ARTERIAL HYPOXAEMIA FOLLOWING PREMEDICATION IN PATIENTS WITH CORONARY ARTERY DISEASE

ERCUMENT A. KOPMAN AND REBECCA C. RAMIREZ-INAWAT

ABSTRACT

The effect of premedication with morphine and scopolamine, morphine alone, and scopolamine alone on arterial oxygen tension has been studied in patients with coronary artery disease undergoing bypass operations.

Control arterial blood samples were obtained with the patients in the supine position breathing room air the day before operation. A second arterial blood sample was taken in the induction room with the patient breathing room air in the supine position.

In the first group (scopolamine only) and second group (morphine only) cH^+ (pH), Pa_{CO_2} and Pa_{O_2} did not change. In the third group (morphine and scopolamine), however, Pa_{O_2} decreased, while Pa_{CO_2} and cH^+ increased (pH decreased). The changes in cH^+ and Pa_{CO_2} were statistically significant, but of no clinical importance.

The present study suggests that, when morphine and scopolamine premedication is used for patients with coronary artery disease, simultaneous administration of oxygen is important in helping to eliminate a possible cause of preoperative myocardial ischaemia.

CHANGES IN ARTERIAL OXYGEN TENSION before, during and after anaesthesia are of interest and concern to anaesthetists and surgeons. Many studies have examined the factors responsible for arterial hypoxaemia before, during and after anaesthesia, with conflicting conclusions.

Premedication drugs may be responsible for changes in oxygenation. However, various results have been reported with narcotic and vagolytic agents. In some studies, morphine was found to have no effect on Pa_{O_2} .^{1,2} In others Pa_{O_2} decreased following administration of a premedication dose of morphine.^{3,4} Of the vagolytic agents commonly used for premedication, one report indicated a decrease in Pa_{O_2} after atropine.⁵ Subsequent studies, however, have been unable to demonstrate an effect of atropine.^{6,7} Therefore, we decided to re-evaluate the effects of morphine and scopolamine, morphine alone, and scopolamine alone on arterial oxygen tension in patients with coronary artery disease undergoing bypass operations. Individuals with angina pectoris were selected because a decrease in availability of oxygen is of vital importance for this group of patients.

METHOD AND MATERIAL

Thirty adult patients (26 male and four female) with angiographically proven coronary artery

disease were studied. Ages ranged from 36 to 72 years (mean 56). Since a morphine scopolamine premedication is routine practice, patients were informed but no written consents were obtained. Control arterial blood samples were obtained with the patients in the supine position breathing room air the day before operation. A second arterial blood sample was drawn on arrival in the induction room, with the patient breathing room air in the supine position, one hour after premedication. Ten patients (randomly selected) received only scopolamine (0.4–0.5 mg) and ten patients were given morphine (10–15 mg) and scopolamine (0.4–0.5 mg). Since sublingual nitroglycerine has been shown to reduce Pa_{O_2} significantly,⁸ patients receiving sublingual nitroglycerine were excluded from the study. Samples were drawn anaerobically in heparinized syringes and were analyzed in duplicate within five minutes by the same technician on the same instrument (Model 213, Instrumentation Laboratories, Lexington, Massachusetts) to determine cH^+ (pH), Pa_{O_2} and Pa_{CO_2} . Student's *t*-test was used for the statistical analysis of the data.

RESULTS

Results are summarized in Tables I, II and III. In the first group (scopolamine only), mean Pa_{O_2} fell from 10.11 ± 1.06 to 9.58 ± 1.06 kPa (76 ± 8 to 72 ± 8 torr) ($p < 0.005$); cH^+ (pH) and Pa_{CO_2} did not change. In the second group (morphine only), cH^+ (pH), Pa_{O_2} and Pa_{CO_2} did not change significantly. In the third group, morphine and scopolamine, cH^+ increased from 38.90 ± 3.11

Ercument A. Kopman, M.D., Associate Professor; Rebecca C. Ramirez-Inawat, M.D., Fellow, Department of Anesthesiology, Washington University School of Medicine, 660 South Euclid Avenue, St. Louis, Missouri, 63110.

TABLE I
PREMEDICATION WITH SCOPOLAMINE ALONE (0.4–0.5 MG)

		nmol/l	cH ⁺ (pH)	kPa	Pa _{CO₂} (Torr)	kPa	Pa _{O₂} (Torr)
Mean	Control	38.90	(7.41)	4.66	(35)	10.11	(76)
	Scopolamine	38.90	(7.41)	4.79	(36)	9.58	(72)
SD ±	Control	2.66	(0.03)	0.31	(2.3)	1.09	(8.2)
	Scopolamine	3.06	(0.04)	0.49	(3.7)	1.09	(8.2)
P		NS		NS		< 0.005	

NS – Not significant.

TABLE II
PREMEDICATION WITH MORPHINE ALONE (10–15 MG)

		nmol/l	cH ⁺ (pH)	kPa	Pa _{CO₂} (Torr)	kPa	Pa _{O₂} (Torr)
Mean	Control	39.81	(7.40)	4.79	(36)	9.18	(69)
	Morphine	40.74	(7.39)	4.92	(37)	9.44	(71)
SD ±	Control	2.12	(0.02)	0.40	(3)	1.02	(7.7)
	Morphine	2.12	(0.02)	0.53	(4)	0.93	(7.0)
P		NS		NS		NS	

NS – Not significant.

TABLE III
PREMEDICATION WITH MORPHINE (10–15 MG) AND SCOPOLAMINE (0.4–0.5 MG)

		nmol/l	cH ⁺ (pH)	kPa	Pa _{CO₂} (Torr)	kPa	Pa _{O₂} (Torr)
Mean	Control	38.90	(7.41)	4.66	(35)	9.58	(72)
	M/S	42.66	(7.37)	5.32	(40)	7.98	(60)
SD ±	Control	3.11	(0.025)	0.39	(2.9)	1.14	(8.6)
	Morphine	3.28	(0.008)	0.41	(3.1)	0.89	(6.7)
P		< 0.001		< 0.001		< 0.001	

M/S – Morphine/scopolamine.

nmol/l to 42.66 ± 3.28 nmol/l, (pH decreased from 7.41 ± 0.02 to 7.37 ± 0.008) ($p = 0.001$); Pa_{O₂} decreased from 9.58 ± 1.06 to 7.98 ± 0.79 kPa (72 ± 8 to 60 ± 6 torr) ($p < 0.001$), the lowest value being 7.18 kPa (54 torr); and Pa_{CO₂} rose from an average of 4.66 ± 0.26 to 5.32 ± 0.40 kPa (35 ± 2 to 40 ± 3 torr) ($p < 0.001$), the highest value being 5.85 kPa (44 torr). The most dramatic fall in Pa_{O₂} was 2.79 kPa (21 torr). There was no significant difference between control values among the groups.

DISCUSSION

This study demonstrates that morphine (10–15 mg) and scopolamine (0.4–0.5 mg) pre-

medication diminishes Pa_{O₂} significantly in patients with coronary artery disease.

In the group receiving scopolamine alone, Pa_{O₂} fell by 0.532 kPa (4 torr). This reduction was statistically significant but of no clinical importance. cH⁺(pH) and Pa_{CO₂} did not change. Since there was no carbon dioxide elevation, reduction in Pa_{O₂} was probably due to uneven ventilation produced by the sedative effects of scopolamine. It is our observation that this group was better sedated than the morphine group, but less sedated than the morphine plus scopolamine group. In the group receiving morphine alone, cH⁺(pH), Pa_{CO₂} and Pa_{O₂} did not change, probably because of persistent anxiety or lack of sedation, which provided a better ventilation-perfusion ratio. Se-

dation may not regularly accompany morphine administration.⁹

A stable Pa_{CO_2} after morphine alone and scopolamine alone indicates that neither had produced respiratory depression or stimulation.

In the group receiving morphine and scopolamine, cH^+ increased (pH decreased) and Pa_{O_2} fell significantly ($p < 0.001$). The change in cH^+ (pH) was statistically significant but of no clinical importance. Although the fall in Pa_{O_2} was associated with higher Pa_{CO_2} values, in some patients the Pa_{O_2} was decreased more than could be accounted for by decreased ventilation, suggesting that other mechanisms were involved. The magnitude of decrease in Pa_{O_2} was greater with the combination than with scopolamine alone.

In five of our patients, Pa_{O_2} fell to an unacceptable level although the mean value for the group was 7.98 kPa (60 torr). ST segment change occurred in one of these patients before induction of anaesthesia and returned to normal after several minutes of ventilation with 100 per cent oxygen. Although this suggests that oxygen was helpful, it is also possible that spontaneous resolution of the process could have occurred during the time oxygen was being administered. In patients with coronary artery disease, ST changes may occur any time, even without medications. Thus, it was impossible to determine whether ischaemic change was due to decreased Pa_{O_2} or to the disease process.

Reduction of systemic arterial oxygen tension in patients with coronary artery disease or in those with angina pectoris in whom maintenance of adequate oxygen tension is fundamentally important, even transient hypoxaemia may be dangerous. It is possible that morphine and scopolamine-induced arterial hypoxaemia may

be one contributing factor in producing preoperative myocardial ischaemia. The present study suggests that when morphine and scopolamine premedication is used on patients with severe coronary artery disease or angina pectoris, simultaneous administration of oxygen is important in helping to eliminate a possible cause of preoperative myocardial ischaemia.

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RÉSUMÉ

Les effets sur la Pa_{O_2} d'une prémédication à la morphine employée seule, d'une autre à la scopolamine, ainsi que ceux de l'association de ces deux agents, ont été étudiés chez des coronariens subissant un pontage aorto-coronarien. Pour fins de comparaison, l'on a fait un prélèvement artériel la veille de l'intervention chez chacun des patients, en position couchée et à l'air ambiant. Le lendemain matin, la gazométrie a été effectuée en salle d'induction et dans les mêmes conditions.

On n'a pas trouvé de modification de la cH^+ (pH), de la Pa_{O_2} et de la Pa_{CO_2} chez les patients ayant reçu une prémédication à la morphine ou à la scopolamine. Par contre, lorsque l'association des deux agents était utilisée, on retrouvait une diminution de la Pa_{O_2} avec élévation de la Pa_{CO_2} et de la cH^+ (pH abaissé). Les modifications de la Pa_{CO_2} et de la cH^+ étaient statistiquement significatives, sans toutefois être d'importance clinique.

En conclusion, il est suggéré d'administrer simultanément de l'oxygène lorsque la morphine est associée à la scopolamine en prémédication, ceci pour éliminer toute possibilité d'hypoxémie pré-opératoire.