Introduction of an inhalation aid for an MDI to the patient does not abrogate a physician's responsibility to teach patients the proper aerosol administration with it and to reexamine their technique on subsequent visits. The first line of our responsibility should lie on teaching inhalation technique in the first place so that the inhalation aids are unnecessary. There is a need to develop a teaching aid that could facilitate teaching of the inhalation technique.

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Oximetry—Know Thy Limits

Measuring arterial blood gas levels has become increasingly important in clinical medicine. Direct sampling of arterial blood has opened new horizons in the diagnosis, management and therapy of lung diseases. Recent technologic advances have led to the development of noninvasive methods for assessing arterial blood oxygenation. Such techniques have several important advantages including the capability for continuous monitoring, ease of use and portability. However, appropriate use of these instruments requires careful evaluation of their accuracy under clinical conditions and attention by users to their limitations.

Oximetry is one technique which has gained widespread use in areas where rapid, continuous monitoring of arterial oxygenation is needed—such as exercise testing, sleep studies, diagnostic procedures (eg, bronchoscopy), intensive care units and operating rooms. An oximeter is a spectrophotometric device which measures the differential absorption of light by oxy- and deoxyhemoglobin and reports the oxyhemoglobin saturation. It does not measure arterial CO2 which is also important in evaluating the adequacy of pulmonary gas exchange. In addition, it is insensitive to other forms of hemoglobin and will give misleading results in the presence of carboxy- or methemoglobin.

Appropriate use of oximetry (or any new device) requires good studies which validate measurements both in the laboratory and in clinical settings where other factors may compromise measurement validity. Previous studies in normal subjects and pulmonary patients at rest and during low level exercise have demonstrated that the accuracy of ear oximetry SaO2 compared to direct arterial blood SaO2 is ±3 to 5 percent saturation (95 percent confidence limits). On the upper, flat portion of the oxyhemoglobin dissociation curve, large changes in PaO2 can be seen with small measured changes in SaO2. Thus, a measured oximetry SaO2 of 95 percent (±4 percent) could be associated with PaO2 values from 60 mm Hg (91 percent saturation) to 160 mm Hg (99 percent saturation).

The article in this issue by Hansen and Casaburi (see page 333) provides an important demonstration of potential limitations of ear oximetry during maximum exercise testing in patients with cardiopulmonary disease. In 14 patients referred for clinical exercise testing, the authors report that ear oximetry SaO2 was falsely elevated in two patients with interstitial lung disease and low in five patients with cardiovascular limitation. They suggest that the latter findings were due to changes in local ear perfusion during exercise. This study highlights the importance of defining the accuracy of oximetry in various clinical applications.

Other factors which may affect the accuracy of oximetry include the presence of carboxyhemoglobin1,3 (false elevated reported SaO2), skin pigmentation,5 jaundice,7 and local tissue perfusion. Another undefined problem is the reproducibility of repeat measurements in the same patient, an important issue in being able to follow patients without repeated invasive blood sampling.

Noninvasive techniques for arterial blood gas measurements are exciting and have many potential uses. However, as with any other new technique, good clinical studies, like the one by Hansen and Casaburi, which critically evaluate accuracy and define clinical usefulness, are needed if we are to meet our professional obligations to use technology wisely, appropriately and cost-effectively. In today's medical world, meeting these obligations is not a luxury: it is a necessity.

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REFERENCES