Anesthesiology
52:88–89, 1980

A Source of Nonanesthetic Nitrous Oxide in Operating Room Air

REGINALD P. WRAY, M.D.*

During the past decade, considerable interest has been focused on trace anesthetic gases in the operating room environment. Possible adverse effects on operating personnel have been suggested, but not universally accepted.[1–5] Sources of nitrous oxide leaking into the atmosphere, other than from anesthesia machines, have been a neglected area of study. N_2O is used for such nonanesthetic purposes as insufflation during laparoscopy and provision of a coolant for cryosurgical probes. N_2O used in a Frigitronic® cryosurgical probe for eye surgery vents into the operating room air from the probe jack connection to the console. Measurements were made of ambient concentrations of N_2O in the breathing zones of the surgeon, close to this connection, and the anesthetist, who sat several feet further from it.

METHODS

Levels of N_2O were measured in 25 cases of cataract extractions in which the cryosurgical probe was used. All operations were done with the use of local anesthesia, and anesthetic gases were not used. The operating rooms had a nonrecirculating supply of 15 air exchanges per hour. Therefore, the source of any N_2O found in the room air would be the cryoprobe.

A Cavitron® environmental Model EM20A infrared monitor was used for the N_2O measurements. The instrument was first zeroed with N_2O–free air sampled in an unused room, then calibrated with standard gas. The standard was certified by Matheson Corporation, Newark, California, to contain 212 ppm N_2O.

Experimental sampling was performed in a standard manner for each case. Background samples were taken in the operating room before the beginning of the first procedure of the day and during each interoperative period longer than 30 min. The operating room doors were closed, the cryoprobe N_2O tanks closed, and there was a zero pressure reading on the cryoprobe N_2O guage. Sampling was continuous for 1 min, and the highest reading found during that time was the one recorded. The sampling tube was 50 cm from the operating surgeon's breathing area, which was 3 feet from the cryoprobe vent. The second sample was taken from a similar location near the anesthetist's breathing area, 6 feet from the vent. Samples were next taken when the cryoprobe N_2O system was pressurized, then after 1 min, after 20 min, at the clearing of the probe, and then 5, 10, 15, and 20 min thereafter. Further readings were taken after closing of the valves of the N_2O tanks and bleeding the tanks to zero gauge pressure, and 20 min after this, or at the end of the procedure.

TABLE 1. Nitrous Oxide in Breathing Zones of Ophthalmologist and Anesthetist (Mean ± SE)

Condition	N_2O (ppm)	
	Ophthalmologist	Anesthetist
Background, valve closed	0.5 ± 0.2	0.5 ± 0.2
Valve open, after:		
1 min	207 ± 47.2	33 ± 6.9
20 min	163 ± 47.4	32 ± 8.0
Clearing probe	433 ± 35.0	72 ± 18.0
During use	504 ± 14.0	91 ± 11.0
Discontinuing probe use	435 ± 35.0	96 ± 10.0
After 5 min	204 ± 43.0	37 ± 3.0
After 10 min	49 ± 10.0	14.0 ± 2.0
After 15 min	14 ± 3.0	5.0 ± 1.0
After 20 min	6 ± 1.4	3.0 ± 1.0
Close valve and bleeding to zero gauge pressure		
After 1 min	427 ± 100.0	56.0 ± 8.0
After 20 min	16 ± 10.0	5.0 ± 2.0
End of procedure	1.8 ± 0.8	1.5 ± 0.8

RESULTS

The results are summarized in table 1. The background readings were within the calibration limits of the Cavitron monitor. During the use of the cryoprobe the N_2O levels were in the ranges of 500 ppm in the ophthalmologist's breathing area and 90 ppm in the anesthetist's breathing area. These levels were maintained for an average time of 34 min, with a range of

* Attending Anesthesiologist; Assistant Clinical Professor of Anesthesiology, University of California, Irvine, California.

Received from the Anesthesiology Service, Veterans Administration Medical Center, 5901 East Seventh Street, Long Beach, California 90822. Accepted for publication July 11, 1979.

6 to 81 min. The levels of N_2O returned to below 25 ppm in 20 min or more.

Discussion

The National Institute of Occupational Safety and Health (NIOSH) has recommended an occupational exposure of less than 25 ppm N_2O during administration of anesthesia. This is a time-weighted average concentration, which NIOSH suggests be the average amount present over at least a 15-min period.[6] This sampling method was not followed in the present study, since it precludes detection of minute-to-minute changes. Instead, the peak values found during one-minute sampling periods are reported.

A significant source of N_2O levels in the operating room has been shown in this study. The ophthalmologist, who was closer to the cryoprobe vent than was the anesthetist, was exposed to higher concentrations. The cryoprobe unit can be adapted to scavenging, but available devices to achieve this are cumbersome and difficult to use. A better scavenging device is needed.

References

1. Cohen EN, Brown BW, Bruce DL, et al: Occupational disease among operating room personnel: A national study. Anesthesiology 41:317–340, 1974
2. Ferstandig LL: Trace concentrations of anesthetic gases: A critical review of their disease potential. Anesth Analg (Cleve) 57:328–345, 1978
3. Vessey MP: Epidemiological studies of the occupational hazards of anaesthesia—A review. Anaesthesia 338:430–438, 1978
4. Walts LF, Forsythe AB, Moore G: Occupational disease among operating room personnel. Anesthesiology 42:608–611, 1975
5. Smith G, Shirley AW: A review of the effects of trace concentrations of anaesthetics on performance. Br J Anaesth 50:701–712, 1978
6. Criteria for a Recommended Standard . . . Occupational Exposure to Waste Anesthetic Gases and Vapors. National Institute for Occupational Safety and Health, U. S. Department of Health, Education, and Welfare, March 1977, Publication #77-140

Anesthesiology
52:89–90, 1980

Methylmethacrylate Airway Obstruction

Thomas H. Cromwell, M.D.*

Methylmethacrylate has been used for more than 20 years in a variety of procedures, including dental prostheses, cranial bone replacement, and prosthetic hip replacements. More recently, it has been employed in the treatment of pathologic fractures, especially where extensive bone destruction has occurred, making adequate fixation difficult.

Coincident with the extensive use of methylmethacrylate, various complications have been reported, including hypotension resulting from a direct vasodilatory effect of the methylmethacrylate monomer,[1,2] bladder fistulas, spinal-cord damage, and arterial occlusion[3] secondary to intense heat produced by the exothermic polymerization process.

To my knowledge, airway obstruction as a complication of methylmethacrylate has not been reported.

Report of a Case

A 41-year-old woman had undergone radical mastectomy for moderately differentiated, infiltrating ductal carcinoma six months prior to admission. She was readmitted with metastases to numerous ribs and the cervical spine. A computerized tomographic scan revealed extensive destruction of the C4 vertebral body, with many lytic lesions in C5 and C6 vertebrae. A cervical myelogram showed no obstruction.

A week after admission the patient underwent anterior surgical exploration of the cervical spine with general anesthesia. A large defect in C3 and C4 vertebrae was filled with methylmethacrylate.

In the immediate postoperative period, the patient complained of slight respiratory distress and a sharp right-sided pain in the neck associated with swallowing. Within two days she was able to tolerate liquids and semisolids, but the pain and dyspnea continued. On the sixth postoperative day, dysphagia developed, and it progressed over the subsequent ten days to complete inability to pass even liquids.

An esophagram revealed pooling of the contrast medium in the hypopharynx, with a small, constricted esophageal lumen in the cricopharyngeal area. Interstitial inflammatory disease involving the left lung was observed on roentgenograms of the chest. A diagnosis of dysphagia secondary to pain and edema in the cricopharyngeal area was entertained, and an attempt to relieve the pain and spasm with narcotics was unsuccessful. The patient was then scheduled for esophagoscopy and reexploration of the neck.

Following an inhalational induction, laryngoscopy revealed a 2 × 3-cm submucosal mass in the posterior pharyngeal wall at the level of the epiglottis, extending down to the arytenoids compressing the esophagus and arytenoids anteriorly against the epiglottis. Identification of the airway opening was made with some difficulty, since it was not only compressed, but deviated to the right. A #7

* Department of Anesthesia, Children's Hospital of San Francisco, 3700 California Street, San Francisco, California 94118.

Accepted for publication July 11, 1979.

Address reprint requests to Dr. Cromwell.