The Journal of Laryngology and Otology
February 1991, Vol. **105**, pp. 109–111

Short Communication

Does post-operative nasal packing cause nocturnal oxygen desaturation?

J. G. Buckley F.R.C.S., S. A. Hickey F.R.C.S., A. F. Fitzgerald O'Connor F.R.C.S. (London).

Abstract
Previous studies have shown an increased frequency and duration of apnoeic episodes during sleep when the nose is occluded. The aim of this study was to ascertain whether oxygen desaturation occurs with nasal occlusion by post-operative packing. Continuous digital pulse oximetry was carried out before and after submucous resection of the nasal septum in 17 otherwise healthy patients. Post-operative nasal packing produced a statistically significant change in oxygen saturation during sleep. The change was, however, of such small magnitude that it is unlikely to be clinically significant.

Introduction

Central apnoeic episodes result from stimulation of the nasal mucosa in animals (James and Daly, 1969). Similarly in humans occlusion of the nose for several days has been reported to cause a fall in arterial tension (Wyllie *et al.*, 1976).

Sleep studies on human volunteers have demonstrated an increase in the frequency and duration of apnoeic episodes when the nose is occluded (Zwillich *et al.*, 1981; Suratt *et al.*, 1986). However, although some subjects show marked dips in oxyhaemoglobin saturation during sleep, our studies have not found a statistically significant overall change in saturation when the groups are compared before and after nasal packing.

Post-operative packing is frequently necessary following nasal surgery. A previous study, based on two arterial blood gas measurements one taken before and the other 24 hours after nasal packing, has suggested that this may cause arterial oxygen desaturation (Hady, *et al.*, 1983). The suggestion that oxygen desaturation may be significant in the aetiology of post-operative cardiac arrhythmias and myocardial infarction (Pateman and Hanning, 1989) raises concern about the safety of nasal packing.

The use of pulse oximetry allows a continuous estimate of arterial oxygen saturation. It has been shown to provide a close correlation with arterial blood gas measurements and is highly reproducible (Kagle, *et al.*, 1987).

The aim of the present study was to investigate, using continuous pulse oximetry, whether or not a significant change in oxygen saturation occurred when the nose was packed after nasal surgery.

Patients and methods

Patients

Seventeen patients were studied: six female and 11 male. The age of patients ranged from 18 to 38 (mean 28.4, standard deviation 7.95).

All patients presented with nasal obstruction which was found to be due to septal deviation and none gave a history suggestive of sleep apnoea. In addition to clinical examination all patients had their pre-operative blood pressure and peak expiratory flow rates measured. Patients with hypertension, respiratory disease or abnormal peak flow measurements (as defined in standard tables, Gregg and Nunn, 1973) were excluded from the study.

Haemoglobin and packed cell volume levels were measured before and on the morning after operation.

A submucous resection of the nasal septum was carried out in all patients, five patients also had submucous diathermy to the inferior turbinates. All patients received the same premedication (papaveretum and hyoscine) and general anaesthesia was induced with intravenous thiopentone and maintained with isofluorane. The duration of the anaesthetic varied from 25 to 47 minutes. Following the procedure the nose was completely occluded by packing with gauze soaked in petroleum jelly. All operations were carried out in the morning and oximetry carried out in the night. In no instance was a narcotic post-operative analgesic given.

Sleep studies

Patients were continuously monitored while asleep on the nights before and after surgery, the patients thus acting as their own controls. Arterial oxygen saturation was estimated using an Ohmeda Biox 3700 pulse oximeter with a Nellcor N100D finger probe. The oximeter was set to respond in fastest mode (3 second averaging). To prevent inaccuracy due to displacement the finger probe was anchored using adhesive tape. Recordings were made over a period of five hours, while the patient was asleep.

Statistics

Significance and confidence intervals on the differences between paired results were evaluated using a paired t-test. In view of the slightly skewed distribution of the differences, significance values were confirmed using Wilcoxons rank sum test. Statistical inference was obtained using the method described by Armitage and Berry (1987).

Results

Pre- and post-operative haemoglobin and packed cell volume

The mean pre-operative haemoglobin levels were 14.03 g/dl

Accepted for publication: 31 October 1990.

(range 12.3–16.1) and 13.97 g/dl (range 12.2–15.5) respectively. The mean pre-operative and post-operative values of the packed cell volume were 0.406 (range 0.337–0.485) and 0.406 (range 0.352–0.445) respectively. There was no significant difference between these levels.

Oxygen saturation values

The mean and minimum oxygen saturation levels were calculated for each patient before and after operation (Table). The number of dips in oxygen saturation and their duration were also recorded for each patient. A fall in saturation below 90% was taken to be significant (Suratt *et al.*, 1986).

The mean oxygen saturation values for the group as a whole, before and after operation were 96.2 per cent (SD = 1.6) and 95.3 per cent (SD = 1.6) respectively. The mean difference was 0.94 per cent (SD = 1.42, 95% confidence interval = 0.2 to 1.7). Analysis of the matched pairs of pre and post-operative results showed a significant fall in post-operative saturation ($p < 0.05$ and approaches 0.01 level).

The means of the minimum saturation value for the group as a whole, before and after operation, were 94.5 per cent (SD = 1.8) and 92.5% per cent (SD = 3.3) respectively. The mean difference was 1.94 per cent (SD = 2.77, 95 per cent confidence interval = 0.5 to 3.4). Analysis of the matched pairs of pre- and post-operative results showed that the minimum saturation level fell significantly post-operatively ($p < 0.05$ and approaches 0.01 level).

A clinically significant fall in mean oxygen saturation was taken to be 4 per cent (Suratt *et al.*, 1986). Only one patient showed a change of this magnitude post-operatively, the value falling from 97.4 per cent to 92.3 per cent. The same patient showed one dip in saturation to a minimum of 86 per cent with a duration of 45 seconds. Another patient showed three dips below 90 per cent saturation during the period of recording with two values of 89 per cent and one of 84 per cent. The total duration of these episodes was 2½ minutes. The mean post-operative saturation level, however, only fell by 0.3 per cent.

The 95 per cent confidence interval, obtained by statistical inference, of the percentage of subjects who might show a fall in mean saturation of 4 per cent or greater was 0.1 to 29 per cent. The corresponding interval for those who might show a dip in saturation below 90% and 1.5 to 36 per cent.

Discussion

Nasal obstruction in healthy volunteers has been shown to increase the frequency and duration of apnoeic episodes during sleep (Zwillich *et al.*, 1981; Suratt *et al.*, 1986). The episodes may be due to neurally mediated central suppression or to mechanical obstruction. The available evidence indicates that they are predominantly obstructive (Suratt *et al.*, 1986).

Measurement of arterial oxygen saturation by pulse oximetry demonstrates that some subjects show changes following nasal occlusion but there are no significant differences in saturation values for the groups as a whole Taasan *et al.*, 1981; Zwillich *et al.*, 1981; Suratt *et al.*, 1986).

It might be expected that in the post-operative situation the changes would be more pronounced because of stimulation of nasal reflexes and the effects of general anaesthesia on the respiratory system. Taasan *et al.* studied seven patients following nasal surgery and found that three patients showed changes in their oxyhaemoglobin saturation but again no significant differences were found for the group as a whole; six of the seven patients, however, had the operation performed under local anaesthesia (Taasan *et al.*, 1981).

The present study demonstrates that, when nasal surgery is carried out under general anaesthesia, there is a statistically significant post-operative fall in mean and minimum oxygen saturation values in healthy adults. This observation may be due to the effects of nasal occlusion or general anaesthesia or both. The effects of general anaesthesia *per se* on oxygen saturation have been well documented in the immediate post-operative period (Pateman and Hanning, 1989) but not on the first night after operation. A study of patients following major abdominal surgery showed a significant fall in median oxygen saturation on the first and second nights after operation; surprisingly the effect was more marked on the second than the first night (Rosenberg *et al.*, 1989). This is postulated to be due to an increase in the proportion of REM (rapid eye movement) sleep at this time. However, it is clear that factors in addition to the anaesthesia, such as pain and reduced ventilation, may be significant after abdominal surgery.

The present study was prompted by concern about the safety of post-operative nasal packing. A question which arises from the results is whether, although the saturation differences are statistically significant, they are clinically significant. It is accepted that a fall in saturation below 90 per cent represents significant hypoxaemia (Suratt *et al.*, 1986); the significance of lesser falls is unclear. Certainly only two patients in the study showed dips in post-operative saturation below 90 per cent, and in neither case were these prolonged. Since the mean fall in oxygen saturation for the group as a whole was only 0.9 per cent and only one patient showed a fall in mean saturation of more than 4 per cent (5.1 per cent), the change in saturation is unlikely to be clinically significant.

TABLE

Patient	Age	Sex	Pre-operative saturation (per cent)		Post-operative saturation (per cent)		Per cent fall in mean post-operative saturation
			Mean	Minimum	Mean	Minimum	
1	18	M	97.5	96	95.6	92	1.9
2	26	M	97.4	95	95.8	91	1.6
3	19	M	97.5	96	95.3	94	2.2
4	45	M	95.5	95	94.4	93	1.1
5	27	M	97.7	96	96.0	95	1.7
6	26	M	97.4	95	92.3	86	5.1
7	27	M	97.0	96	97.2	95	−0.2
8	43	M	96.4	95	94.4	93	2.0
9	21	F	98.1	96	97.5	96	0.6
10	25	M	93.0	91	93.0	91	0
11	28	F	96.0	94	95.3	91	0.7
12	28	M	94.0	91	94.0	92	0
13	38	F	92.9	91	92.6	84	0.3
14	22	M	96.2	95	96.8	95	−0.6
15	22	F	96.5	95	97.2	96	−0.7
16	36	F	96.3	95	96.6	95	−0.3
17	32	F	95.8	94	95.3	94	0.5

https://doi.org/10.1017/S0022215100115075 Published online by Cambridge University Press

The results do not cast doubt on the suggestion that nasal obstruction may be significant in the development of nocturnal oxygen desaturation in sleep apnoea. The study was carried out in young healthy patients and it is possible that nasal obstruction may be important in the already compromised airway. Further study is needed to clarify the role of nasal obstruction in sleep apnoea.

References

Armitage, P., Berry, G. (1987) Statistical methods in medical research, 2nd Edition. Blackwell Scientific Publications: Oxford, p 119.

Gregg, I., Nunn, A. J. (1973) Peak expiratory flow in normal subjects. *British Medical Journal,* **3:** 282–284.

Hady, M. R. A., Kodeira, K. Z., Nasef, A. H. (1983) The effect of nasal packing on arterial blood gases and acid base values and its clinical importance. *Journal of Laryngology and Otology,* **97:** 599–601.

James, J. E. A., Daly M. de B. (1969) Nasal reflexes. *Proceedings of the Royal Society of Medicine,* **62:** 1287–93.

Kagle, D. M., Alexander, C. M., Berko, R. S., Giuffre, M., Gross, J. B. (1987) Evaluation of the Ohmeda 3700 pulse oximeter: Steady state and transient response characteristics. *Anesthesiology,* **66:** 376–380.

Pateman, J. A., Hanning, C. D. (1989) Postoperative myocardial infarction and episodic hypoxaemia. *British Journal of Anaesthesia,* **63:** 648–649.

Rosenberg, J., Dirkes, W. E., Kehlet, H. (1989) Episodic arterial oxygen desaturation and heart rate variations following major abdominal surgery. *British Journal of Anaesthesia,* **63:** 651–654.

Suratt, P. M., Turner, B. L., Wilhoit, S. C. (1986) Effect of intranasal obstruction on breathing during sleep. *Chest,* **90:** 324–329.

Taasan, V., Wynne, J. W., Cassissi, N., Block, A. J. (1981) The effect of nasal packing on sleep disordered breathing and nocturnal oxygen saturation. *Laryngoscope,* **91:** 116–1171.

Wyllie, J. W. III., Kern, E. B., O'Brien, P. C., Hyatt, H. I. (1976) Alteration of pulmonary function associated with artificial nasal obstruction. *Surgical Forum,* **27:** 535–537.

Zwillich, C. W., Pickett, C., Hanson, F. N., Weil, J. V. (1981) Disturbed sleep and prolonged apnoea during nasal obstruction in normal men. *Annual Review of Respiratory Diseases,* **124:** 158–160.

Address for correspondence:
J. G. Buckley M.Sc., F.R.C.S.,
E.N.T. Department,
St. Thomas Hospital,
London SE1 7EH.

Key words: Nasal packing; Oxygen desaturation