

## LARYNGEAL INCOMPETENCE DURING EXPERIMENTAL "RELATIVE ANALGESIA" USING 50% NITROUS OXIDE IN OXYGEN *A preliminary report*

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### SUMMARY

Ten healthy adult volunteers inhaled 50% nitrous oxide in oxygen while dental treatment was simulated for a period of 30 min. During this time 15 ml of radio-opaque dye was placed at the back of the tongue. A similar control study was performed 1 week later, the subjects inhaling pure oxygen without nitrous oxide. X-ray examination revealed that two of the 10 volunteers had aspirated dye while breathing nitrous oxide and oxygen, but no aspiration was apparent in the control study.

Regurgitation and inhalation of acid gastric content remains a common cause of death during anaesthesia (Harrison, 1968). The inhalation of 50% nitrous oxide in oxygen for induction of anaesthesia in the poor risk patient is often preferred to other induction techniques. The administration of nitrous oxide in oxygen in dentistry is a fashionable and popular technique with a high degree of patient acceptance because of the pleasant euphoria and relaxation produced (Clement, 1951). Inhalation of premixed nitrous oxide in oxygen (Entonox) for pain relief in labour occurs commonly. Pleasants (1971) challenged the safety of the latter technique; suggesting that the pharyngeal protective reflexes might be obtunded.

The purpose of this study was to assess the efficiency of laryngeal closure during the administration of 50% nitrous oxide in oxygen, employing the Quantiflex nitrous oxide/oxygen anaesthetic machine, an apparatus used commonly by the dental surgeon (Allen, 1972).

### PATIENTS AND METHODS

Ten healthy non-pregnant adult female volunteers, aged 18–21 yr, gave informed consent for the study. After an overnight fast a control chest x-ray was taken before the study commenced.

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Each volunteer reclined in the dental chair for 30 min, during which time she inhaled a mixture of 50% nitrous oxide in oxygen from a Quantiflex apparatus ("relative analgesia"). The inspired concentration of gas was monitored throughout using an Airco Ohio Model 600 oxygen monitor. Subjects breathed through a nasal mask for a period of 10 min until they were comfortable and equilibration with the inspired gas mixture could be assumed. The pulse was monitored continuously using a photoelectric pulse transducer (Sanei II Pulsemeter) attached to the thumb. All the necessary facilities for resuscitation were readily available. Volunteers with previous history of allergy or sensitivity to iodine were excluded from the study.

At intervals of 1½ min, 8–10 ml of water was sprayed into the mouth around the teeth with a dental drill. Adequate suction was applied to remove the water from the mouth.

Fifteen millilitres of radio-opaque liquid "Dionosil" was then placed on the back of the tongue with a soft-tipped plastic catheter over a period of 2 min, during which time most of the volunteers swallowed the dye. Intermittently, water from the dental drill was squirted into the mouth and suction was applied to the pharynx for a further 20 min, simulating drilling and filling of the teeth. Inhalation of the nitrous oxide in oxygen mixture continued throughout this time. Pure oxygen was then administered for 6 min at the end of the investigation, to wash out residual nitrous oxide from the lungs. At the end of the procedure, the x-ray examination was repeated to determine the fate of the dye.

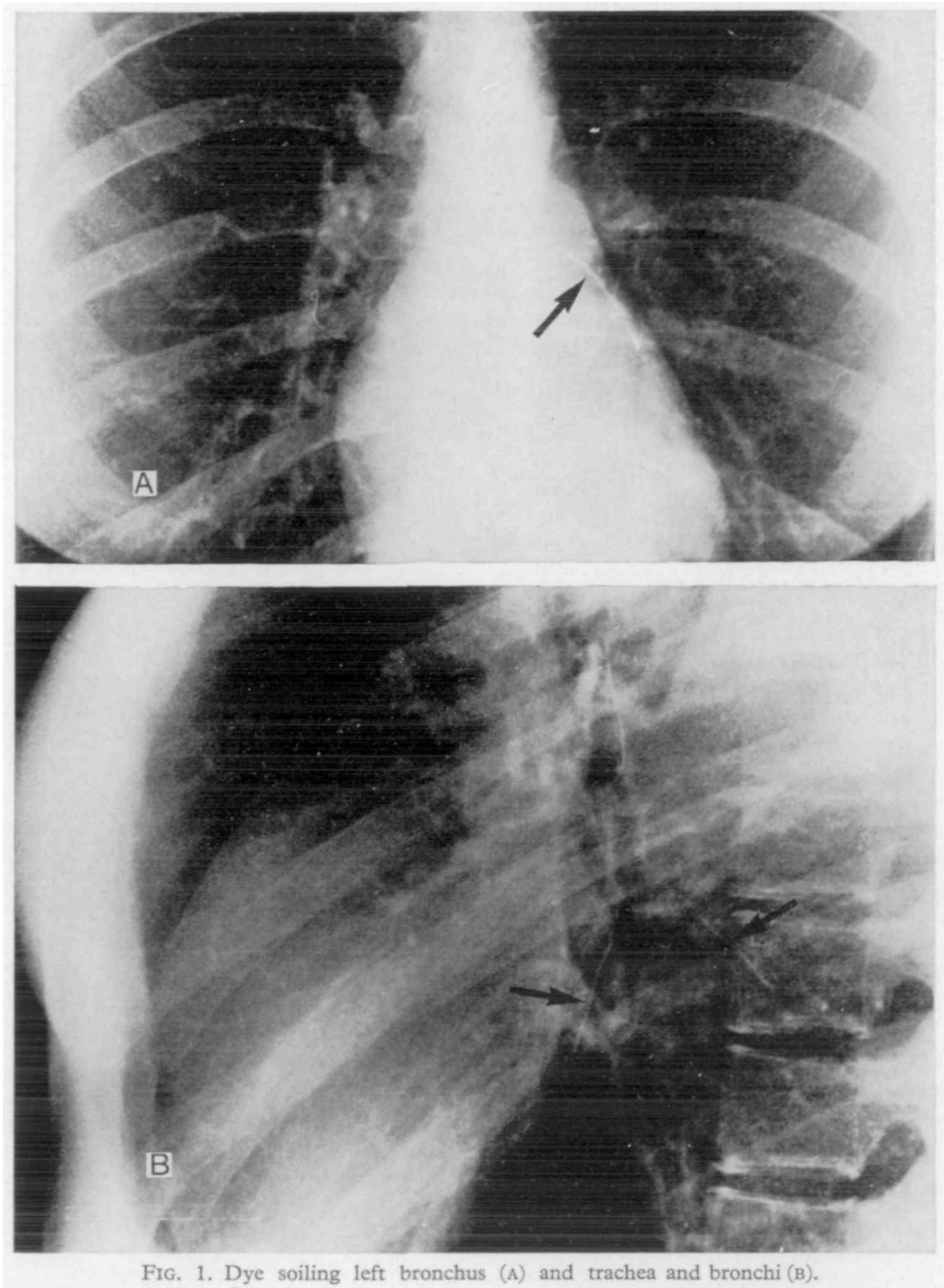


FIG. 1. Dye soiling left bronchus (A) and trachea and bronchi (B).

One week later, a similar study on the same volunteer was performed except that nitrous oxide was not included in the inspired gases. All the x-ray films were viewed independently by a radiologist (J. B.), who was unaware of the method of management on the day of the study.

#### RESULTS

In all subjects, the presence of dye in the stomach could be identified on screening after the procedure. No evidence of aspiration of dye was detected in the control study, but two of the 10 volunteers showed clear signs of pulmonary aspiration of dye on x-ray

examination after the inhalation of the nitrous oxide in oxygen mixture (fig. 1) ( $\chi^2$  test corrected for discontinuity:  $0.4 < P < 0.5$ ).

## DISCUSSION

Several investigators have shown that reflex laryngeal closure is depressed under general anaesthesia and following i.v. sedation with methohexitone, diazepam, ketamine and neurolept analgesia (Wise et al., 1969; Healy, Robinson and Vickers, 1970; Taylor and Towey, 1971; Brock-Utne et al., 1976).

Taylor and Towey (1971) failed to demonstrate radiological evidence of pulmonary aspiration of dye in conscious volunteers lying supine and premedicated with hyoscine. Prout and Metreweli (1972) found evidence of pulmonary aspiration in 24 patients undergoing fiberoptic endoscopy of the upper gastrointestinal tract while sedated with diazepam or chlormethiazole and topical pharyngeal analgesia. Protective reflexes are compromised with advancing age, and depressant drugs should be used with great care in the elderly (Pontoppidan and Beecher, 1960). Pleasants (1971) has also expressed doubt as to the effects of relative analgesia on the laryngeal response during dental procedures, but his view has been refuted by Cleaton-Jones (1976).

Our study suggests that the inhalation of 50% nitrous oxide in oxygen differs little from other commonly used anaesthetic techniques with respect to suppression of pharyngeal and laryngeal reflexes. This study can be regarded as a pilot investigation only. The treatments were not allocated randomly and the difference between the treatments in respect of the main finding was not significant. We make this preliminary report in view of a recent communication advocating the safety of "relative analgesia" (Cleaton-Jones, 1976). However, in the latter study, conducted at an altitude of 1800 m, 50% nitrous oxide in oxygen was administered for only 5 min before challenging laryngeal competence. Under these circumstances there may have been less depression than in our study.

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INSUFFISANCE LARYNGIENNE AU COURS  
D'UNE "ANESTHESIE RELATIVE"  
EXPERIMENTALE A L'AIDE D'UN MELANGE  
A 50% DE PROTOXYDE D'AZOTE ET  
D'OXYGENE

## RESUME

Dix adultes volontaires en bonne santé ont inspiré un mélange à 50% de protoxyde d'azote et d'oxygène au cours d'un traitement dentaire simulé d'une durée de 30 min. Pendant cette période, on a placé 15 ml d'un colorant opaque aux rayons X sur l'arrière de la langue. On a effectué une semaine plus tard une étude de contrôle similaire tandis que les sujets inspiroient de l'oxygène pur sans protoxyde d'azote. L'examen aux rayons X a révélé que deux volontaires sur les dix avaient inspiré le colorant alors qu'ils respiroient le mélange de protoxyde d'azote/oxygène, mais aucune aspiration de ce genre ne s'est apparemment produite pendant l'étude de contrôle.

KEHLKOPF-VERSAGEN WÄHREND "RELATIVER  
ANALGESIE" MITTELS 50% STICKOXYD  
IN SAUERSTOFF

## Ein Vorläufiger Bericht

## ZUSAMMENFASSUNG

Zehn gesunde, erwachsene Freiwillige atmeten 50% Stickoxyd in Sauerstoff ein, während 30 min lang eine Zahnbehandlung simuliert wurde. Während dieser Zeit wurden 15 ml einer radiopaquen Farbe auf den hinteren Teil der Zunge gelegt. Eine ähnliche Kontrollstudie wurde 1 Woche später durchgeführt, wobei die Versuchspersonen reinen Sauerstoff ohne Stickoxyd einatmeten. Röntgenuntersuchungen zeigten, dass zwei der 10 Freiwilligen beim Atmen Farbe angesaugt hatten, während dies bei der Kontrollgruppe nicht der Fall war.

INCOMPETENCIA DE LARINGE DURANTE  
"ANALGESIA RELATIVA" EXPERIMENTAL  
EMPLEANDO 50% OXIDO NITROSO  
EN OXIGENO

*Un informe preliminar*

SUMARIO

Diez voluntarios adultos saludables inhalaban 50% óxido nítrico en oxígeno mientras se simulaba tratamiento dental durante un período de 30 min. Durante este tiempo se colocaron 15 ml de tintura radio-opaca en la parte posterior de la lengua. Una semana más tarde se realizó una prueba de control similar, con los individuos inhalando oxígeno sin óxido nítrico. Un examen por rayos-X indicó que dos de los 10 voluntarios habían aspirado tintura mientras respiraban óxido nítrico con oxígeno, pero la aspiración no fue aparente durante la prueba de control.