applicable not only to general anaesthesia but also to the treatment of and prevention of pulmonary conditions. Most of the morbidity and mortality associated with narcosis can be prevented. Let us call a halt to making the *narcotic* the scapegoat of general anaesthesia'. I fully agree.

1. Samson, H. H. (1956): S. Afr. Med. J., **30**, 197.