to handle a syringe correctly to give an intravenous injection. Instead of experimenting on patients, the student is taught on the model how to demonstrate that a "vein" has been entered. The "vein" on the medial side has been deliberately made larger than the lateral one, in order to tempt the unwary student, as underneath it is another piece of tubing containing red ink to simulate the brachial artery. Penetration of this by the needle affords convincing proof of the danger of venepuncture on the medial aspect of the cubital fossa. In practice this model has been well received by students, as they are genuinely distressed when pain is caused to patients by unsuccessful attempts at injection due to lack of skill while learning the technique.

Both models were made by Schema Ltd., 2 Heriot Road, London, N.W.4, and I am indebted to Mr. D. Ellis for the photographs.

CORRESPONDENCE

HYPERVERVENTILATION AND CEREBRAL DAMAGE

Sir,—We are appreciative of the opportunity of replying to Doctors Rees and Gray (Brit. J. Anaesth., 34, 690), if only for the purpose of emphasizing the fact that maintenance of adequate ventilation is at times both difficult and perplexing, and that unthinking or deliberate attempts at hyperventilation, either manual or mechanical, may sometimes produce unwanted side effects. The purpose of our study was to investigate, in unselected patients, the effects of hyperventilation during general anaesthesia. Therefore, no attempt was made to match the series as this would have necessitated selection. However, in comparing the control group to the group of hyperventilated cases, correctly the ratios are (a) less than 120 minutes, 11:5; and (b) more than 120 minutes, 16:19. It is agreed that the series is not extensive but the results are provocative.

During planning of the study, the possibility of using the e.e.g. as an aid in determining depth of anaesthesia was considered. However, it was decided that in this pilot study clinical appraisal would be of greater value since the e.e.g. is subject to alteration by many factors in addition to anaesthesia and carbon dioxide. In all of these patients, posture was supine but since pH, carbon dioxide and oxygen were measured, posture per se does not appear to have a pertinent bearing on the observed results. Patients' ages ranged from 20 to 70 years in both groups. Those in very poor physical condition were excluded from the series since the degree of co-operation required for the critical flicker fusion determination would have probably exceeded their capacity.

Two of the rejected cases were cited in the text; one a hypoxic incident, the other a severe hypotensive incident which required multiple blood transfusions. In addition, four others were rejected for hypotension during operation. The use of postoperative analgesics was a factor in the elimination of two of the rejected cases, for it was felt that they had received an excess of opiate postoperatively. However, the presence of normal postoperative sedation does not invalidate the hexobarbitone tolerance method of evaluating critical flicker fusion. Two further cases failed to co-operate in the performance of the test. One of these was mentally confused for several days postoperatively, probably due to administration of an excessive dose of postoperative opiate which resulted in a prolonged episode of both hypotension and hypoxia. Deliberate hyperventilation with volume cycled mechanical ventilators failed to lower the Pco$_2$ in six of the patients. Far from being astonishing, this is a common finding.

The negative results were reported and discussed in the interest of accuracy. Such negative results do not in any sense negate the positive findings. It must be agreed that the large fund of clinical experience available indicates a possible value of hyperventilation as an occasional adjunct to anaesthesia but it seems to us that controlled respiration will provide the benefits attributed to hyperventilation without the possibility of unwanted side effects of alkalois.

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EXTERNAL CARDIAC MASSAGE

Sir,—We would like to make some comments on the paper by Dr. Pryor, entitled "Some Studies on External Cardiac Massage" (Brit. J. Anaesth., 34, 566).

We would voice a warning against the recommendation that, in a resuscitation, closed chest massage be applied before artificial ventilation. We would wish to state, in addition, that adequate ventilation is only rarely produced by external cardiac massage.

The pulse is usually palpable when the systolic blood pressure is about 50 mm Hg. Thus, at this stage, ventilation without external cardiac massage may well be effective in restoring life. On the other hand, external cardiac massage in the presence of airway obstruction is futile because circulation of unsaturated blood produces no re-oxygenation of the heart.

Measurements of artificial ventilation by any form of chest pressure are invalid, with respect to field use, when a cuffed endotracheal tube is in place. In practice, severe or total airway obstruction is almost always present. We have measured ventilation produced by external cardiac massage in victims of actual cardiac arrest. These measurements we made with a Wright ventilation meter attached to a mask. The majority of patients had no exchange of air; in most of the others ventilation was less than estimated dead space.

Dr. Pryor states that his subjects received 60-80 external compressions a minute, and that 7.5 to 8 litres of air were moved per minute. This means that tidal volumes between 94 to 133 ml were produced. He was ventilating very little more than the endotracheal tube.