It is of interest that the slope and intercept of our air regression line are in close agreement with Nunn.[3] Kitamura's line is steeper and has a higher intercept, but is closer to those obtained by Gordh *et al.*[4] and Palmer and Gardiner,[5] who reported measurements made 24 hours after operation. Although we did not measure Pa_{O_2} before operation, our line is virtually parallel to regression lines previously reported for age and Pa_{O_2} in healthy subjects.[6, 7] Kitamura found a significant increase in slope after operation. Their measurements were made "usually one to two hours after operation." It may be that the time interval from the end of operation is the important factor. A recent study in this department[8] suggests that an adverse shift in the relationship of small airways' closing point to end-tidal point, probably the result of abdominal muscle spasm,[9] is an important cause of maldistribution 24 and 48 hours after upper abdominal operations. The early recovery period is likely to be one of rapid transition as regards these changes.

Conway and Payne[10] implied that there was little purpose in administering inspired oxygen in excess of 35 per cent after operation, since this concentration would be sufficient to compensate for the V/Q disturbance. Kitamura's measurements during breathing of 100 per cent of O_2 and ours with 35–40 per cent O_2 make the point that older patients not only suffer greater hypoxemia while breathing air, but obtain the least benefit from high inspired oxygen concentrations. The practical lesson is that higher oxygen concentrations may be needed for older patients and that the adequacy of therapy should be measured rather than assumed.

A. G. DAVIS, M.B., F.F.A.R.C.S. ENG.
A. A. SPENCE, M.B., F.F.A.R.C.S. ENG.
University Department of Anaesthesia
Western Infirmary
Glasgow, Scotland

REFERENCES

1. Flenley DC, Hutchinson DCS, Donald KW: Behaviour of apparatus for oxygen administration. Br Med J 2:1081–1088, 1963
2. Severinghaus JW: Blood gas calculator. J Appl Physiol 21:1108–1116, 1966
3. Nunn JF: Influence of age and other factors on hypoxaemia in the postoperative period. Lancet 2:466–468, 1965
4. Gordh T, Linderholm H, Norlander O: Pulmonary function in relation to anaesthesia and surgery evaluated by analysis of oxygen tension of arterial blood. Acta Anaesth Scand 2:15–26, 1958
5. Palmer KNV, Gardiner AJS: Effect of partial gastrectomy on pulmonary physiology. Br Med J 1:347–349, 1964
6. Raine J, Bishop JM: A-a difference in O_2 tension and physiological dead space in normal man. J Appl Physiol 18:284–288, 1963
7. Conway CM, Payne JP, Tomlin PJ: Arterial oxygen tension of patients awaiting surgery. Br J Anaesth 37:405–408, 1965
8. Alexander JI, Horton PW, Millar WT, et al: The effect of upper abdominal surgery on the relationship of airway closing point to end tidal position. Clin Sci 43:137–141, 1972
9. Spence AA, Alexander JI: Mechanisms of postoperative hypoxaemia. Proc Roy Soc Med 65:12–14, 1971
10. Conway CM, Payne JP: Post-operative hypoxaemia and oxygen therapy. Br Med J 1:844–845, 1963

(Accepted for publication July 6, 1972.)

Precurarization and Dose of Succinylcholine

To the Editor:—Freund and Rubin (ANESTHESIOLOGY 36:185, 1972) reported that pretreatment with 3 mg *d*-tubocurarine markedly reduced the duration of total twitch depression following 0.7 mg/kg succinylcholine. However, both Miller and Way (ANESTHESIOLOGY 35:567, 1971) and Cullen (ANESTHESIOLOGY 35:572, 1972) demonstrated only minimal effects of 3 mg *d*-tubocurarine on the duration of twitch depression with 1.0 mg/kg succinylcholine, even though Cullen found delayed onset of depression and impaired intu-

TABLE 1. Effects of Precurarization on Intubation Conditions and Twitch Response Following Different Doses of Succinylcholine

	Number of Patients	Dose of Succinylcholine	Intubation Score				Number of Patients with Complete Twitch Suppression	Mean Duration of Complete Twitch Suppression
			1	2	3	4		
Group A	10	0.6 mg/kg	10	0	0	0	7	256 sec
Group B	10	0.6 mg/kg	3	1	0	6	2	55 sec
Group C	9	0.8 mg/kg	3	2	1	3	8	213 sec
Group D	11	1.0 mg/kg	6	3	0	2	6	262 sec
Group E	10	1.2 mg/kg	10	0	0	0	10	210 sec

bating conditions with this combination. When he increased succinylcholine to 1.5 mg/kg, there remained some delay in onset of twitch depression, but intubating conditions were comparable to those with 1 mg/kg succinylcholine alone. It would seem that *d*-tubocurarine pretreatment does not affect twitch depression and intubating conditions in a parallel manner. Our recent study supports this observation.

Five groups, each containing nine to 11 patients, were studied. Patients in Group A received 0.6 mg/kg succinylcholine without prior *d*-tubocurarine. Patients in Groups B, C, D, and E received 3 mg/70 kg *d*-tubocurarine, followed three minutes later by succinylcholine in doses of 0.6, 0.8, 1.0, and 1.2 mg/kg, respectively. The anesthesiologist who performed the intubation had no knowledge of drugs or doses given. He scored intubation according to the following scale: 1, easy with good relaxation; 2, relaxation not optimum but intubation still easy; 3, relaxation poor and intubation difficult; 4, intubation impossible because of laryngeal spasm, poor relaxation, or coughing after insertion of the laryngoscope. The response to ulnar nerve stimulation at maximum voltage with a Block-Aid Monitor * was observed and the time from disappearance of twitch to the first return to visible twitch recorded.

The numbers of difficult intubations (scores 3 and 4) were significantly greater ($P < 0.01$) in Groups B and C than in Group A. The number in Group D was also greater, but not significantly so ($P > 0.05$), and Group E conditions were comparable to those in Group A. Only in Group B, however, were there significant differences from the control group with respect to the number of patients showing disappearance of twitch ($P < 0.01$) and duration of complete twitch suppression ($P < 0.02$) after succinylcholine (table 1).

Although precurarization may inhibit twitch depression and impair intubating conditions after succinylcholine, our data indicate that the responses depend on the relative doses of the agents used and vary independently of each other. Thus, within the range of succinylcholine doses studied twitch depression was not a good predictor of intubating conditions.

W. M. COPPAGE, JR., M.D.
B. WOLFSON, M.B., F.F.A.R.C.S.
E. S. SIKER, M.D.
Department of Anesthesiology
Mercy Hospital
Pittsburgh, Pennsylvania 15219

(*Accepted for publication July 14, 1972.*)

* Burroughs Wellcome, Tuckahoe, New York.