Comparison of a Closed with an Open Endotracheal Suction: Costs and the Incidence of Ventilator-associated Pneumonia

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비용, 인공환기관련폐렴 발생 빈도에 있어서의 개방 기관내 흡인술에 대한 폐쇄 흡인술의 비교

정재우1, 최은희2, 김진희2, 서호경2, 최지연2, 최재철1, 신종욱1, 박인현1, 최병휘1, 김재열1
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연구 배경: 폐쇄관을 이용한 기관내 흡인은 임상적으로 중환자에게 생리적인 이점이 있지만, 병원성 균주에 의한 기관내의 절막화가 증가할 수 있다는 보고가 있다. 비용증가는 폐쇄흡인의 또 다른 한계점이다. 본 연구는 폐쇄흡
인 및 개방흡인이 따른 병원균주의 절막화와 인공환기관련폐렴의 빈도와 가격효율성 비교해보고자 시행하였다.

방 법: 각각 한 달의 간격을 사이에 두고 내과계 중환자실에 입원한 환자를 대상으로 다중사용 개방흡인, 단일사
용 개방흡인, 다중사용 폐쇄흡인술을 순차적으로 시행하였다. 비용, MRSA의 기관지내 집락화, 인공환기관련폐렴의 발생
를 분석하였다.

결 과: 106명의 환자가 연구 대상으로 포함되었고, 이 중 20명의 환자에서 다중사용 개방흡입을, 42명이 단일사용
개방흡입을, 44명이 다중사용 폐쇄흡인술을 시행받았다. MRSA의 절막화와 인공환기관련폐렴의 빈도는 세 군간에
의미있는 차이를 보이지 않았다. 입원 일당 소모되는 비용은 다중사용 개방흡인이 $10.58, 단일사용 개방흡인이
$28.27, 다중사용 폐쇄흡인의 경우 $23.76인 것으로 나타났다.

결 론: 다중사용 폐쇄흡인을 매 48시간마다 교환하는 경우 MRSA 절막화와 인공환기관련폐렴 발생 빈도는 비슷하였고, 기관내 흡인술에 있어서 비용면에서도 효율적인 방법임을 알 수 있었다. (Tuberc Respir Dis 2008;65:198-206)

Key Words: Closed suction, Cost, MRSA, Open suction, Ventilator-associated pneumonia

Introduction

The removal of airway secretion is critical in the management of mechanically ventilated patients because these patients breathe solely through an artificial airway. Therefore, endotracheal suctioning is the most frequently performed nursing and physiotherapy procedure in the ICU. Although the benefits of patent airways by endotracheal suctioning are evident, it has complications.

Endotracheal suctioning has been associated with arterial oxygen desaturation, decrease in systemic venous oxygenation, cardiac arrhythmia and even sudden death. Currently, two types of suction catheter systems are used. The conventional suction technique involves the use of a sterile, single-use open suction catheter. Open-system suctioning requires the patient to be disconnected completely from the ventilator circuit; therefore, oxygen, humidity and PEEP are not delivered during suctioning. Because the desired PEEP is not maintained in the patient’s lungs, small airways and alveoli may collapse. Unstable patients may immediately deteriorate due to hypoxemia.

Another method of endotracheal suctioning is using a multiple-use closed suction system. Closed suction consists of a suction catheter enclosed within a flexible plastic film sleeve. Because the catheter remains attached to the ven-
tilatory circuit, it eliminates the need to disconnect the circuit for endotracheal suctioning. The benefits of closed suction over open suction include the maintenance of positive pressure ventilation during suctioning, less desaturation, and a reduced risk of disseminating contaminated bronchial secretions. In addition, many critical care nurses consider closed suction to be easier to use, less time-consuming and better tolerated by the patient. In some reports, closed suction was associated with lower incidence rate of ventilator-associated pneumonia (VAP) and even with the high probability for survival.

Although, closed suction appears to be a safe and an effective method of endotracheal suctioning, disadvantages also exist. Because suction catheters are contaminated after the initial pass through an endotracheal tube, repeated insertion of closed suction catheter may increase the risk for colonization of endotracheal tube by pathogens. Another problem is the high cost of closed suction catheter. The cost-burden of disposable, single-use, suction catheters are quite high because at least several hundreds of them are used and discarded in a day in single MICU. To save cost, many ICUs, including ours, use the open suction catheter repeatedly (usually it is changed 3 times a day per patient). Although the tip of the suction catheter is dipped into sterile saline while it is not used, it cannot be considered to be clean enough. In this situation, the use of multiple-use, closed suction catheter can be the most cost-effective and the most sanitized way of endotracheal suctioning.

In the present study, we hypothesized that closed suction does not increase the risk for colonization of tracheobronchial tree by pathogens or the development of ventilator-associated pneumonia compared to single-use, open suction. Authors also analyzed the cost-effectiveness of the closed suctioning.

Materials and Methods

1. Patients

After Institutional Review Board approval, the study was conducted prospectively at the medical ICU of ChungAng University Hospital, Seoul, Republic of Korea from April 1st to September 14th, 2006. Patients on mechanical ventilation via artificial airways were included in the study, after informed consent had been provided by their families.

2. Methods of endotracheal suctioning

For patients treated with open suctioning, a sterile suction catheter (Suction Catheter, Insung Medical co., LTD, Korea) was passed through the endotracheal tube until resistance was encountered. A suction pressure of 80 to 100 cm H2O was applied while withdrawing the catheter from the airway. The pass of suction catheter was limited to <15 sec. Patients were suctioned at least every 3 hours and on an “as needed” basis determined by nursing personnel.

Before starting this study, nursing staffs in the MICU completed education program for closed suction catheter (Trach Care Closed Suction System, Ballard Medical Products, Midvale, UT, USA). It was composed of video and oral presentation for the closed suction system with bedside practice. For patients receiving closed suctioning, the catheter (inside the sheath) advanced into the endotracheal tube until mild resistance was met. The catheter was then withdrawn using intermittent suction pressure of 80 to 100 cm H2O and each pass was limited to <15 sec. The catheter was then irrigated through the irrigation port with sterile saline while applying suction, Patients were suctioned at least every 3h and on an “as needed” basis determined by nursing personnel. Catheters were changed every 48 hr.

3. Protocol

The study consisted of three separated, one month periods. Each month of study was separated by one or one and half month of wash out period. Three ways of endotracheal suctioning; multiple-use, open suction catheter-suction catheter was changed 3 times a day (from April 1st to April 30th), single-use, open suction catheter (from June 1st to June 30th) and multiple-use, closed suction catheter (from September 15th to October 14th) were consecutively applied. During each study month, colonization of endotracheal tube by methicillin resistant Staphylococcus aureus (MRSA), VAP incidence rate and the cost of each method were analyzed.