Bronchial provocation testing is widely performed in the evaluation of airway hyperresponsiveness. Several methods have been described in the literature, but the most commonly used nonspecific agent is aerosolized methacholine. Exercise-induced bronchoconstriction (EIB) occurs in 95 percent of asthmatic children; therefore, the performance of EIB testing is also commonly performed.

The literature suggests correlation between severity of asthmatic symptoms and the severity and degree of EIB. The American Association for Respiratory Care published a clinical practice guideline (CPG) in 1992 to address bronchial provocation testing. Subsequently, two chapters in the American Thoracic Society (ATS) “Pulmonary Function Laboratory Management and Procedure Manual” address the methacholine challenge test and the exercise challenge test. Most recently, in January 2000, the ATS published guidelines for methacholine and exercise testing. The AARC Bronchial Provocation CPG is under revision and will be published later this year to reflect changes in practice and recommendations over the past several years.

This article will highlight portions of the ATS guidelines for methacholine and exercise challenge testing. For laboratories performing bronchial provocation testing, a thorough review of the entire document is required.

**Guideline purpose**

The intended purpose of the ATS guideline is to outline specific details associated with the two most widely used bronchial provocation methods: methacholine and exercise. It does not limit the use of alternative methods when the procedure or protocol has been well established in the literature. Methacholine challenge testing is better established than exercise. The document is directed at performance of these two methods in a patient population that can perform good-quality spirometry.

**Indications and contraindications**

Methacholine challenge testing will have the greatest diagnostic value when the pretest probability is between 30 and 70 percent. Its negative predictive power exceeds the positive predictive power; therefore, it becomes more useful in excluding a diagnosis of asthma. The exercise challenge test is...
selected to make the diagnosis of EIB in an asthmatic patient with symptoms related to exercise. A negative response to methacholine does not exclude EIB.

It is important to include a pretest interview and/or questionnaire with the testing session to identify possible contraindications. The contraindications are grouped into categories that may impact the quality of the test or subject the patient to increased risk or discomfort. Contraindications are further defined as absolute or relative. These contraindications include the ability to perform reliable spirometry maneuvers, the degree of airflow limitation, history of cardiovascular problems, pregnancy, nursing mothers, and current use of a cholinesterase inhibitor. In addition, if exercise is performed, additional contraindications apply, as well as recommended monitoring with a 12-lead electrocardiogram for patients greater than 60 years of age.

Technologist training and safety issues

The technologist training and competence assessment remains the responsibility of the pulmonary laboratory director, but minimum recommendations are addressed in the ATS document.

The first recommendation states the technologist should be familiar with this document and the specific testing procedures. In addition, one should be able to manage all equipment used for testing, perform spirometry proficiently, recognize contraindications, know safety and emergency procedures, know when to terminate testing, and administer and evaluate responsiveness to bronchodilators.

A good precautionary measure to perform a methacholine challenge on each technologist responsible for testing patients.

Patient preparation

Careful attention to patient preparation is essential. In my experience, a primary reason for canceling this procedure is a lack of adequate patient preparation. Upon scheduling the patient, a list of medications to withhold and the specific amount of time to withhold each medication must be given to the patient. In addition, verbal communication between the patient and technologist a few days pretest may prove beneficial.

Just prior to testing, the procedure is explained, informed consent signed (when required), medications reviewed, and an evaluation for contraindications is completed.

Methacholine choice and preparation

Although the document states that industrial sources of methacholine appear to work as well as Provocholine, there are definite advantages to U.S. Food and Drug Administration (FDA) approved methacholine. Provocholine is approved for human use and is required to meet good manufacturing practices for quality, purity, and consistency. Methapharm Inc., based in Brantford, ON, Canada, is currently the sole provider of FDA-approved methacholine (Provocholine). The guidelines committee members made a special note concerning their preference for normal saline without phenol as the diluent, but there is no evidence that adding or not adding...
preservative impacts the test results. Both are considered an acceptable diluent, but buffered solutions should not be used as the diluent.

The mixing of the methacholine solutions should be performed by a pharmacist or well-trained individual. Storage instructions vary based on the source of the methacholine. The methacholine should be at room temperature when the testing is performed.

Protocols

The ATS guidelines committee narrowed the protocol recommendation for methacholine challenges to two: the 2-min. tidal breathing method and the five-breath dosimeter technique. The reader is referred to the document for a detailed description of each protocol. Two dosing schedules are recommended. The first is a doubling schedule beginning with 0.031 mg/mL, and the second is a four-fold schedule beginning with 0.0625 mg/mL. The two protocols described in the statement are those most widely used in North America and Europe.

Exercise testing is performed with either a motor-driven treadmill or an electromagnetically braked cycle ergometer.

Quality assurance

Nebulizer output is critical to obtaining valid results. Each nebulizer should be tested to verify that it meets the specifications for either the tidal breathing method or the five-breath dosimeter method. The method for verifying nebulizer output varies based on the method selected. Two nebulizers for performing the methacholine challenges are described in the guidelines: the DeVilbiss 646 and the English Wright nebulizer.

The quality of the actual test maneuvers impacts the interpretation of test results. High-quality baseline testing should be obtained. Other tests, such as the forced inspiratory maneuver, body plethysmography, transcutaneous oxygen, and forced oscillation are described as alternatives when the patient cannot perform reliable spirometry. Each of these tests may be indicated based on the age of the patient, clinical indication, and ability to reliably perform each test maneuver.

The document also addresses data presentation and interpretation of the results. Attention to detail is imperative in bronchial provocation testing. Multiple variables exist and should be controlled to yield reliable test results.

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references