

Effects of Open and Closed Suctioning Systems on Pain in Newborns Treated with Mechanical Ventilation

■ ■ ■ Ayfer Acikgoz, PhD,* and Suzan Yildiz, PhD[†]

■ ABSTRACT:

This experimental study was conducted to compare the effects of open and closed suctioning systems on pain in newborns receiving ventilation support. The study sample consisted of 42 babies (23 female, 16 male) hospitalized in the unit between December 2010 and December 2011 who met the selection criteria established for the study. Using the random sampling method, 20 of the babies were included in the closed suctioning system group and the remaining 22 were analyzed in the open suctioning system group. The data collection tools of the study were intervention monitoring form, data collection form, and documentation of the personal information on the babies; and the Neonatal Pain, Agitation, and Sedation Scale (N-PASS) evaluated the babies' pain responses. The data were evaluated using SPSS 15 software. Most neonates were born preterm (≤ 37 weeks' gestation at birth; 69% [$n = 29$]). The mean (SD) birth weight, gestational age, and intensive care unit stay were 1.82 kg (1.1 kg), 31.9 (5.3) weeks, and 25.3 (2.9) calendar days, respectively. Results of the study revealed no statistically significant difference between the open suctioning and closed suctioning groups ($p = .194$). However, the N-PASS pain scores obtained before and during the suctioning processes were significantly different ($p < .001$). In conclusion, babies seem to experience pain during the suctioning process, according to N-PASS scores, and although not significant statistically, the level of pain felt during open suctioning was observed to be slightly higher compared with closed suctioning.

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From the *Nursing Department, Eskisehir Osmangazi University, Higher School of Health, Eskisehir, Turkey; [†]Nursing Department of Pediatrics, Istanbul University, Istanbul, Turkey.

Address correspondence to Ayfer Acikgoz, PhD, Assistant Professor, Department of Nursing, Eskisehir Osmangazi University Medical School, Meselik Campus, Eskisehir, Turkey 26480. E-mail: aacikgoz@ogu.edu.tr

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People can suffer pain at any age. However, ethical concerns and false assertions (e.g., those suggesting that newborns do not suffer pain or that pain does not negatively affect infants) prevented any studies on the effects of pain on this age group until the 1980s (Derebent & Yigit, 2006). Since then, however, various studies have found that newborns do sense and remember pain, and they are even able to feel pain in utero (Derebent & Yigit, 2006; Ovali, 2008).

Pain treatment is a complicated process requiring a team approach, and nurses should be considered as indispensable and active members of these teams. Nurses should be familiar with the causes, properties, and prevalence of pain; the factors affecting the control; and the approaches to pain evaluation and elimination (Bacaksiz, Cöcelli, Ovayolu, & Ozgur, 2008). Eliminating pain and offering relief to the patient are among the most important objectives of nursing care. However, like other health personnel, nurses have been known to underestimate the level of pain suffered by babies (Ovali, 2008). In a study including 467 clinicians (nurses and physicians), it was found that although nurses and physicians believe that babies suffer pain, they tend to minimize its severity (Porter et al., 1997). On the other hand, most nurses do not have adequate knowledge to diagnose and manage pain; 47.4% of them do not observe patient behaviors to determine the intensity of pain; and 74.5% of them do not use a pain scale to measure the level of pain ($n = 235$ nurses) (Ozer, Akyurek, & Basbakkal, 2006). One study (Efe, Altun, Cetin, & Isler, 2007) ($n = 198$ nurses and physicians) also found that although physicians and nurses are knowledgeable in the field of pain in newborns, nurses tend to use nonpharmacologic methods during processes but physicians do not, and most nurses have sufficient knowledge about the nature of pain; however, they do not adopt these approaches to evaluate and manage the pain ($n = 227$ nurses) (Aslan & Badir, 2005).

Invasive procedures are common sources of pain in newborns (Efe et al., 2007; Anand & International Evidence-Based Group for Neonatal Pain, 2001). Suctioning is an invasive procedure often applied by nurses in the care of patients treated with mechanical ventilation (Ozden, 2007a). During the stressful process of suctioning, babies are observed to exhibit the same physiologic responses encountered in other painful procedures. Using pacifiers or sucrose solutions or swaddling the baby may be used during the suctioning to help to relieve the pain. In addition, opioids may be administered through continuous intravenous infusion or slow injection (Anand & International Evidence-Based Group for Neonatal Pain, 2001).

The purpose of the suctioning procedure is the removal of respiratory tract secretions by use of a vacuum tool that applies negative pressure. Currently, the two widely used suctioning methods are open suctioning and closed suctioning (Ozden, 2007a; Sivasli & Tekinalp, 2005). In open system aspiration, the patient is separated from the ventilator. Aspiration is performed with a disposable sterile catheter placed on the tip of a vacuum system. After the completion

of aspiration, the patient is reconnected to the ventilator. Closed system aspiration is only used in patients with tracheostomy cannula or endotracheal tube connected to the mechanical ventilator. Closed aspiration system is composed of a flexible and easily bent catheter in a plastic and transparent protective cover, a T-part connecting the endotracheal tube or tracheostomy tube to the ventilator line, an irrigation port used to irrigate the catheter on the T-part, and an aspiration control button that is controlled by the thumb. In this system, the aspiration catheter is the connection of ventilator line and a part of the ventilator circuit. This is a multiuse catheter that can be stored in its protective cover for 24 hours. The process is performed by moving the catheter to and fro in the transparent protective cover and by closing the aspiration valve by the thumb (Ozden, 2007a).

The most important advantage of the closed suctioning system is the elimination of any disadvantage caused by the process of disconnecting the ventilator from the patient. Moreover, endotracheal suctioning, reintubation, and neonatal mortality are less commonly encountered during closed suctioning, and this method provides shorter ventilation duration and hospital stays for the babies compared with the open suctioning method. In addition, bronchopulmonary dysplasia is less severe in closed suctioning procedures (Cordero, Sananes, & Ayers, 2000; Sivasli & Tekinalp, 2005). Another study including 15 intubated and ventilated extremely low birth weight preterm infants found that oxygen saturation rates and pulse rates are significantly more stable in the closed suctioning procedure compared with open suctioning (Tan et al., 2005). Although closed suctioning is slightly more expensive, it is a simpler method that can be applied in a shorter time and is better tolerated by little preterm babies treated with mechanical ventilation (Cordero et al., 2000; Sivasli & Tekinalp, 2005).

Although there are abundant literature data comparing many aspects of these two suctioning systems, most notably the development of infection (Cordero et al., 2000; Ozden, 2007a; Sivasli & Tekinalp, 2005), we could not find any study comparing their effects on pain. In fact, it previously has been reported that the main problem related to the ventilation treatment was pain in 57 of 158 adult patients (36%) monitored during the mechanical ventilation treatment in the intensive care unit; importantly, 30% of these patients defined the suctioning as the major cause of pain (Berghom-Engberg & Haljamae, 1989). Another study (Carbajal et al., 2008) on 430 neonates found that pharmacologic and/or nonpharmacologic pain relief methods

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