suscitation practice and presumably is also occurring in the field. Therefore, this cannula could perhaps be used for pleural puncture where closed thoracotomy equipment (trocars and chest tube) is not available. This was successfully tried in dogs and on one patient. The cannula proved too short to pass through skin, subcutaneous tissue and intercostal tissues with the flap remaining outside the skin. Pleural puncture was possible, however, when the skin incision was long enough to accommodate the entire flap, which then came to rest directly upon the ribs. A Heimlich chest-drain valve is connected to the cannula.

The ability of medical corpsmen of the Armed Forces to learn cricothyrotomy on animals has been demonstrated. Physicians may familiarize themselves with the cricothyroid space by performing translaryngeal injection of local anesthetics for topical anesthesia of the larynx and trachea. In addition, we have introduced into our Cardiopulmonary Resuscitation Course the practice of cricothyrotomy on dogs. Trials indicate that practice is necessary to learn this method.

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References


Effects of Nitrous Oxide on Middle Ear Pressure

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Recent reports have shown that nitrous oxide causes a rise in pressure in air containing cavities when inhaled in high concentration. A closed or semiclosed air containing space is needed and nitrous oxide must be inhaled in high concentrations, i.e., above 60 per cent. The purpose of this paper is to describe the increase in pressure occurring in the middle ear following inhalation of nitrous oxide.

When nitrous oxide is inhaled in high concentrations it will be dissolved in blood and carried to the air containing space in relatively large amounts. Nitrous oxide will diffuse into the air containing cavity, tending to establish the partial pressure it exhibits in arterial blood, and equilibrate with the gases originally present. Nitrogen originally in the space is slowly absorbed as its partial pressure in arterial blood is reduced. Both of these diffusion processes occur independently. Since nitrous oxide is 34 times as soluble as nitrogen in blood, nitrous oxide molecules will collect in the air space faster than nitrogen molecules leave. This will cause temporary increase of volume or, if the size of the air cavity is fixed, an increase of pressure in the cavity (fig. 1).

Methods

Five cats were anesthetized using 25 mgm./kg. of pentobarbital given intraperitoneally. Exposure of the tympanic bulla, which in the cat is continuous with the middle ear, was made by removing the submaxillary gland,
Fig. 1. (A) shows rapid increase of pulmonary nitrous oxide with a concomitant decrease in nitrogen concentration. This is associated (B) with similar changes in blood. This results in a rapid increase of nitrous oxide partial pressure in the middle ear associated with a gradual decrease in the partial pressure of nitrogen resulting in an increase in middle ear pressure (C).

digastric muscles and ligating the ascending pharyngeal artery. In two cats, tracheostomy was performed to insure an adequate airway. An 18 gauge needle was introduced into the bulla. The needle was attached via a side arm to a water-filled Statham strain gauge transducer and pressure changes were recorded with an Offner polygraph. The system was calibrated with a water manometer. Gas samples were obtained through a 25 gauge needle placed through a self-sealing membrane into the 18 gauge needle. The system consisting of middle ear needle and pressure transducer was checked for tightness by observing the tympanic membrane movements when positive and negative pressures were caused by introducing air into the middle ear by means of a microsyringe.

Sixty-six per cent nitrous oxide in oxygen was inhaled up to 80 minutes using a semi-open system with high flow. The percentage of nitrous oxide in the middle ears in three cats was measured by gas chromatography at the height of pressure increase. One hundred microliter samples of gas were obtained from middle ear using a Hamilton syringe with a no. 25 needle.

Results

Nitrous oxide causes a slow rise in pressure in the middle ear of cats studied (Fig. 2). The pressure rose slowly over 10–15 minutes until peak pressures ranging from 12 to 40 cm of water were obtained. The eustachian tube usually opened as the peak pressure was achieved, with a resulting temporary drop in pressure (Fig. 3). The percentage of nitrous oxide rose slowly to 21 to 23 per cent. The increase in middle ear pressure correlated with the rise of nitrous oxide concentration.

Fig. 2. In all cats studied, middle ear pressure rose to 12 to 40 cm. of water. After 25 minutes middle ear pressure remained constant.

Fig. 3. Idealized schematic representation of pressure changes in middle ear during N₂O breathing. (A) demonstrates a rapid increase in middle ear pressure. Pressure usually remained constant (B), followed by a sudden drop in pressure due to eustachian tube venting with pharynx (C).
DISCUSSION
The cat was selected for this study because the volume of the middle ear cavity is large, approximating the human middle ear, and the tympanic bulla affords a convenient site for sampling gas and making pressure measurements. The middle ear represents a closed air space which can be vented from time to time when the eustachian tube is opened. In deeply anesthetized animals, we have observed that the pressure in the middle ear tends to be low and the eustachian tube remains closed. When nitrous oxide is inhaled, the pressure slowly rises to overcome the passive resistance of the eustachian tube. In our cats there was no evidence of rupture of the tympanic membrane, presumably because the Eustachian tube opened before sufficient pressure to cause a perforation developed. It seems possible that nitrous oxide inhalation, with its resultant rise in middle ear pressure, might be partly responsible for tympanic perforation, hemotympanum and serous otitis media as sequelae of general anesthesia, particularly in patients with swelling or proliferation of mucous membranes which interfere with normal function of the eustachian tube.

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REFERENCES

A New Double Lumen Endobronchial Tube Connector

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A connector † which was developed for use with a double lumen endobronchial tube has the following advantages: (1) It is uncomplicated in design, simple to operate, and easy to manufacture. (2) Using only one maneuver: a) it shuts off one lung from the ventilatory source; b) it enables this isolated lung to collapse freely to the atmosphere; c) without any further intervention, it allows the passage of a suction catheter, a catheter for oxygen insufflation, or selective ventilation; whichever is indicated by clinical circumstances, or individual preference of the anesthesiologist. (3) Being made of plexiglass, one is able to see whether or not it is properly adjusted. (4) The connector may be used for “one lung” anesthesia or in bronchopulmonometry.

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DESCRIPTION
The connector (fig. 1) consists of two slightly modified plexiglass discs held in tight apposition by a nut, bolt, and spring washer. The discs rotate easily upon one another, and yet are not so loosely approximated as to allow leakage of gases. The first disc is perforated by two holes, into which fit the metal ends for attaching to the double lumen endobronchial tube. In the second disc three holes are cut—one large hole and a small one on either side of it. The large hole is of sufficient size so that when opposite to the small holes in the first disc, it overlies both of them. The smaller holes are the same size as those in the first disc. Surmounting this large hole is a plexiglass funnel, the free end of which fits directly into the anesthetic machine or ventilator delivery tubing. By simply rotating the second disc upon the first, the large hole is opposite only one of the small holes in the first disc, i.e., opposite that lung which