The Effects of Instrumentation on Gas Flows during Bronchoscopy Using the Sanders Ventilating Attachment

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Studies showing the adequacy of ventilation provided by the Sanders ventilating attachment to the bronchoscope have been made. Arterial blood–gas tensions have been used as the criteria for this adequacy.[1-5] However, it has not been shown whether significant impairment of gas flow is produced by the introduction of different instruments into the bronchoscope using this technique. This consideration becomes important in the prolonged use of these instruments. Therefore, we set up a physical model to measure the effects of such necessary instrumentation during diagnostic bronchoscopy using the Sanders ventilating attachment.

METHOD

The instruments used in bronchoscopy, including Krumperman's adaption of the Sanders ventilating attachment to the sidearm of the Holinger bronchoscope,[6] were assembled (figs. 1 and 2). A 5-liter reservoir bag was used to simulate one lung and its resistance. A Wright respirometer was interposed between the distal end of the bronchoscope and the reservoir bag for measurement of gas flows. The oxygen line, with a single-stage pressure regulator, was attached to a wall outlet.

The inspiratory phase, corresponding to the depression of the intermittent injector valve, was set at 1.5 sec, and the respiratory rate at 15/min. Gas flow per minute was determined: a) through an open bronchoscope; b) with the suction tip in the bronchoscope; c) with the suction on; d) with the telescopic lens; e) with the Roberts forceps within the bronchoscope. Three pressure gauge settings, 20, 35, and 50 psi, were used. The same experimenter handled the ventilating attachment throughout. Three determinations were made for each variable and the averages taken. The per cent reduction of gas flow produced by each instrument was then computed.

RESULTS

The model showed that the higher the pressure gauge settings, the greater the gas flows through the bronchoscope (table 1). It also showed that gas flows were impaired during instrumentation, especially during suctioning. This degree of impairment was minimized at higher pressure gauge settings. Using the telescopic lens and Roberts forceps, the per cent

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TABLE 1. Average Gas Flows through the Bronchoscope and Per Cent Reductions with Different Instruments Using Various Gauge Settings*

	20 psi			35 psi			50 psi		
	l/1.5 Sec	l/Min	Per Cent Reduction	l/1.5 Sec	l/Min	Per Cent Reduction	l/1.5 Sec	l/Min	Per Cent Reduction
Open bronchoscope	1.64	24.6	—	2.3	34.5	—	3.13	46.95	—
Suction in place	0.78	11.7	52	1.4	21.0	39	1.86	27.9	41
Suction on	0.12	1.8	93	0.70	10.5	70	1.41	21.0	55
Telescopic lens	0.32	4.8	80	0.82	12.24	65	1.00	15.0	68
Roberts forceps	0.55	8.25	67	1.54	23.1	33	1.77	26.5	44

* 1.5 sec was used for the inspiratory phase. Respiratory rate was set at 15/min.

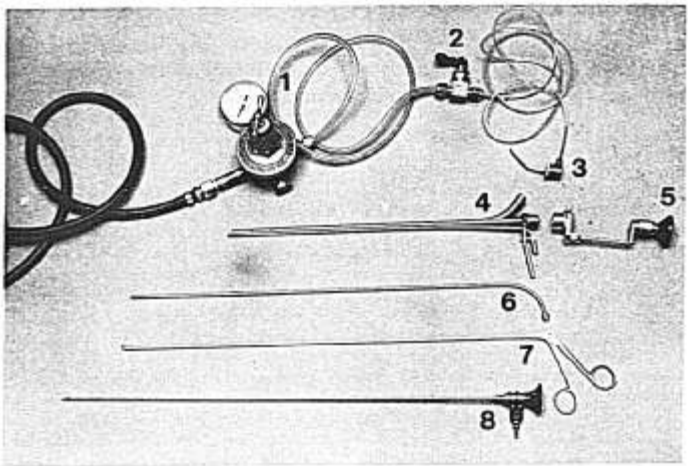

FIG. 1. Instruments used during the study. *1*, one-step pressure regulator; *2*, intermittent jet injector valve; *3*, ventilating attachment; *4*, Holinger bronchoscope; *5*, "gunsight" telescope; *6*, suction; *7*, Roberts forceps; *8*, telescopic lens.

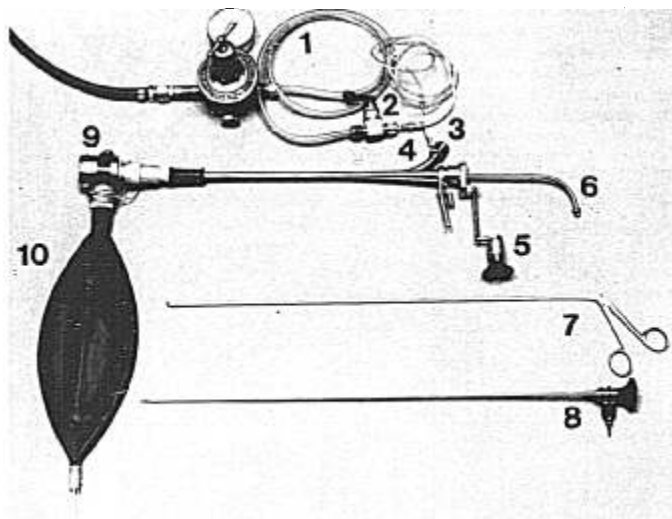

FIG. 2. Physical model: the same instruments with the Wright Respirometer interposed between the distal end of the bronchoscope and the reservoir bag. *9*, Wright respirometer; *10*, 5-liter reservoir bag with open end.

reduction in gas flow was least at 35 psi and greatest at 20 psi.

Discussion

This model demonstrates the relative impairment of gas flows during instrumentation through the bronchoscope. It suggests that there may well be an optimum pressure gauge setting for each type of instrument utilized. For example, when the telescopic lens or Roberts forceps is used, the proper pressure gauge setting is 35 psi or higher but less than 50 psi, since the greater degree of reduction of gas flow at the latter setting, using the aforementioned instruments, might cause turbulence.

Since the instruments studied are invariably used during bronchoscopy, proper attention to pressure gauge settings on the Sanders ventilating attachment is mandatory. Changes should be made to compensate for impairment of gas flow. The anesthesiologist will then be assured of greater efficiency of the Sanders ventilating attachment in maintaining adequate ventilation of the patient.

References

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Neonatology

UMBILICAL-VESSEL CATHETERIZATION Umbilical-vessel catheterization is associated with serious complications: intravascular thrombosis, organ infarcts, infection, perforation, hemorrhage. This study is a review of umbilical-vessel catheterization in 143 newborns. Included in the group catheterized were: 1) all acutely ill infants requiring blood gas determinations; 2) all infants who needed inspired oxygen concentrations higher than 40 per cent for longer than an hour (to monitor Pa_{O_2}); 3) all infants weighing less than 1,200 g (to provide a stable route of infusion and to facilitate blood sampling).

Using sterile technique, umbilical-artery catheters were passed in 112 infants and umbilical-vein catheters in 31 infants. The tips of the arterial catheters were placed above the diaphragm in the descending aorta; the tips of the venous catheters were placed either in the right atrium or in the thoracic segment of the inferior vena cava. The locations of the catheter tips were ascertained immediately by x-ray and the catheters were attached to a constant-infusion pump.

The complication rate associated with umbilical-vein catheterization was 35 per cent, compared with 17 per cent for arterial catheterization. Although the passing of a catheter into the umbilical vein is technically easier, the anatomy of the venous system is such that unless the ductus venosus is properly aligned with the umbilical vein, misdirection of the catheter is possible—in this series, the catheter tip was placed in the right atrium or in the thoracic segment of the inferior vena cava in only 13 of 31 infants. The higher complication rate, together with the potential long-term complication of portal hypertension, makes the venous route less desirable than the arterial route. The arterial catheter complication rate, however, increased with increasing duration of catheterization, while the venous route showed no such correlation. The authors believe the risk of umbilical-vein catheterization outweighs its clinical usefulness except when the arterial route cannot be used. (*Symansky, M. R., and Fox, H. A.: Umbilical Vessel Catheterization: Indications, Management, and Evaluation of the Technique, J. Pediatr. 80: 820–826, 1972.*)