AUTOMATIC ENDOTRACHEAL TUBE CUFF INFLATOR AND CONTINUOUS PRESSURE MONITOR/CONTROLLER

MUSA MUALLEM*, MOHAMAD F. EL-KHATIB**

Background

Endotracheal tube cuff pressure over 30 cm of water has been found to occur in about 50% of cases where cuff inflation was performed without monitoring, using pilot balloon palpation, minimal leak, or minimal occlusive volume techniques1. The incidence of post operative respiratory complications such as cough, sore throat, hoarseness, blood-streaked expectoration, and even tracheal stenosis is increased with increase of cuff pressure over 30 cm of water2. Mandatory continuous monitoring and control of the endotracheal tube cuff pressure have been recommended to minimize such complication.

Anesthesiologists continue to ignore the above important recommendation in many institutions because they do not have easy access to devices that monitor and control cuff pressure, and because continuous intracuff pressure control and measurement using a device are not yet mandate or standard of care for anesthesia practice. Intermittent checking of the cuff pressure during anesthesia is not good enough and has a very poor compliance. Ideally, the cuff pressure should be monitored and controlled at the required level continuously and automatically without concern from the anesthesiologist.

This situation prompted us to design and develop cuff inflator and cuff pressure monitor/regulator that is simple and practical.

Description of the apparatus

The cuff inflator/monitor is operated by an oxygen line from the auxiliary outlet of the anesthesia machine at a pressure of 50 psi. The oxygen line is connected to the inlet of a Butane gas reducing valve available commercially in the market and which operate at an inlet pressure of five bars and an outlet pressure variable from 15 to 45 cm of water. This reducing valve fits the requirements of a reducing valve suitable for building a cuff inflator monitor/controller. The oxygen comes out from the Butane reducing valve at a maximum pressure of 45 cm of water and can be further reduced to 15 cm of water by the valve pressure controlling knob.

The oxygen from the reducing valve outlet is connected by plastic tubings to:

1- Outlet nipple that connect through an oxygen plastic tube, via a luer tap at the distal end, to the ET tube cuff pilot balloon (Fig. 1, 2).

* Emeritus Professor.
** Professor.
Department of Anesthesiology, American University of Beirut Medical Center, Beirut 1107-2020 Lebanon.
Correspondence to: Dr. Mohamad El-Khatri. E-mail: mk05@aub.edu.lb
2- Airway pressure gauge graduated from 0 to 60 cm H2O (figure 1, 2).

3- Needle valve that is vented to atmosphere.
A brass insert with a very small hole is placed in the valve outlet plastic tube to reduce the oxygen flow rate to a minimum, yet enough to inflate the cuff in few seconds. While the venting needle valve and the outlet to the tube cuff are closed, the outlet pressure of the Butane reducing valve is set at 45 cm H2O, by the valve controlling pressure knob or by a screw driver. Then the venting needle valve knob is turned to open and pressure set at 30 cm H2O. When the cuff inflator/controller is connected to the tube cuff, the cuff will be inflated instantly and its pressure is maintained constant at 30 cm of water or as set by the user.

The pressure of the cuff can be increased or decreased by the needle valve that increases or decreases the gas vented out, as each case may require, and depending on the inflating pressure required to inflate the lung. Usually the cuff pressure is set at 30 cm of water or slightly higher than the lung inflating pressure required.

The cuff inflator/controller described above (Fig. 3) has been used successfully for many years in the department of anesthesia at the American University of Beirut Medical center during anesthesia and in chronically intubated and ventilated patients, without complications or failure, provided all connections are tight with no leaks.
References

