This year is flying by! As I write this column in mid-August, many of us are already looking ahead to the AARC International Congress in Cincinnati this October. This meeting signals the highlight of my year as Diagnostic Section chair. I hope to see many of you there.

The Congress offers us all a great opportunity to learn from, and network with, our peers and other medical professionals. I am especially looking forward to our annual Diagnostic Section business meeting, which will be held Tuesday morning, October 10, from 10:45-11:15. (If this Bulletin has reached you prior to the meeting, be sure to check your final Congress schedule for the room location and any time changes.) If you cannot attend the meeting, rest assured the minutes will be published in our next issue of the Bulletin for all to review and comment on.

Our feature article in this issue comes from Dr. G.C. Okeson, from Scott and White Clinic and Hospital in Texas. Dr. Okeson gives us insight into the pulmonary physiology behind the symptoms of dyspnea in COPD patients at rest, with daily activity, and during exercise. The research performed at the Scott and White facility helps to confirm a method to evaluate the exercise tolerance for this population of patients. Dr. Okeson provides practical techniques that we can use when working with COPD patients in the clinic, or in rehabilitation/education situations, to reduce symptoms of dyspnea and increase daily function and quality of life.

Susan Blonshine has also provided an informative article on the NCCLS document, “Quality System Model for Respiratory Services.” She states that this guideline is open for comments until December 2000. Read her article, then please consider reviewing and commenting on this important document.

Lastly, I’d like to continue to encourage all of you to become more active in the section. Do the Bulletin and AARC International Congress provide you with beneficial information that you can use in your daily work pertaining to diagnostics? Do you feel challenged to try new things? What additional information would you like to hear about? Do you want to join a committee or sign up to help with section activities? We would like to hear from you! You can contact us at the addresses/numbers listed on page two.

The Dyspnea of Chronic Obstructive Lung Disease
by G.C. Okeson, MD, FCCP, professor of medicine and medical director, pulmonary function laboratory and pulmonary rehabilitation program, Texas A&M College of Medicine, Scott and White Clinic and Hospital, Temple, TX

Shortness of breath, especially with exertion, is a significant problem in most patients with chronic obstructive pulmonary disease (COPD). While the mainstay of treatment in this day of high technology remains pharmacologic, I would like to review a couple of non-pharmacologic measures that are very helpful in controlling dyspnea and improving quality of life in these patients. Understanding the physiologic events that lead to dyspnea in COPD patients is the key to understanding and properly administering these treatment measures.

The Problem:
The term “dynamic hyperinflation” is a new term for an old phenomenon previously known as “air trapping.” There are several physiologic definitions of air trapping, each based on a different type of measurement. A “static” definition would be the difference in the total lung capacity (TLC) measured by...
with airways or not. The other techniques only measure the volume that is communicating with airways. The difference between these measurements would be the volume of air not communicating, or "trapped" within the lung. A second "static" definition would be the measurement of a disproportionate increase in residual volume (RV) compared to TLC, manifest as an increased RV/TLC ratio. An illustration of "dynamic" air trapping would be a progressive reduction in tidal volume during performance of a maximum voluntary ventilation (MVV) test or demonstrating that the forced inspiratory vital capacity (FVC) is larger than the forced expiratory vital capacity (FEVC). 

In COPD, exertion increases the demand placed upon the ventilatory apparatus, resulting in an increased tidal volume and an increased respiratory (or cycling) frequency. Because airway resistance is less during inspiration than expiration in these subjects, exhalation is more difficult than inhaling. Because of this, the end tidal volume progressively increases at the expense of the inspiratory capacity (IC), forcing the tidal range higher and higher toward TLC, eventually impinging upon the tidal volume and resulting in the sensation of dyspnea. This process now bears the name "dynamic hyperinflation."

This concept is not new. It was originally popularized by Dr. William Miller in Dallas, TX almost a half century ago. Figures 1 and 2 are from one of his articles published in 1958. Figure 1 shows the air trapping noted with chest breathing (which is how patients with fixed diaphragm breathing do it). Figure 2 shows the tremendous stepwise increase in the end tidal volume during an MVV maneuver. You will note that at the height of air trapping, the tidal volume is smaller than before the MVV was started. The patient is at TLC and cannot fill his chest with more air. Dr. Miller noted that air trapping could be demonstrated whenever forced inspirations and expirations were performed by COPD patients, such as repetitive coughing or laughing, or when exercising. Dynamic hyperinflation has been most recently popularized by O’Donnell as a major factor in exercise limitation in COPD patients.

Traditionally, the best estimate of exercise tolerance from pulmonary function data has involved measurement of the MVV. The MVV can be estimated fairly accurately by multiplying the forced expiratory volume in the first second (FEV1.0) by some factor, usually 35. It is interesting that this works out as well as it does, since the FEV1.0 does not really measure air trapping, while the MVV is definitely altered by air trapping.

More recently, O’Donnell has measured the reduction in IC during exercise in COPD patients. The reduction in IC was found to be one of the best predictors of exercise tolerance, suggesting that dynamic hyperinflation (air trapping) is a major component of exercise intolerance in these patients, confirming what Dr. Miller taught us decades ago. Unpublished data from our laboratory now suggests that the FEV1, when performed at the end of an MVV, may be the best estimate of potential exercise tolerance based on the 12-minute walk distance (p<0001).

The Solution:

How can dynamic hyperinflation be minimized? Dynamic hyperinflation results from using increased expiratory force during expiration, breathing with an increased respiratory rate, or both. While it is possible to exhale with excessive force while breathing slowly, rapid respiratory rates in these patients almost always result in excessive driving pressures. These events result in dynamic compression of the central airways within the chest, markedly increasing the resistance to airflow during expiration. If the patient voluntarily slows his respiratory rate and reduces the force used to exhale, then air trapping can be controlled. To be more specific, if expiration can be slowed to reduce resistance and minimize dynamic compression of the central airways, air trapping will be minimized.

Pursed lip breathing has been around for many years. This technique involves narrowing the lips during expiration just enough to slow expiration. If done properly, it works to reduce dynamic hyperinflation and dyspnea. The major problem in teaching this technique is that patients often get in the bad habit of pursing their lips tightly and blowing out forcefully against them. This defeats the purpose by causing more dynamic collapse of central airways and greatly increasing the work of breathing. It can result in increased dyspnea. Many COPD patients, when left to their own devices, learn to perform pursed lip breathing through trial and error without being taught. I have noticed that these patients almost always do it correctly. On the other hand, most of the patients whom I have been teaching are those who have been taught to do it. I don’t mean to imply that we should stop teaching pursed lip breathing. On the other hand, if we teach patients to do it, they should be taught correctly. A different way of measuring the same end result is by using the technique of "paced breathing." We prefer this technique in our rehabilitation program. It has none of the problems that are encountered when trying to teach patients to do pursed lip breathing correctly because it does not involve using the lips to slow expiration. Paced breathing involves teaching the patient to modify his inspiratory-expiratory ratio (I/E) from a "normal" 2:1 to a ratio of 2:4 or 1:3 by counting (silently, of course) It works best while walking or doing an exercise, since leg motion can be used as the "pacer." It’s the respiratory frequency to be preserved...
Lung Disease” continued from page 2

...and not excessively elevated, the increased time given to expiration assists to maintain respiratory function. Since resistance to airflow during inspiration is always less than resistance to expiration, in these patients, they usually do not find it difficult to inhale a little more rapidly to allow an adequate time to exhale. Dyspnea and breath holding

The Problem:

It is a well known clinical observation that patients with COPD often have more shortness of breath when engaging in activities involving their upper extremities than when using their lower extremities. The reason for this is intimately entwined in the anatomy of the upper extremities.

The arms are unique in that they are attached to the body entirely by muscle. This is different than the legs, which have steady weight bearing bony attachments to the trunk. The clavicle doesn’t really count since it is not weight bearing and appears to be almost useless as our appendix. The clavicle’s major function seems to be to keep us from touching our shoulders in the midline in front of our bodies. The important fact is that all upper extremity weight bearing is handled by muscles.

In anatomy, you learned that each muscle has an origin, an insertion, and an action. The action depends upon the origin and the insertion. The origin is the end of the muscle that attaches to a fixed point that does not move when the muscle contracts. The insertion is the attachment to the part that moves. Some muscles have variable actions. Depending on the activity, the upper limb is flexed and the arm moves to different positions. This is typical of many of the muscles that attach the upper limbs to the trunk. They act both as accessory muscles of respiration and as movers of the shoulder girdle and neck.

When, for instance, the pectoralis muscles are used for shoulder and arm motion, the origin becomes their attachment to the rib cage and the insertion is their attachment to the shoulder. The rib cage and trunk are stabilized by tightening the trunk muscles and frequently by taking a deep breath and holding it. This creates the stability off which the muscles can act. When the same muscles are used as accessory muscles of respiration, the shoulder is hyperextended slightly and fixed by the posterior neck and shoulder muscles, so that this becomes the scaffold upon which the muscles can act on the insertions attached to the rib cage, raising it to help with inhalation.

In COPD patients are known to be more dependent on their accessory respiratory muscles, since their diaphragms are usually flatter and less effective in moving air. In fact, if the diaphragm gets flat enough, it can change from a muscle of inspiration to a muscle of expiration. When the rib cage is fixed, so that arm and shoulder action is possible, the diaphragm cannot compensate for the loss of the accessory muscles, and air movement is greatly attenuated or stops. Typically, the breath is held at the end of a deep inspiration. When shortness of breath ensues, the patient still has to exhale to empty the lung before fresh air can be inhaled. The time since the last inhalation is thereby significantly increased by the expiratory airflow limitation that prevents a rapid exhalation.

Breath holding as a cause of dyspnea in COPD patients was first described by Tangri and Woolf in 1973. They documented that rib cage motion became very shallow or stopped completely when COPD patients were asked to do simple upper extremity tasks such as combing their hair or brushing their teeth. The reference to their article is in the reading selection list at the end of this article.

Breath holding is also involved in the dyspnea that COPD patients develop when bending over to tie their shoes, or when doing activities that require concentration on fine motion, such as threading a needle or using a camera.

The Solution:

The treatment is twofold. These patients should be taught to exhale with upper extremity activity or bending. This allows them to maintain a relatively stable trunk through the activity, but places the rib cage at end inspiration when the activity is finished, so that they can immediately inhale fresh air. This technique effectively shortens the length of the breath hold. The second useful technique is elbow propping when using their arms. Arm activity that can be done at a table, like brushing the teeth, produce less dyspnea if the elbows are propped on the table to unload the shoulder muscles. This allows them to function as respiratory muscles once again and makes it possible for the patient to continue with his activity. These techniques are simple and can be learned by almost anyone. The relief of dyspnea is immediate. These remedies are collectively known as anti-breath holding techniques.

I want to emphasize that it is natural for everyone to breathe with activities such as arm motion, bending, and getting up from a chair. The next time you get up from a chair, pay attention to your breathing and note how you inhale and then hold your breath until you are standing upright. Breath holding during some activities can also be a learned behavior.

When you learn to shoot a gun or use a camera, you are taught to take a breath and hold it to ensure steadiness while sighting the target.

Conclusion

Dynamic hyperinflation (air trapping) and breath holding are significant causes of dyspnea in patients with emphysema, decreasing their comfort and quality of life. There is no satisfactory pharmacologic solution to these problems because the causes are mechanical. Fortunately, effective techniques are available that, once learned, help to reduce symptoms and improve function. The patients who master these techniques will never have to worry that they will forget and leave them at home and thus be without them should they become short of breath, as is often the case with medications. Adding these techniques to your patients’ rehabilitation programs will help them to make better use of their exercise training and further improve their quality of life.

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Suggested Reading


Call for Comments on NCCLS Quality System Model for RT Services

by Susan Blochshine BS, RRT, RPFT, FAARC

AARC encourages respiratory therapists to comment on the National Committee for Clinical Laboratory Standards (NCCLS) document, HS4-P, A Quality System Model for Respiratory Services.

In May of this year, the NCCLS published the first in a series of discipline specific documents based on GP-26, A Quality System for Health Care, Approved Guideline. The first in the series is HS4-P, A Quality System Model for Respiratory Services. Members of the working group include Gary Kaufman, MPA, RRT; Carl Mottram, BA, RRT, RPFT; Karen J. Stewart, MS, RRT; and Marta Tingdale, BCA, RRT, RN. The guideline provides a structure for a comprehensive, systematic approach to building quality into the respiratory service’s processes, assess its performance, and implement quality improvements. Respiratory therapeutics and pulmonary diagnostics are used as specific examples, with the understanding that this system can be implemented in any service area.

The Institute of Medicine report listing “medical errors” as a major cause of mortality and morbidity in today’s health care system should prompt all health care professionals to assess their systems. Building a quality system has been discussed previously in Edward Deming’s work and is the cornerstone of the Malcolm Baldrige award. Several years ago, the Joint Commission on the Accreditation of Healthcare Organizations began changing its focus to one of quality improvement. Despite all of these efforts, medical errors remain a significant concern. The NCCLS document provides guidance very specific to respiratory services (see previous article).

The path of workflow as described in HS4-P includes these major areas. The path of workflow is specific to the service. The primary components of the quality system include quality essentials and the path of workflow. The ten quality essentials as described in GP26 are:

- documents and records
- equipment
- process control
- personnel
- purchasing and inventory
- occurrence management
- internal assessment
- process improvement
- organization
- customer service and satisfaction

These essentials apply to all health care areas. The path of workflow is specific to the service. The pulmonary diagnostic path of workflow as described in HS4-P includes these major areas:

Pre-test
- patient assessment
- test request process
- patient preparation
- equipment preparation

Testing Session
- patient training
- results review and training
- patient assessment for further testing

Post-test
- results report
- interpretation

Information Management
- information system
- clinical consultation

The respiratory therapeutics path of workflow is described in HS4-P as follows:

- quality indicators and establishing clinical consultation
- defining processes, developing procedures, and implementing comprehensive training programs. The document provides a plan for implementation of each phase of the quality system. Multiple references and appendices are included to provide examples for the user.

The NCCLS consensus process allows a proposed document to be open for comment for a six-month period. These comments are essential to the consensus process, and users are encouraged to submit comments. The comment period on HS4-P ends in December 2000. The original working group will reconvene and address all comments, which will be published as an appendix to the approved document. The document may be obtained from NCCLS, 940 West Valley Road, Suite 1400, Wayne, PA 19087-1898, (610) 688-0100.

Effective Management and Clinical Practice of Respiratory Care; Susan B. Blochshine, RRT, RPFT, FAARC, TechEd, Mason, MI
- Enhancing Clinical Effectiveness Through the Application of a Quality Plan, Marta Tingdale, RCA, RRT, RN, Baylor University Medical Center, Dallas, TX
- Easier Management through the Cultivation of Quality, Karen J. Stewart, RRT, Charleston Area Medical Center, Charleston, WV

If you missed the session, tapes are available through the AARC office, (972) 243-1272.

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To assist its members in gaining a greater understanding of the application of quality systems in respiratory services (see previous article), the AARC International Congress, held in Cincinnati, OH, in October, featured a symposium entitled “Moving Up the Quality Hierarchy: Applications in Respiratory Care.” Speakers and topics included the following:

- Quality System Essentials that Support...
The AARC is currently seeking information on JCAHO accreditation site visits. Please use the following form to share information from your latest site visit with your colleagues in the Association. The information will be posted immediately on the AARC website at http://www.aarc.org/members_area/resources/jcaho.html and will also be featured in the Bulletin.

Accreditation visit you are reporting (choose one):
- Home Care
- Hospital
- Long Term Care
- Pathology & Clinical Laboratory Services

Inspection Date: __________________________________________________________________________________
Facility Name: ___________________________________________________________________________________
Contact: ________________________________________________________________________________________
(Please provide name and email address.)

1. What was the surveyors’ focus during your site visit? __________________________________________________
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   _________________________________________________________________________________________________
   _________________________________________________________________________________________________

2. What areas were cited as being exemplary? 
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   _________________________________________________________________________________________________
   _________________________________________________________________________________________________

3. What suggestions were made by the surveyors?
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   _________________________________________________________________________________________________
   _________________________________________________________________________________________________

4. What changes have you made to improve compliance with the guidelines?
   _________________________________________________________________________________________________
   _________________________________________________________________________________________________
   _________________________________________________________________________________________________

Additional comments:
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