A Convenient and Accurate Nebulizer

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Many suggestions and types of apparatus have been proposed for nebulizing drugs such as bronchodilators during anesthesia and positive pressure breathing. A serious problem with use of all of these nebulizers is that incorrect dosage occurs frequently. In addition, attachment of the nebulizer to inhalation equipment is often inconvenient. Need for a hand bulb or separate source of gas for nebulization and the necessity for keeping the nebulizer horizontal also present significant problems when the common jet orifice type of apparatus is used. Since bronchodilatation following the administration of intravenous agents may be less predictable than after the direct inhalation route, a convenient and inexpensive technique for nebulizing bronchodilator drugs is described.

Recently, pressurized, valved cartridges containing aerosol suspended drugs have become available and provide accurate dose delivery with each valve depression. The cartridge of isoproterenol fits into a casing which is particularly suitable for anesthesia and inhalation therapy apparatus. It contains a fine particle suspension of 2.0 mg./ml. isoproterenol sulfate (USP) in an inert propellant. An exact amount of 0.075 mg. is delivered with each valve depression. The drug is micronized so that the 302) the disc is removable and may be fitted with the nylon tube outside the housing.

The sensitivity, linearity, and speed of response of the cuvette densitometer with the modified lumen are not significantly different from those obtained using the original lumen. The machining of the Ebonite disc takes less than 1 hour and needs only standard workshop tools and techniques. A working drawing is shown in figure 2.
mean mass diameter is less than 5 $\mu$.” Approximately 85 per cent of the particles are within the 0.5–7.0 $\mu$ range. The micronized material is suspended in a freon system and packaged in the pressurized cartridge.

The in-line plastic casing containing the cartridge (fig. 1) is interposed between a conventional anesthesia rebreathing system and an endotracheal tube. The casing may also be interposed between a ventilator with non-rebreathing valve and an endotracheal tube, a mask and elbow or mouthpiece, or a tracheostomy tube with 15 mm. adapter. This casing is close to the airway and the nebulized drug does not “rain out” into the anesthesia equipment. It is easily cleaned and has a dead space of less than 20 ml. Both casing and cartridge have the advantage of versatility, convenience and economy and can be stored in any anesthesia machine for immediate use.

We have utilized this in-line adapter for the nebulization of isoproterenol on 25 occasions within the past year. The following cases illustrate some of our experiences:

**Case 1.** A patient was anesthetized for cholecystectomy with thiopental, halothane-nitrous oxide-oxygen and the trachea intubated.

When the surgeon applied traction to the gallbladder, the anesthetist was unable to inflate the lungs and audible wheezing occurred. The nebulizer was interposed between the Y-piece of a circle carbon dioxide absorption system and the endotracheal tube (fig. 2) and the cartridge valve was depressed five times. Within one minute, the lungs became easy to inflate and within ten minutes, wheezing disappeared.

**Case 2.** The trachea of a patient in status asthmaticus was intubated and the patient placed on a respirator. Fifty per cent oxygen was administered with adequate humidification. Intermittent injections of intravenous morphine were given to prevent reaction to the endotracheal tube. The nebulizer was interposed between the endotracheal tube and “Q” circle of a Bird respirator. Bronchodilator treatment was initiated and within one hour the airway pressure, indicated on the ventilator manometer, was reduced and the patient gradually awakened. Within the next hour, secretions became watery and profuse. By the following morning, the patient’s condition was greatly improved.

**Case 3.** A patient was anesthetized with cyclopropane via an endotracheal tube and contrast media injected by the surgeon into the portal circulation. Within seconds, audible wheezing occurred, the lungs were virtually...
impossible to inflate and the patient became
grossly cyanotic. The nebulizer was inter-
posed between the split joint of the endotra-
cheal tube and the Y-piece of the circle car-
bon dioxide absorption system (fig. 2). The
cartridge was squeezed ten times and within
60 seconds, gas was able to enter the lungs
and breath sounds were heard. Five minutes
after the initiation of nebulization of isopro-
tenol, the cyanosis disappeared.

CONCLUSION
The clinical experience with this convenient,
effective and accurate nebulizer during the
past year has been gratifying.

CASE REPORTS

Management of Hemorrhage Following Induced Hypotension

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Reactionary hemorrhage is one of the fre-
quently reported complications following de-
liberate hypotension. Hampton and Little, in
an extensive review, found an incidence of
1.16 per cent in 6,805 cases of controlled hy-
potension performed in the United States.1-2
Tough (1960) reported that there was no evi-
dence that the risk of reactionary hemorrhage
was increased owing to hypotension during anes-
thesia.3-4 Reviewing data published be-
 tween 1958 and 1963, Larson found that the
overall incidence of reactionary hemorrhage
was 0.27 per cent in 13,264 patients sub-
jected to deliberate hypotension.5 By achiev-
ing adequate hemostasis, using pressure dress-
ings, and allowing a slow return of arterial
blood pressure to preoperative levels, Mc-
Laughlin reported only one instance of reac-
tionary hemorrhage in one thousand consecu-
tive cases of deliberate hypotension.2-5

During 1965–67, we used controlled hypotension in 92 cases for extensive surgery of the

head and neck and thorax. Following the pre-
cautious measures outlined by McLaughlin,
reactionary hemorrhage occurred in only one patient. In this instance, hemorrhage was
precipitated by straining in the early post-
operative period while changing a tracheo-
tomy tube and after the arterial blood pressure
had returned to the preoperative level. The
hemorrhage was successfully managed by re-
instituting hypotension for a period of three
hours.

CASE REPORT

A 54 year old woman, weighing 80 kg, was
admitted for treatment of a malignant mixed
tumor of the right parotid gland, of 40 years
duration. The tumor has been slowly but re-
lentlessly destroying the right side of the face,
which presented an open ulcerated area. Her
past history included a radical excision of the
tumor at the age of 16, complicated by right
facial paralysis; total abdominal hysterectomy
for a fibroid uterus; right radical neck dissec-
tion; first and second stages of chest flaps; and
extensive irradiation to the right neck and