A NOMENCLATURE FOR METHODS OF INHALATION ANESTHESIA *

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Received for publication April 6, 1953

A RECENT review of a number of standard textbooks of anesthesiology has revealed a startling discrepancy in their nomenclatures of inhalation systems and techniques. For example, one finds the Ayre's T tube variously described as (1) open, (2) semiclosed nonrebreathing, and (3) semiclosed. Such inconsistency has led to communication difficulties in the literature and lends itself to teaching difficulties, particularly with the undergraduate and the beginning resident. Moreover, it leaves no provision for the proper placement of a future technique or system, since the terms presently employed are not universally meaningful.

In an effort to resolve the problems attendant to the present system, or lack of one, a nomenclature is presented based on the following concept:

All inhalation systems and techniques either do or do not utilize a reservoir bag; and all methods either provide rebreathing or preclude it. Therefore, more or less precise definitions are possible.

	Reservoir	Rebreathing
Open	No	No
Semi-open	Yes	No
Semiclosed	Yes	Yes, partial
Closed	Yes	Yes, complete

The selection of a technique involves a consideration of several measurable factors the proper application of which greatly influences the success of the anesthetic procedure. Among these are heat loss, humidity of inspired gas, carbon dioxide retention, and resistance to respiration. If the above nomenclature is viewed in the light of these factors, considerable insight into the method used is afforded and the system of terms takes on a meaning which will be reflected in a more rational approach to a given anesthetic administration.

Open. In the open system air is available so that moisture loss should be no problem. However, heat loss is a factor. Resistance to respiration is minimal and carbon dioxide is not retained.

Semi-open. Since a reservoir of anesthetic gases is employed and no rebreathing is allowed, water and heat are lost and carbon dioxide

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accumulation is avoided. If proper care is given to the equipment, the resistance to respiration should be minimal. Unclean valves, however, can compromise this advantage.

Semiclosed. The rebreathing involved in this system allows moisture loss and heat loss to be reduced. Resistance will be increased by a valve system if it is used and by the necessary inflation of the rebreathing bag on expiration. Carbon dioxide accumulation is an important feature of this system; therefore, its absorption must be provided. This will be discussed later.

Closed. The closed system minimizes heat and water loss, particularly in the to-and-fro absorption method. The amount of resistance is determined by the equipment used but will certainly be more than with the open or semi-open system. Obviously, the absorption of carbon dioxide is obligatory.

The categorization of a few of the common techniques with respect to this nomenclature will perhaps clarify the concept.

The open drop technique is an open system, but only if there is egress of expired gases. If there is a build-up of towels or if the mask is thick then there will be a reservoir of a sort and definite rebreathing, so that this method takes the form of a semiclosed system and should be considered as such.

The T-tube provides an open technique, because it precludes rebreathing and lacks a reservoir of anesthetic gases. If, however, one extends the expiratory arm of the tube so that rebreathing is allowed it becomes a semiclosed system. And if, in the process of assisting or controlling the respiration, the expiratory limb is occluded during inspiration, the method is properly classed as semi-open. The flow from the machine provides an anesthetic reservoir undiluted by room air and there is no rebreathing.

Valve arrangements such as those described by Leigh, and Stephen and Slater provide an anesthetic reservoir undiluted by atmospheric air, and preclude rebreathing and are semi-open in type. This does not obtain if the valves are placed some distance from the end of the endotracheal tube, in which case rebreathing is not obviated.

The bag and mask method is a semiclosed system. A reservoir is provided and rebreathing is allowed. Moisture loss and heat loss are reduced. However, carbon dioxide does accumulate and unless the period of use is restricted to a very few minutes an absorber is mandatory. One can approach the features of a semi-open system if the flow from the machine is quite high, in which case more gas leaves the system than is expired into it by the patient. If the face piece is of proper size and the gas is admitted near the face piece this high flow provides heat loss, an inspired gas of low humidity, and minimal rebreathing. The flow needed to supply these conditions is more than the minute volume exchange of the patient, and in such a case a carbon dioxide filter is perhaps not necessary.

SUMMARY

An attempt has been made to standardize the nomenclature of inhalation systems and techniques. Its justification is the inconsistencies of the past, teaching difficulties under present conditions, and a need for provisions for classifying future methods. A nomenclature providing an insight into the features of different systems is offered and examples are presented. It is hoped that its use will afford a more rational consideration of those factors which influence the choice of a method for the administration of inhalation anesthesia.