QuickSF: A New Technique in Surfactant Administration

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\textbf{Background}

Recent studies indicate an increasing use of less invasive surfactant administration (LISA) to treat infants with respiratory distress syndrome \cite{1–3}. Different techniques have been shown. In Germany, the most widely known LISA technique is the method developed by Kribs et al. \cite{1}. It uses a thin endotracheal catheter (4- or 6-Fr feeding tube) and Magill forceps to apply surfactant during nasal continuous positive airway pressure (nCPAP), is easy to conduct and, especially in difficult airways, can be combined with video laryngoscopy. Two other methods, one developed by Dargaville et al. \cite{2}, who used a more rigid 16-gauge vascular catheter, the other by Kanmaz et al. \cite{3}, who used a (flexible) 5-Fr nasogastric tube, have also been reported. Both disperse with the use of Magill forceps.

However, in our clinical practice, each method displays its own pros and cons. The use of Magill forceps sometimes leads to bleeding or injures the vulnerable mucosa. A nonguided, soft catheter is also considered difficult to handle, and may result in a prolonged manipulation time and potential dislocation of the catheter during mouth closure. Rigid, straight catheters are quicker to handle, but require greater laryngoscope use for direct view of the vocal cords.

\textbf{Key Words}

Surfactant · Respiratory distress syndrome · Spontaneous breathing · Less invasive surfactant application · Minimal invasive surfactant therapy

\textbf{Abstract}

\textbf{Background:} Recent studies indicate an increasing use of less invasive surfactant administration. Different techniques have been shown with distinct risks and benefits. The aim of this study was to develop a new method that simplifies this procedure. \textbf{Objectives:} An applicator was developed and tested on a manikin to make tracheal surfactant application easier and faster. \textbf{Methods:} A device for oral administration of a catheter into the trachea was developed. After refining, it was tested by 9 neonatologists on a manikin. The primary aim was device feasibility, which was defined as successful intubation within 30 s. \textbf{Results:} The first device showed success in 30 of 33 measurements (90.9%). After refinement, the final device showed successful intubation in all 27 trials (100%). \textbf{Conclusion:} The new technique was feasible in this manikin test and should be confirmed in a clinical study.
Thus, which technique is used largely depends on each neonatologist’s preference. We decided to develop a new tool for catheter guidance that resolves this conflict.

**Materials and Methods**

We expected the new technique to fulfill the following objectives:
1. Use a relatively soft tracheal catheter
2. Allow surfactant to be safely administered without using Magill forceps
3. Afford a possibility to guide the tracheal catheter close to the larynx and also stabilize the catheter in place even when the mouth is closed (to minimize the loss of CPAP)
4. Afford a possibility of using an indirect view to the vocal cords via videolaryngoscopy

To reach these goals, we developed a plastic guide out of the dispenser of the guide wire from a central venous catheter. Using this as a handle, we found an easy way to move the tracheal catheter forward and backward by holding the device with one hand. We then bent the dispenser (in a similar way to that with Magill forceps) and combined it with a bent endotracheal tube at the tip of the guide, thus assembling our first device.

After that, a team of neonatologists with different levels of experience met to discuss and test our device on a manikin. We chose the Laerdal® Neonatal Intubation Trainer, which was the smallest and most realistic model we could find. The head circumference of the manikin is 33 cm and thus corresponds to the 50th percentile of a neonate born at 35 weeks of pregnancy [4]. All physicians had 3 trials and all of these were filmed with a digital camera (Casio EX-Z100). The online supplementary video (for all online suppl. material, see www.karger.com/doi/10.1159/000450823) was measured with Avidemux 2.6.8 v2 with a fidelity of 0.033 s. The primary aim was to test the feasibility of our device, which was defined as successful intubation of the manikin within the recommended period of 30 s [5]. To monitor the success, the catheter was pushed forward until it was seen at the end of the manikin. Finally, we interviewed the team about advantages and disadvantages.

With the data from this first trial, we refined our device with the help of a team of plastic engineers. The final device and how to use it is shown in figures 1 and 2. The operator moves the catheter by moving their thumb. After the catheter is in position, the laryngoscope is removed. The device remains in place while the mouth is being closed to maintain the CPAP. An online supplementary video is available at [https://[.]

**Results**

The first device showed success in 30 of 33 measurements (90.9%). The average intubation time with the first device was 13.5 ± 5.7 s (median 12.6 s). One trial was terminated prematurely by the examiner before the catheter tip was visible. Two physicians reported problems with the handling of the device; this prolonged the time of intubation. After refinement, the final device showed successful intubation in all 27 trials (100%) and no problems were determined. The average intubation time was shortened to 11.0 ± 4.3 s (median 9.5 s).

**Discussion**

This new technique shows a feasible way to intubate the trachea with a soft catheter in this manikin test. Compared to the method of Kribs et al. [1], we abandoned the
use of Magill forceps, as did Dargaville et al. [2] and Kanmaz et al. [3]. However, instead of their methods, we used a soft catheter for endotracheal insertion and built a device to guide this catheter through the pharynx and stabilize its tip near the larynx. We expected that this would protect the catheter prior to displacement while the mouth is being closed to reduce the loss of CPAP, and we assumed that the soft tip would be tolerated as well as a pharyngeal tube. The outer form of the device is modeled like Magill forceps and enables combination with video laryngoscopy for successful control and use in difficult airways. The handle affords easy movement of the catheter through the guide, which allows the operator to react quickly. All of these are expected to be relevant potential advantages compared to other published methods.

Unfortunately, it was not possible to compare the handling of our device with these other methods, because our team has not yet made routine use of all of them.

A disadvantage of our device is that it requires some training to handle it smoothly, but, in our experience and because of its similarity with Magill forceps, clinicians who are used to the latter will learn to use it very quickly. There is also no possibility of introducing the catheter via the nasal route, and the device has to remain in the oral cavity throughout the procedure. In addition, the device is a product for single use, which results in higher costs.

Nonetheless, the device and its apparent benefits need to be validated in a clinical study on neonates, which we have planned for once we receive the CE marking (expected at the end of 2016). At the moment, it has not yet been approved for use in humans.

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Disclosure Statement

C.A. Maiwald has a financial relationship in the profits of the product as an inventor. The other authors have indicated they have no financial relationships relevant to this article to disclose.

References