Exhalation Tunnel for Nonrebreathing Techniques

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The commercially available nonrebreathing valves can be classified in one of the following two categories:

(1) Nonrebreathing valves with automatic exit occlusion mechanisms which are closed by the suddenly increased pressure from the reservoir bag such as that initiated by hand compression. Whether the pressure created to occlude the exit is from within the valve chamber (such as Ruben, Lewis-Leigh, Rudolph, Etheridge, Shuman, etc.) or from without (such as Fink and Frumin valves) all of them have the inevitable disadvantage of increasing expiratory resistance when the pressure in the bag gradually builds up. There is also a dangerous disadvantage of sudden occlusion of the exit, hence a sealed-off system when the pressure in the reservoir bag is increased suddenly and unintentionally. Not rarely this may burst the lung and cause pneumothorax. Therefore, a pressure buffering device is often used with more or less success to diminish the mishaps.1–3

(2) Nonrebreathing valves with no automatic exit occlusion mechanism, such as the Leigh and Stephen-Slater valves. These have simple inhalation and exhalation valves. They have a very simple design, low resistance, minimal dead space and are safe and simple in operation. They do not have the dangerous disadvantages of those in the first category. However, they have the drawback of requiring an extra hand to occlude the exhalation valve when the bag is compressed during intermittent positive pressure respiration.

In order to eliminate this disadvantage and to maintain their advantages an exhalation tunnel has been made as a simple attachment to a nonrebreathing valve of the second type mentioned above.

The attachment as shown in figure 1 consists of a simple and tubular tunnel with its distal part made of compressible substance. The proximal end of the attachment is connected to the exit of a nonrebreathing valve and the compressible distal part is laid along the reservoir bag so that it can be compressed against the bag with the same hand simultaneously during inflation of the lungs (fig. 2). In this way the exit of the valve will be closed. During the remaining period of intermittent positive pressure respiration or during spontaneous respiration the attachment does not interfere with the original function of the nonrebreathing valve. There is no danger of exit obstruction when the pressure in the system is increased even when the system is flushed with direct oxygen through oxygen by-pass valve. The exhalation tunnel adds virtually no extra resistance at or below the flow of 20 liters per minute. With a flow of

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fig. 1. Diagram of a nonrebreathing system with an exhalation tunnel.

fig. 2. A nonrebreathing system set-up with a Stephen-Slater valve and an exhalation tunnel. The tunnel is made of two rubber bushings connected by a right-angle piece and a compressible portion which is made of 6 by 1 inch latex tube strengthened by water-proof adhesive tape.
25 to 50 liters per minute the resistance is increased 5 mm. of water. The exhalation valve of the nonbreathing valve can be removed in order to decrease the expiratory resistance to almost zero at the flow of clinical range. Thus the flabby end of the exhalation tunnel may act just like an exhalation valve.

New Three-Way Connector with Unidirectional Valve

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It is not unusual to administer more than one intravenous solution simultaneously into one vein during the course of anesthesia. Many devices have been marketed in an effort to facilitate the simultaneous use of more than one intravenous solution. Disposable three-way stopcocks are used, but only two bottles of intravenous fluid may be hooked into the stopcock; and they are relatively expensive. The presently described three-way connector is jointed and flexible. The intravenous tubing adaptors fit directly into the female portions of the connector without the use of a needle. A unidirectional valve (A) is incorporated proximal to the connector to prevent reflux of blood through the connector and back into the intravenous tubing. It is the only intravenous apparatus into which a unidirectional valve has been built. An 18-inch extension tube is added to the connector at (B). At the completion of the case the extension tube may be thrown away and a new one attached to the three-way connector.

The connector has undergone thorough sterility tests. The unidirectional valve functions perfectly when considerable pressure is exerted against it. In some instances a small amount of reflux can occur into the extension tube before the valve is activated. In three instances out of 600, the valve failed to function properly and reflux of blood did occur through the extension tube.

The unidirectional valve was checked by applying a tourniquet around the upper arm and observing if there was any reflux of blood back into the tubing. The incidence of functional failure of the valve has been low; however, it does not function perfectly in all instances and the attention of the anesthetist is still required in order to be sure that the valve is functioning properly.

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References