A SIMPLE METHOD OF CARBON DIOXIDE ESTIMATION IN EXPIRED AIR

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A SIMPLE method for the estimation of carbon dioxide in air or gas mixtures containing anaesthetic gases finds many applications in the investigation of anaesthetic problems and in the control of artificial respiration by mechanical respirators. This adaptation of already established techniques utilizes apparatus which may be found in most hospitals. It is rapid, and can be performed at the bedside or in the operating-room.

The principal has been employed for some time (Higgins and Marriott, 1917; Wilson, Orcutt and Peterson, 1932; Wilson, 1933), and has recently been adapted by Brinkman in an instrument known as the "Carbovisor". The gas mixture to be examined is brought into equilibrium with an indicator solution lightly buffered with sodium bicarbonate. The tension of carbon dioxide in the gas mixture determines the pH achieved in the buffered solution and the pH, in turn, determines the colour of the indicator. The colour of the indicator is estimated in a photo-electric colorimeter, using a convenient filter. The indicator solution consists of bromthymol blue 0.005 per cent and sodium bicarbonate 0.05 per cent and it has been found to be stable in storage provided that it is kept in bottles the interior of which have been carefully lined with paraffin wax.

The sample of gas to be analysed is drawn into a syringe with a long needle attached; 10 ml are required. The tip of the needle is then placed underneath the surface of a small quantity of the indicator solution and 2 ml of gas expelled from the syringe; 2 ml of the indicator solution are then drawn in. The syringe is then closed, either with a blanked-off needle hub or by thrusting the point of the needle into a rubber bung. The syringe and

FIG. 1
indicator solution are shaken for one minute. The solution is then transferred to the cuvette of the colorimeter. We have used an “EEL” portable colorimeter employing the small-sized tubes, but no doubt other colorimeters are equally suitable. The red filter No. 205 is employed. Using in the cuvette some indicator solution free of carbon dioxide, the zero point is set to a convenient position on the scale, usually about midway deflection. Calibration is conveniently achieved by having a sample of carbon dioxide in oxygen in a cylinder, which has been carefully analysed. A specimen of indicator is brought into equilibrium with this gas and provides the second point on the calibration line. It has been found by careful check that in these conditions the tension of carbon dioxide in the sample is linearly related to the galvanometer deflection. The composition of the indicator solution and other details mentioned are chosen so that the concentrations of carbon dioxide up to 7 per cent may conveniently be estimated.

It is desirable to check the zero point before each estimation and occasionally to confirm the slope of the calibration line by estimating the standard gas mixture. The indicator solution may change slowly with time but the linearity of its response does not.

The collection of end-expiratory samples.

It is often desirable to collect end-expiratory air when the patient is exhaling through some form of breathing apparatus. Provided that the respiration is slow, satisfactory end-expiratory air may be collected from a polythene catheter passed into the trachea or to some part of the expiratory tube close to the outlet of the natural air passage. The sample withdrawn at the end of exhalation must be small and it is desirable to obtain a mixed sample from several exhalations. We use a semi-automatic syringe shown in the photographs. The syringe is mounted upon a board and the plunger is under tension, tending to be withdrawn by the spring S. This withdrawal is prevented by a series of large brass washers fixed to the rod R which can be rotated by the
knob K. From each of these washers a segment defined by a chord has been cut away so that about two-thirds of the circumference remain. The knob on the plunger of the syringe can escape past this missing segment and the missing segments are fixed upon the operating rod at 180° alternately so that the plunger escapes from one and is immediately caught by the next washer. The respiration is carefully watched and at the end of exhalation the knob K is rotated through 180° thus allowing about 2 ml to be drawn into the syringe. This is repeated until the syringe is full.

REFERENCES


BRAZILIAN CONGRESS, 1955

The 2nd Brazilian Congress of Anesthesiologists was held in Salvador, Bahia, during the week of November 27 to December 3. Despite the disturbing political situation there was a good attendance of anaesthetists from all parts of this vast country, Rio de Janeiro and Sao Paulo being especially strongly represented.

The Congress opened with a cocktail party given by His Excellency the Rector Magnificus of the University, Professor Dr. Edgard Rêgo dos Santos followed by the inaugural session held in the beautiful senate house of the university. A graceful tribute was paid to British anaesthesia when Dr. T. Cecil Gray was invited to preside at this opening. The opening speeches were made by the President of the Executive Committee of the Congress (Dr. Menandro L. de Faria), the President of the Brazilian Society of Anaesthetists (Dr. Zairo Viera), and by the Rector of the University.

The official themes of discussion at the scientific meeting of the Congress were “Pulmonary Ventilation” and “Muscle Relaxants”. In addition there was a session devoted to discussion of “Free Subjects”.

The programme of social activities gave opportunities for visitors to see many aspects of the culture and folklore of this part of Brazil. Arrangements were made for those attending to see a demonstration of Capoeira, a local form of “boxing”, the only rule of which is that the hands must not be used, the blows being struck with the feet and head. This results in an extraordinary exhibition of gymnastic ability, the whole being done to the rhythm of characteristic music provided by a small orchestra of diverse primitive instruments.

The visitors were also taken to a session of candomblés, an Afro-Brazilian religious cult with a considerable hold on the negro population of the area, and to watch the age-old method of net fishing in which a net 3½ kilos long is hauled inshore by thirty or more fishermen, again to primitive chants and rhythmic dances originating in far-off Africa. Bahia is so rich in historical buildings, wonderful churches and examples of extremely advanced modern Brazilian architecture that no visitor could have left this Congress without carrying away indelible memories of this fascinating region.

The Congress terminated with a dinner in a boîte adjoining the Hotel da Bahia, in which the long speeches characteristic of many similar functions in the Anglo-Saxon world were supplanted by songs and dances from various distinguished visitors.

The undoubted success of this 2nd Brazilian Congress, itself testimony of the enthusiasm and enterprise of the Brazilian anaesthetists and their society, was a great tribute to the work of the local organizing committee.