

know with a logical flow, opening with a strong foundation of history, physiology, and pharmacology, on which is built a structure of soundly informed clinical practice.

Future Directions

There are a number of topics not covered in *Neonatal Anesthesia* that might be worth adding in future editions. Missing from the text are in-depth discussions of neonatal resuscitation, fetal anesthesia and EXIT procedures, and the care of conjoined twins, who may require anesthesia in the neonatal period in preparation for separation. A more robust discussion of regional anesthesia with regard to test dosing and lipid rescue would be welcomed in subsequent editions, as would consideration of the implications of residual morbidity in the formerly premature infant on future anesthetic care. A few audiovisual complements to the text may be of value, as increasingly popular enhanced online materials such as videos of regional anesthetic techniques or airway management may benefit some readers. The addition of an electronic test bank would be greatly appreciated by those practitioners preparing for subspecialty board examination.

All in all, Lerman's *Neonatal Anesthesia* is a sophisticated but approachable text that offers its readers theory-based practical approaches to understanding and managing anesthesia in our youngest, most fragile patient population. And almost no one can argue against ensuring the very best care for those who hold the future in their hands.

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(Accepted for publication May 13, 2016.)

Smartphone Application Review: The Airway Assessment App (V. 4.0.0). Created by Monica Galindo Palazuelos and Carlos Marente Tamayo. Last Update June 4, 2015. Software Application for Google Android Devices with Version 2.3 and Up. Price: \$1.87.

The past few years have brought about a considerable and dramatic increase in the number of mobile medical applications. We are practicing in an exciting time for technology and innovation to impact the way we care for patients. The ubiquitous presence of smartphones in today's healthcare arena means that providers can have instantaneous access to a wealth of information including electronic health records, clinical references, educational materials, and medical journals. The *Airway Assessment App (V. 4.0.0)* is a smartphone application developed to help healthcare providers rate the difficulty of an airway. While this may sound like a useful application, a review of the app demonstrates that it is flawed

and further underscores the call for more rigorous oversight before using apps in clinical practice.

The *Airway Assessment App* is a software application designed for the Google Android device. As of the time of this article, there was no version available for Apple devices such as the iPhone or iPad. This is an interesting choice in application development since many surveys claim that more than 80% of healthcare providers use an Apple smartphone. Once the *Airway Assessment App* was downloaded from the Google Store, installation was seamless and opening the app was intuitive. It is not clear from the app description, however, who the authors consider the main audience for the app.

When opening the app, the user is immediately brought to a page that most clinicians familiar with airway management would recognize as six different factors that may be used to describe an airway. These factors are as follows: Mallampati score, upper lip bite test, thyromental distance, sternomental distance, interincisor gap, and neck mobility. The app then asks the user to provide a score for each of the different factors in a structured format. For example, the Mallampati factor in the app could be a 0 to 3 value, where 0 would correlate with a Mallampati score of 1. Other factors such as the upper-lip bite test could be scored on a 0 to 2 scale. The application then sums the score and provides an "assessment" of the difficulty of the airway. After this "assessment" and scoring, the user has the option of filling out other variables such as the patient name, age, gender, body mass index, medical record number, the Cormack-Lehane grade, and an e-mail address that can be used to export the results. The application can be used in English and Spanish.

While there are many factors to consider when reviewing a smartphone application, such as user interface and usability, it is probably best to start with just seeing if the application does what it is intended to do. In order to "test the app," I engaged a colleague and conducted an airway assessment using the app. With a Mallampati score of 1, ability to bite the upper lip easily, good thyromental distance, and good neck mobility, the airway assessment app calculated a score of "3," which was then defined as an "Easy Airway." My own individual assessment of my colleague's airway, independent of the app, would also describe the airway as "reassuring." So far so good!

To further explore the limits of the application, however, I simulated different airways to determine what the app defined as "easy" or "difficult." The *Airway Assessment App* seemed to define any calculated score of greater than or equal to 5 as a "difficult airway." This cutoff was true for a variety of different combinations of airway variables, even some that many would not judge as "difficult." For example, the Airway Assessment App would designate a Mallampati score of 2, thyromental distance of 2 fingerbreadth, moderate interincisor gap, and moderate neck mobility with being unable to bite the upper lip as a "difficult airway." In a real clinical scenario, it is unlikely that a clinician would consider this a "difficult airway." Changing these variables to make

the airway appear “more difficult,” for example, by increasing the Mallampati score to 4, would still yield a “difficult airway” by the app standards, even though it is clear that this would be a dramatically different airway to manage compared to the previous scenario. Unfortunately, the simplicity of the application in determining airway difficulty directly limits the clinical utility of the application. In short, it is difficult to imagine that anyone who would need to assess an airway in the healthcare world would find this application useful.

The lack of patient security protocols that abide by the Health Insurance Portability and Accountability Act and the electronic transfer of patient information in an unsecure fashion also make this application of limited use in a real-world healthcare setting. The application is designed to input patient health information variables including name and medical record number. It is not clear from the application that this information is secure when transmitted *via* electronic means such as e-mail. The lack of protocols to protect patient health information further reduces the usability of the application.

While the application developers should be applauded for their attempts to create a smartphone app that could have the potential of assisting healthcare providers, the ultimate conclusion of this reviewer is that this is a prime example that all smartphone applications (just like any novel device or new research) should be reviewed carefully before implementation in clinical practice. The important questions to ask include if the smartphone application was tested for accuracy, precision, usefulness, and safety in a clinical setting. Although there are currently some

guidelines recently released by the Food and Drug Administration regarding the various levels of regulation imposed on some applications, the current focus is on applications that make the mobile platform into a regulated medical device such as a mobile phone that can take blood pressure or temperature readings. Smartphone applications such as the *Airway Assessment App* are not yet regulated and have limited attention by regulatory bodies that are traditionally designed to focus on medical devices. For now, it is unclear if the future of mobile applications will require the development of a “peer-reviewed” infrastructure, review by a traditional regulatory body such as the Food and Drug Administration, or the development of a completely new organization to validate such applications. It is still up to the individual user to ask important questions when navigating the multitude of mobile applications in the healthcare space. These questions include if the app is useful and safe in clinical practices and whether it provides the right information at the right time to help healthcare providers make the right decisions.

Competing Interests

The author declares no competing interests.

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(Accepted for publication May 25, 2016.)