

CHRONIC BRONCHITIS*

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DEFINITION

The basis of the currently accepted definition is the clinical symptom of chronic productive cough on most days for at least 3 successive months of the year over a 2 year period. All specific causes for these symptoms must be excluded before the diagnosis can be accepted. The common differential diagnoses are tuberculosis, carcinoma of the lung, bronchial asthma, congestive heart failure, and pulmonary mycoses. This chronic bronchitis of non-specific type may coexist with the diseases mentioned or may be a consequence of them. The establishment of the diagnosis of chronic bronchitis is often neglected when other overt specific disease is present, although it is important to identify all diagnoses so that complete therapy can be instituted.

The exact cause of chronic bronchitis is not known. It appears to be more common in urban or industrial areas. A number of inhaled irritants appear obviously to play a role in the persistence or aggravation or both of the symptoms and pathology. These include inhaled tobacco smoke, certain air pollutants, dusts, powders, and noxious fumes. Bacterial or viral infections of the bronchopulmonary tree such as pneumonia or acute viral tracheobronchitis may be the precipitating event or more seriously aggravate the course of the disease. When the diagnosis of chronic bronchitis is established, chronic bronchial infection is usually present. All age groups are affected but over 20 per cent of adult males and about 10 per cent of adult females appear to have the symptoms of chronic productive cough. The serious consequences of the disease are usually noted after the age of 40. There are now 15,000 documented deaths yearly attributed to bronchitis and emphysema in the United States and these diseases are second only to cardiac disease as a cause of disability. Although a history of heavy cigaret smoking is common, the disease can be observed in nonsmokers.

Pathologically there is hypertrophy and hyperplasia of the mucus-secreting bronchial glands relative to the bronchial wall thickness and of the goblet cells of the bronchial epithelium. There are diffuse inflammatory changes of the bronchial epithelium with ulceration, neutrophile infiltration, loss of cilia, bacterial invasion, and areas of squamous metaplasia with "abnormal" mucus in the bronchial lumina which may even extend to the proximal alveoli. Many of these changes interfere with mucociliary function.

Among other things, chronic bronchitis is called smoker's bronchitis, simple bronchitis, purulent bronchitis, cigaret cough or morning cough. When dyspnea and/or wheezing are present, chronic bronchitis may be misdiagnosed as asthma or emphysema. The recent tendency to assimilate chronic bronchitis into the broader category of chronic obstructive lung disease is unfortunate. This detracts from a more specific pathophysiologic understanding of the disease process, while emphasizing only one feature of chronic bronchitis, i.e. the airways obstruction.

SYMPTOMS

The identifying symptoms of chronic cough and expectoration may be difficult to elicit from the patient with early or minimal disease. The increase in severity of symptoms may be gradual with the patient accepting each new increased level as part of his normal existence. If the onset of the disease was a specific bronchopulmonary insult, the patient is more likely to remember the actual onset of the symptoms and be concerned by their presence. The cough is more noticeable in the morning because of pooling of nocturnal secretions in the supine position which are then mobilized with morning activities. Lying down at night may also result in cough because of the shifting of secretions. Wheezing is common and is characteristically relieved by raising sputum. Clinical distinction from the wheezing associated with asthma (relieved by specific medications) or

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emphysema (effort related) is possible. A background history of asthma is often obtained. Frequent and protracted chest colds or pneumonias are common in these patients, but severe disease may be present without such history. Severe coughing spells may lead to insomnia, anorexia, depression, and "cough" fractures of ribs simulating pleurisy. The dyspnea in pure chronic bronchitis may be insidious and is probably related to obstruction of airways with abnormal and excessive mucus. Malaise, weight loss, fatigability, and retrosternal burning with cough are common in the moderately severe case. Chronic bronchitis is the most frequent basis for mild hemoptysis. Chronic upper respiratory disease of both allergic and infectious nature may be a commonly associated or precipitating factor.

Blue lips and nails, enlargement of the terminal phalanges, swelling of the legs, or dyspnea at rest is usually a late symptom of chronic bronchitis, but interestingly may be the chief complaint that first brings the patient to the physician's attention.

PHYSICAL EXAMINATION

Abnormal physical findings in the chest may be absent or minimally present even in moderately severe cases, and this discrepancy must not be interpreted as a denial of the history presented. Positive signs are almost all referable to bronchial secretions. Roughened breath sounds, coarse rales, and rhonchi may be noted on inspiration, or expiration; they are often basilar and transient, and may clear completely with cough. Decreased to absent breath sounds related to secretions also may be of a spotty and migratory nature. Wheezing may be noted on inspiration or expiration, but expiration frequently is prolonged. Such findings are usually exaggerated during acute exacerbations of bronchitis. Palpation of the chest may reveal local tenderness over a recently fractured rib or callous formation. In more advanced disease, the patient may be plethoric or have a dusky cyanosis and have cardiac findings of cor pulmonale. Overt clubbing is not commonly observed in pure chronic bronchitis (although the nail beds are often soft) and should make one suspicious of other disease, e.g. abscess, carcinoma, or bronchiectasis. When bronchial asthma or emphysema is concomitantly present, the physical findings may be related to the multiple disease processes.

ROENTGENOGRAPHY

In minimal chronic bronchitis the chest x-ray findings are often normal. However, occasionally one sees thickening of bronchial walls and crowding of bronchial structures in the lower medial zones. In cross section such bronchi appear as distinct circles of density with air inside and out. A longitudinal section shows thickened parallel walls with air contrast. Intra-bronchial beading or rosary effects may be produced by the irregularly piled-up mucus interspersed with air pockets. In addition, tiny air "diverticulae" extend out of the lumen and into the wall representing dilated mucus gland ducts. These bronchial findings become more common as the disease becomes more severe. The vasculature is preserved or more pronounced than normal. The finding of diminished or tapered vessels suggests associated emphysema. A scalloped diaphragmatic border or localized areas of fibrosis represent healed parenchymal processes which are common complications of bronchitis. Laminography may define some of these abnormalities. Bronchography demonstrates the extent to which the bronchial mucus glands are involved and mucosal thickening related to edema or hyperplasia. The beading, reduced numbers of peripheral bronchi, and overt cutoffs of the larger bronchi due to secretions may be surprising in their extent. Fusiform and cylindrical dilations are consistent with bronchitis and do not denote bronchiectasis. Fluoroscopy is of little value, but may reveal patterns of regional ventilation or signs of early pulmonary hypertension by the prominence of hilar pulmonary artery pulsations.

LABORATORY STUDIES

The peripheral blood examination is of limited value. The white blood cell count is usually normal even during an acute infectious exacerbation. A mild shift to the left of the neutrophilic cells is often the only indication of increased turnover. The sedimentation rate is more often normal than increased. Increased hematocrit and hemoglobin occur with hypoxia, but may not correlate with the degree. With advanced stages, a decrease in PaO_2 which is further decreased with exercise, and an elevation of PaCO_2 are present. The pH will vary depending on the degree of renal compensation and concurrent therapy (diuretics). Hypochloremia often accompanies chronic re-

spiratory acidosis. A lower hemoglobin than expected should lead one to search for a cause for blood loss, since bleeding peptic ulcer is very common in this group of patients.

Production of sputum indicates bronchopulmonary disease of some type. The cells can be evaluated by simple examination of a wet preparation or a Papanicolaou stained smear. In stable chronic bronchitis there is a characteristic cytologic pattern. Numerous individual bronchial epithelial cells are exfoliated and are usually degenerated with some metaplastic changes, and occasionally contain identifiable bacteria. These bronchial epithelial cells constitute 5 to 20 per cent of the total cell population and their numbers reflect the area of bronchial mucosa involved in the process at the time of sampling. The predominant cell type is the polymorphonuclear neutrophile (60 to 90 per cent of total cells) and marked increases indicate an inflammatory exacerbation even in the absence of clinical evidence. The histiocyte or alveolar macrophage is a very sensitive indicator of cellular responsiveness. There may be from 1 to 20 per cent present in the stable state. A marked paucity of histiocytes is commonly the first sign of an acute inflammatory exacerbation. A marked increase denotes that the cellular response is good and this is usually followed by recovery. When the number of histiocytes is maintained at a high level in the stable state, the patient is usually handling his disease well. Other cells such as monocytes, lymphocytes, and plasma cells are usually found in small numbers. If over 2 per cent of the cells are eosinophiles, one should suspect an allergic component. Sputum cultures can be helpful in following the course of and suggesting the antibiotic treatment of chronic bronchitis, particularly if these cultures are carried out in conjunction with a careful gram stain analysis. Gram stains and cultures carried out with material that has been shown microscopically to represent bronchopulmonary secretion can be very useful. The investigators who belittle bacteriologic examination of sputum do not usually select material on this simple criterion. Exactly what constitutes a pathogen in chronic bronchitis is not clear, but one can almost invariably find some bacteria in the gram stain of a bronchitic. When there are more than 30 to 50 organisms per oil immersion field, there is probably a significant bacterial infection present. The usual organisms found are streptococci, *Neisseria* sp., *D. pneumoniae*, diphtheroids, and *Hemophilus*

influenzae. The marked predominance of *H. influenzae* or *D. pneumoniae* almost always represents a significant infection, although the others should not be ignored. It is unusual to find staphylococci to be a predominant factor in an acute exacerbation of chronic bronchitis. The role of virus infection in the stable state of bronchitis is not clear, although acute exacerbations frequently appear to be triggered by such infections.

BRONCHOSCOPIC FINDINGS

The findings are related to the extent and severity of the mucosal inflammation and of the degree of hypersecretion of mucus. Red, friable, and edematous mucosa and dilated bronchial mucus gland ducts may be seen. A biopsy of the bronchial wall may demonstrate inflammation, areas of metaplasia, and the hyperplasia-hypertrophy of the bronchial mucus glands. In the absence of other specific infectious cause or of cystic fibrosis, these findings are diagnostic of chronic bronchitis.

PULMONARY FUNCTION STUDIES

In early or minimal chronic bronchitis all pulmonary physiologic tests may be within normal limits. The abnormalities which may be observed later in the disease reflect the partial and complete obstruction of bronchi due to secretions or mucosal changes. These tests are discussed in the section on chronic pulmonary emphysema. However, one should note that the patterns observed may not distinguish chronic bronchitis from chronic pulmonary emphysema.

COURSE

It is important to remember that chronic bronchitis by itself can progress to cause complete disability and finally death. Although insidious progression can bring the patient to the physician in a severe state of disability, it is clear that reversibility is possible. Patients presenting with cor pulmonale, polycythemia, weight loss, and frequent infectious exacerbations may be returned to a fully active life. Those who present with early or minimal disease can have a complete clinical resolution. Despite treatment, the course is unpredictable. In general, based on clinical impressions, it is safer to assume that the disease will progress without adequate therapy. Exactly how chronic

pulmonary emphysema is related pathophysiologically is not clear, but the diseases are highly related.

Clinically we suspect that the earlier chronic bronchitis is recognized, the more favorable

will be the outcome. The intelligent use of the diagnostic criteria, with particular emphasis on mild cough and sputum production, may result in a substantial improvement in the early detection of this disease.

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