CORRESPONDENCE

AUTOMATIC VENTILATION DURING BRONCHOSCOPY

Sir,—The recent paper (Bennetts, 1977) describing the use of the Bird Mark 2 ventilator and the jet injection technique for bronchoscopy states, "...there is dilution with air by as much as 50%".

In his original paper describing the injection technique, Sanders (1967) demonstrated entrainment volumes in the region of 5:1 with adult bronchoscopes. Recent measurements in our laboratory using a Sanders Venturi and a 7 x 40 bronchoscope reveal similar entrainment volumes. Both calculation and actual measurement showed that 100% oxygen as the driving gas delivers 33% oxygen at the end of the bronchoscope, 60% delivers 26%, and, as suggested by Dr Bennetts, 40% delivers 23%. Further calculations show that even 75% nitrous oxide in the driving gas will lead to only 12% nitrous oxide being delivered to the patient. Such nitrous oxide concentrations are of little value.

The amount of entrainment will vary with the size of the injection orifice and it may be that, with the bronchoscope used by Bennetts (1977), which is not available to us, only 50% dilution is produced. However, we would caution against the use of any technique involving air entrainment by a nitrous oxide in oxygen mixture unless hard data concerning oxygen delivery are available.

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REFERENCES

Sir,—Many thanks for allowing me an opportunity of responding to the comments of Dr B. Wolfson and Dr L. Shete.

Sanders' paper showed not only that entrainment of air of the order of 5:1 or 6:1 occurred when the outflow from the bronchoscope is unrestricted, but also that the situation changes dramatically when the gas flow is impeded. Oxygen (the driving gas) concentration increased and entrained gas volumes decreased strikingly at a point distal to the constriction in the simulated clinical situation. My own (unreported) experiments with a model tracheobronchial tree and lung confirmed this effect and demonstrated substantial reductions in the volume of entrained air under conditions which, I thought, bore a close relationship to actual bronchoscopy. During the virtual "wedging" of the bronchoscope in the main bronchi, the lung under examination is ventilated with the relatively undiluted driving gas mixture, but a greater degree of air entrainment occurs while the bronchoscope is in the trachea. Flows of the order of 100 litre min⁻¹ may be obtained in the laboratory when there is no resistance at the distal end of the bronchoscope, but lung ventilation of this order does not take place during bronchoscopy as indicated by the modest decrease in 

Paco, shown in my paper and also by the increases in 
Pao, which were related closely to changes in the oxygen concentration of the driving gas.

In the clinical situation, variable relationships exist, from moment to moment in an individual patient, between driving gas flow and entrained air as a result of movement of the bronchoscope, and these prevent precise knowledge of the concentrations of oxygen entering the bronchi whatever driving gas is used. That adequate oxygenation may be achieved by the methods described in my paper even during the use of nitrous oxide was, I thought, documented adequately.

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NON-DEPOLARIZING RELAXANTS AND LIVER DISEASE

Sir,—Somogyi, Shanks and Triggs (1977) have reported that patients with total biliary obstruction had a significantly reduced plasma clearance of pancuronium associated with prolongation of neuromuscular blockade. With the possible exception of one patient, none of the patients showed "resistance" to the effect of pancuronium, suggesting that the phenomenon of resistance should be evaluated only in patients with liver disease, those with total biliary obstruction being excluded.

Such differentiation has been reported by El-Hakim and Baraka (1963), who showed that the response to tubocurarine varied according to the underlying liver pathology. In patients with liver dysfunction secondary to bilharzial cirrhosis, a marked "resistance" to tubocurarine was observed. This phenomenon was attributed to the possible binding of tubocurarine to gamma-globulin which is increased in cases of bilharzial cirrhosis up to 300% of the normal concentrations. On the other hand, patients with extra-hepatic biliary obstruction did not show resistance, but rather a paradoxical sensitivity to tubocurarine. As with pancuronium, a reduced plasma clearance of tubocurarine may occur in the presence of biliary obstruction and this may explain increased neuromuscular blockade.

Under normal conditions 75% of tubocurarine is excreted unchanged by the kidney within 24 h, while biliary excretion accounts for the elimination of only 10–20%. However, in cases of renal dysfunction or following administration of large doses of tubocurarine, the liver increases its rate of biliary elimination and also acts as a drug reservoir until further elimination is effected via the kidney (Cohen, 1974).

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REFERENCES