

A Ventilating Attachment for the Fiber-optic Bronchoscope

W. E. SPOEREL, M.D., F.R.C.P. (C)*

The use of a jet injector to ventilate patients during bronchoscopy under general anesthesia, originally described by Sanders,¹ has simplified anesthetic technique and improved the safety of this procedure.^{2,3,4} In all the adaptations for the various makes of bronchoscopes described, the jet is attached to the observer's end of the bronchoscope. The fiber-optic bronchoscope (American Cystoscope Makers, Inc.) has a wide opening at the observer's end and a side arm with a male 15-mm fitting, specifically designed to accept the ventilating attachment from an anesthetic gas machine. The following device was developed to introduce the ventilating jet through this side arm.

A brass adapter was machined for the 15-mm fitting of the side arm. A blunted #16 needle was threaded through the center of the adapter and carefully bent so that its tip came to lie parallel to the wall of the bronchoscope, with the opening of the needle directed toward the patient end of the scope (fig. 1). A groove cut into the adapter directly opposite the tip of the needle allows the correct positioning of the device, which must lie precisely in line with the axis of the bronchoscope. The slightest lateral deviation of the jet will reduce its ventilating efficiency by generating turbulence.

Since the observer's end of the scope is widened at the entrance of the side arm, the tip of the needle is not visible to the endoscopist and his field of vision is not impaired. The ventilating device does not interfere with any instrumentation through the bronchoscope, and there is no need to interrupt ventilation at any time during the procedure.

A plastic pressure tubing is attached to the hub of the #16 needle with a Luer-Lok adapter (fig. 2). An oxygen cylinder with a reducing valve is used to power the jet; a regulator allows pressure settings up to 100 psi.

The jet can be interrupted by a hand valve¹ or with a Bird Mark 2 ventilator² to obtain intermittent positive-pressure ventilation.

The flow through the jet and the total flow through the jet plus air entrainment by the force of the jet) were measured for various pressure settings with a Collins spirometer (fig. 3). With the same bronchoscope attached to a lung analog,² inflation pressures up to 56 mm Hg were obtained (fig. 4).

The ventilating attachment has been used in more than 50 patients with very satisfactory results. Anesthesia was induced with thiopental and complete muscular relaxation obtained with intermittent doses of succinylcholine. After preoxygenation, the bronchoscope was introduced and ventilation with the jet begun at a rate of 12 to 16 inflations per minute. The adequacy of ventilation was judged by observing the chest excursion of the patient with inflation and the jet pressure was regu-

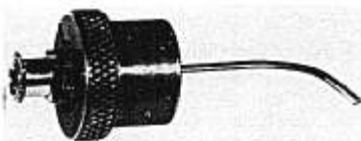


FIG. 1. Ventilating attachment.

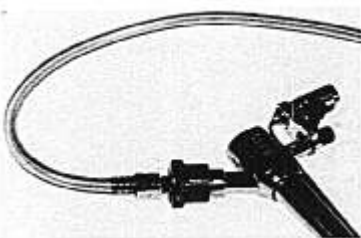


FIG. 2. Bronchoscope with ventilating attachment.

*Department of Anaesthesia, University of Western Ontario and Westminster Hospital, London, Canada.

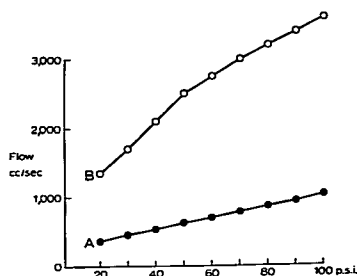


FIG. 3. Oxygen flows through jet (A) and total flows through 8-mm bronchoscope (B) at pressures between 20 and 100 psi applied to jet (#16 needle).

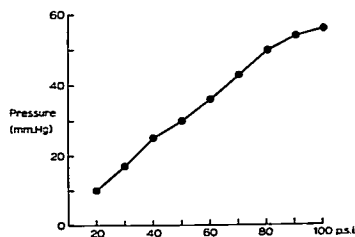


FIG. 4. Inflation pressures in lung analog, obtained with an 8-mm bronchoscope.

lated accordingly. In most adult patients there is a substantial leak back through the glottis, but this usually could be compensated for by increasing the force of the jet. Occasionally, gentle compression of the neck just above the larynx was used to reduce this leak. The bronchoscopist noticed an expiratory flow

from the bronchoscope similar to that of quiet spontaneous breathing.

Blood gas analysis at the end of 7 to 18 minutes (average 12 minutes) of ventilation with the jet injector through the bronchoscope revealed P_{O_2} values above 100 mm Hg in all patients and P_{CO_2} values between 19 and 45 mm Hg (average 34 mm Hg) in 14 of 16 patients examined. The remaining two, elderly patients with considerable obstructive pulmonary disease and bronchial tumors, had P_{CO_2} values of 52 and 62 mm Hg after ten minutes of ventilation. This confirms the efficiency of this ventilating device.^{2,3,4}

The ventilating attachment can be removed easily for cleaning purposes and is sterilized together with the bronchoscope.

For bronchoscopes less than 5 mm in diameter the use of a jet equal to a #20 needle is recommended. In children the bronchoscope usually occludes the glottis; a smaller jet provides adequate force for inflation and prevents the production of high inflation pressure which theoretically could be a danger with a larger jet.

REFERENCES

1. Sanders, R. D.: Two ventilating attachments for bronchoscopes, *Delaware Med. J.* 39: 170, 1967.
2. Pender, J. W., Winchester, I. W., Jamplis, R. W., Lillington, G. A., and McClenahan, J. B.: Effects of anesthesia on ventilation during bronchoscopy, *J. Anesth. Analg. (Cleveland)* 47: 415, 1968.
3. Spoerel, W. E.: Ventilation through an open bronchoscope, *Canad. Anaesth. Soc. J.* 16: 61, 1969.
4. Morales, G. A., Epstein, B. S., Cinco, B., Adkins, P. C., and Coakley, C. S.: Ventilation during general anaesthesia for bronchoscopy: Evaluation of a new technique, *J. Thorac. Cardio. Surg.* 57: 873, 1969.