Bilateral diaphragm paralysis can be difficult to diagnose. Restriction evidenced by pulmonary function test results is nonspecific, as is the finding of low lung volumes on chest radiographs. Fluoroscopic sniff testing (i.e., diaphragm fluoroscopy) can yield false-negative and false-positive results. Measurement of transdiaphragmatic pressure is the gold standard, but it is somewhat invasive, requiring placement of catheters in the esophagus and stomach. Alternatively, B-mode ultrasound of the diaphragm in the zone of apposition is a noninvasive means of diagnosing diaphragm paralysis.

Treatment should address the underlying disease, which may or may not be reversible. If paralysis is idiopathic or caused by neuralgic amyotrophy (i.e., brachial plexus neuritis), more than 50% of individuals may recover. Phrenic nerve pacing may be used in patients with spinal cord injuries above C3, and noninvasive positive-pressure ventilation can be used to treat patients with nocturnal hypoventilation. Diaphragm plication is not indicated in patients with bilateral diaphragm paralysis.

PROSPECTUS FOR THE FUTURE

Numerous advances can be expected in treating individuals with pleural, mediastinal, and chest wall diseases. Progress in pleural fluid analysis using novel biomarkers and nucleic acid amplification tests may lead to more rapid and accurate diagnosis of tuberculous pleural effusions. Assays of pleural fluid tumor markers and chromosome analysis are promising developments for the differentiation of malignant from nonmalignant effusions. Mesothelioma remains resistant to traditional therapeutic approaches, but evolving technology centered on gene therapy may produce a new treatment modality.

Better visualization of mediastinal structures can be achieved as magnetic resonance imaging (MRI) evolves and becomes more routinely applied to examination of the chest. Molecular tracers targeting tumor receptors or proteins may be used with MRI and positron emission tomography imaging techniques to better differentiate malignant from benign mediastinal masses.

Noninvasive nocturnal ventilation remains a cornerstone of therapy for patents with chest wall and neuromuscular diseases, but compliance can be problematic. Continued evolution of techniques to deliver nocturnal noninvasive ventilation may improve compliance with treatment, and application of this technique to patients with obesity-hypoventilation syndrome may reduce morbidity and mortality for them.

Patients with diaphragm paralysis due to high cervical spinal cord lesions may benefit from advances in intramuscular diaphragm pacing. This technique may provide an alternative means of treating respiratory failure in these individuals and others with diaphragm paralysis.

For a deeper discussion on this topic, please see Chapter 99, "Diseases of the Diaphragm, Chest Wall, Pleura, and Mediastinum," in Goldman-Cecil Medicine, *25th Edition.*

SUGGESTED READINGS

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