

Research Article

The use of a T-piece resuscitator in the newborn infants

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Abstract

Resuscitation devices for infants must be capable of delivering adequate and consistent ventilation in a controlled and predictable manner. Different devices are available to perform PPV such as self-inflating bags and T-piece resuscitators.

This white paper identified that T-piece resuscitator are safe and effective for the ventilation of newborns in first- and second level settings. The TPR offers many benefits in a hospital setting as well as a transport setting, the potential to allow preset safety and ready to go ventilation support.

Keywords: Resuscitators; T-piece; Ventilation

Introduction

About 10% of neonates require assistance at birth for smooth transition to extra-uterine life [1]. Assistance can also be needed during acute deterioration, equipment failure or during transport of the neonate [2]. Positive pressure ventilation (PPV) is a key to successful resuscitation in neonates who fail to establish spontaneous breathing to establish lung opening, different devices are available to perform PPV to the newborn during transition or resuscitation. Self-inflating bags are a commonly used device to provide PPV but are not designed to deliver positive end expiratory pressure (PEEP). T-piece resuscitators (TPR) on the other hand, are one of the devices that deliver positive pressure and provides PEEP [1]. TPRs are flow-dependent devices and required a constant gas inflow to enable provision of PPV; delivered peak inspiratory pressure (PIP) is adjustable via an airway pressure limit valve, and PEEP is adjustable via an expiratory flow

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resistor [3]. During PPV it is recommended to use a PIP between 20 and 30 cmH₂O during neonatal transition or resuscitation and a PEEP between 5 and 8 cmH₂O. Appropriate PIP establishes the functional residual capacity (FRC) and generates reflexes that stimulate the onset of spontaneous breathing while PEEP maintains the FRC [4,5].

There are different disposable and non-disposable TPRs, such as neopuff (Fisher and Paykel), Nice 5020 (Neötech), Inspire rPAP Driver (Inspiration Healthcare), Atom Rescusi Flow (Atom Medical) and the Neo-Tee (Mercury Medical). The Neo-Tee Infant T-piece resuscitator (Mercury Medical) is a disposable TPR. This single use, flow-controlled and pressure-limited device consists of a proximal controller, a tubing set and a distal built-in manometer near the T-connector (figure 1). The proximal controller consists of an adjustable pressure relief valve, offering the ability to apply a more consistent targeted PIP. The PEEP is adjusted through the resistor, incorporated in the T-connector [5,6].

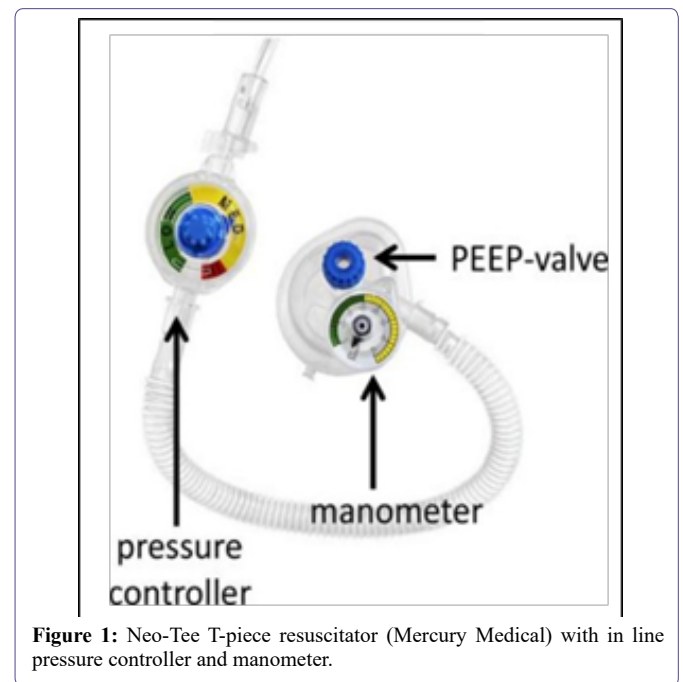


Figure 1: Neo-Tee T-piece resuscitator (Mercury Medical) with in line pressure controller and manometer.

The use of the T-piece in the newborn infants for in- and out hospital

The nursing and midwifery staff is of paramount importance for many critical aspects, such as the early recognition of a deteriorating infant and the startup of ventilation manoeuvres with the TPR.

The T-piece resuscitator is a device that can be used in a safe and effective manner in different units such as the neonatal intensive care unit (NICU), pediatric intensive care unit (PICU), emergency rooms, delivery rooms, maternity and during transport of the patient. A recent international Liaison Committee on resuscitation (ILCOR) suggests the use of a T-piece resuscitator over the use of a self-inflating bag in newborns in need of PPV [7].

Pérez et al [4] reported the use and evaluation of different PPVs (self-inflating bag, flow-inflating bag and the Neo-Tee T-piece resuscitator) by trainees in the last year of medical school on a neonatal resuscitation simulator. In the inflating bags, a higher percentage of PIP and PEEP was found to be ineffective. The use of the disposable TPR resulted in a PIP and PEEP safety range. They concluded that the disposable TPR is an effective device for manual ventilation, when used by inexperienced personnel for resuscitation.

In the delivery room, PPV performed with the TPR is less harmful to the lung. PEEP helps facilitate clearance of fetal lung fluid and maintain the FRC. It is important that training be provided for the use of TPR [2,4].

In the NICU, the TPRs are used during deterioration of the infant, during ventilator circuit change to maintain continuous positive airway pressure (CPAP) and also during transport of the infant.

Studies introduced the TPR in the maternity. After a short training most of the staff members were able to setup and used the TPR successfully. All of the midwives are able to ventilate with the TPR but regular training is recommended [8,9].

TPR can be used in pediatric settings for infants up to a weight of 10 kgs. However, little clinical data or bench studies examining the pediatric use of TPR systems up to 10 kgs are available [10].

Summary

The T-piece resuscitator is safe and effective for the ventilation of newborns in first- and second level settings. The accuracy of the Neo-Tee is comparable to the other non-disposable TPR's. Results show variation in delivered ventilation from set values due to inherent TPRs device design characteristics with a range of lung compliance expected at birth. An increase of the gas flow rate in the T-piece will result in a substantially increased delivered pressure. Hence, the importance that each user has enough knowledge about lung physiology and has received training for the use of the TPR.

The TPR offers many benefits in a hospital setting as well as a transport setting, the potential to allow preset safety and ready to go ventilation support. Make it a safety and easy to use device to apply a continuous flow. It provides application of peak and PEEP pressures to the newborn during every respiration.

Conflicts of interest

The authors have no conflicts of interest to declare that are relevant to the content of this paper.

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