Pneumonia in the Elderly: Overview of Diagnostic and Therapeutic Approaches

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Pneumonia is more frequent in the elderly and results in higher morbidity and mortality. Although the incidence of pneumonia increases with age, from 1 per 1,000 to 12 per 1,000 persons over age 75 years, comorbid medical illnesses and host defense impairments (especially heart disease, chronic obstructive pulmonary disease, and aspiration risk) are independent risk factors. The microbial etiology of pneumonia in the healthy elderly is similar to that in younger patients but shifts toward a more gram-negative and opportunistic flora with increasing age and severity of concomitant medical illness. The choice of antimicrobial therapy must be based on risk stratification (age, medical illnesses, and severity of presentation). Guidelines based on these principles will be reviewed. Pneumococcal and influenza vaccination reduce the risk of death due to pneumonia and are cost-effective preventative strategies.

The United States, along with the rest of the developed world, is undergoing extraordinary demographic change. Elderly patients constitute an ever-increasing proportion of the population. Lower respiratory tract infections, along with severe tracheobronchitis, have traditionally been recognized as problems that particularly afflict older individuals. As the population of those over age 65 years moves from its current level of 12% to close to 25% in the year 2050, respiratory tract infection will assume a greater degree of importance to the overall public health [1]. The purpose of this review is to highlight the unique features and barriers to improved outcomes of pneumonia in the elderly as well as to highlight potential solutions. The focus is on diagnostic and therapeutic considerations of pneumonia acquired in the community rather than of nursing home pneumonia, which has many similarities to nosocomial lower respiratory tract infection.

**Problem Defined**

There is little doubt that death is more likely (threefold to fivefold) to be the outcome of pneumonia in elderly individuals than it is in young adults. This observation must be viewed in the context of the host-pathogen interaction [1]. Risks increase with age and associated medical illness. Those over age 65 years account for greater than 50% of pneumonia cases and 90% of all deaths due to lower respiratory tract infection [2–5]. The overall rate of pneumonia requiring hospitalization is as low as 1 per 1,000 persons in the general population but increases to 12 per 1,000 persons for those over age 75 years and to 33 per 1,000 residents for those in chronic care facilities. The crude mortality rate for influenza and pneumonia published by the Centers for Disease Control and Prevention (CDC) was 32 per 100,000 population in 1994. The elderly are more likely to be dependent and require care in a chronic care nursing facility, where the prevalence of pneumonia may be as high as 2% and mortality as high as 32% [6]. In this setting, the clinical manifestations of lower respiratory tract infection may overlap those of what has been traditionally viewed as hospital-acquired pneumonia [1, 6, 7]. In chronic care facilities, the increasing population of patients who are chronically mechanically ventilated adds a new dimension to the problem of prevention, diagnosis, and treatment. These patients are chronically colonized and have a higher risk for recurrent pneumonia.

What is the nature of the enhanced risk of lower respiratory tract infection faced by older individuals [4, 8–10]? First, aging itself results in reduced lung elasticity and respiratory muscle strength (both inspiratory and expiratory), with potential impact on secretion clearance after aspiration. More important is the cumulative effect of multiple medical illnesses, which continues to add “baggage” to host defense impairment. In one study, independently defined risk factors for community-acquired pneumonia included alcoholism (RR 9.0), asthma (RR 4.2), immunosuppression (RR 3.1), and heart disease (RR 1.9) [4]. Chronic obstructive pulmonary disease (COPD), congestive heart failure, malignancy, and neurological impairment are consistently reported in association with pneumonia requiring hospitalization [4, 11]. With increasing age, it becomes more likely that more than one significant medical illness will be present.

Recent studies have highlighted the association of the level of functional dependence, cognitive impairment, malnutrition, and hypoalbuminemia as specific risk factors for pneumonia in older individuals; these factors may merely reflect the overall state of health and of host defenses [4, 5, 11]. Recurrent aspira-
Table 1. Microbial etiology of community-acquired pneumonia (CAP).

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Pathogens

The etiology of pneumonia in the healthy elderly parallels that in younger individuals and shifts as a function of deteriorating functional status, increased severity, and numbers of coexisting medical illnesses (table 1).

The elderly are more likely to be colonized with enteric gram-negative rods, especially if functional status, duration of hospitalization, and concomitant medical illness are factors [13–15]. An increasing incidence of gram-negative rod and mixed pneumonia is observed in community-, nursing home-, and hospital-acquired lower respiratory tract infection. Community-acquired pneumonia due to *Pseudomonas aeruginosa* may be more common with aging and structural lung disease. In the healthy elderly residing in the community, the spectrum of pathogens is similar to that seen in healthy younger patients. Chlamydia and mycoplasmal infection may occur, although the latter is distinctly less frequent in those over 65 years. Although *P. aeruginosa* is infrequently isolated as a cause of community-acquired pneumonia, even from patients with COPD, coverage for this pathogen in patients with structural lung disease has been endorsed by recent guidelines for the management of community-acquired pneumonia [16, 17]. The role of silent aspiration is increasingly recognized in the pathogenesis of lower respiratory tract infection in older patients [11, 18, 19–21], where the role of anaerobic infection may be significant.

Problems of Diagnosis: What’s Wrong with the Traditional Approach?

The diagnosis of pneumonia in the elderly has remained a clinical challenge even as our radiographic, culture, and serological techniques have become more sophisticated [21, 22]. The older, more debilitated the patient, the more likely the classic pneumonia syndrome will be incompletely expressed [1, 9, 23]. The characteristics identified by most commonly employed techniques of physical diagnosis (decreased breath sounds, crackles, and egophony) are poor and must be combined with vital-sign abnormalities if specificity is to be improved [23]. While fever is less commonly observed, confusion and delirium are more common. Tachypnea and tachycardia may be the only findings heralding the onset of lower respiratory tract infection. Radiological examination, the reference standard for diagnosis of pneumonia, has limited specificity, as illnesses such as COPD, heart failure, and malignancy obscure the interpretation of classic alveolar and interstitial infiltrates. This has been a particular problem for the critically ill and ventilator-dependent patient [24–27].

Traditionally, clinicians have relied on gram staining and culture of expectorated sputum to establish microbial etiology. Since the old and seriously ill often produce little sputum and cough ineffectively, this approach may not be applicable or cost effective, given the limited specificity of culture and sensitivity of gram staining [22, 23]. The role of blood cultures remains controversial, and although culture is part of “the usual care standard,” its result does not usually change treatment plan or outcome. Given the frequency and severity of underlying medical illness, the risks of invasive diagnostic approaches using bronchoscopy (with quantitative culture) or needle aspiration may be too high to warrant routine application. This has led to widespread empirical antibiotic therapy (with its attendant cost) and, consequently, emergence of resistant *Staphylococcus aureus* gram-negative rods and *S. pneumoniae*. While one may question whether age should be a reason for altering the diagnostic approach, careful analysis suggests it probably is, especially for debilitated patients near the end of life.
Where Should the Elderly be Treated?

Innovative programs are attempting to meet patient demand for treatment in a nonhospital setting. In general, most patients who believe they are not critically ill prefer treatment at home. Thus, the traditional clinical practice of management within the hospital for all patients over age 65 years may be modified on the basis of risk factors, severity of illness, virulence of pathogens, age, and comorbidities. Recent paradigms relying on prospectively validated scoring systems permit better triage of patients to appropriate settings of care [27, 28]. Those over 75 years of age presenting with high-risk conditions (organ dysfunction, respiratory failure, or shock) or medical illnesses (diabetes, chronic renal failure, COPD, congestive heart failure, or stroke) should be managed within the hospital setting. Outcome studies, however, have not validated the efficacy of these practices. Unique to very elderly or infirm patients is the need to ensure adequate monitoring and compliance with the medication regimen. When this is not possible in the home, access to hospital care is important.

Therapeutic Paradigms: How Different are the Elderly?

The older and more infirm the patient, the more likely therapeutic difficulties will be encountered. Declining creatinine clearance poses an added risk of drug toxicity when renally excreted antibiotics (i.e., aminoglycosides) are administered. In addition, dementia may result in uncertain compliance with medication regimens. The high cost of any antibiotics must also be factored into the likelihood that low- or fixed-income patients will complete antibiotic regimens.

A number of recent consensus conferences have sought to establish a rational approach to initial management of pneumonia. The 1993 clinical practice guidelines of the American Thoracic Society [17] and guidelines published in 1998 by the Infectious Diseases Society of America [16] suggested empirical therapy based on risk factors, age, and triage location (home, hospital, or intensive care unit). Recommendations for those over age 60 years with more than one comorbidity include therapy with a second- or third-generation cephalosporin (when they are hospitalized), with an added macrolide agent if atypical pathogens are suspected on the basis of local epidemiology. A recently published prospective registry study evaluated outcomes for outpatients and showed that the use of macrolide antibiotics (erythromycin, clarithromycin, or azithromycin) was associated with improved outcomes (at lower cost) for elderly patients, even those with associated comorbidity [29].

Newly available expanded-spectrum quinolone antibiotics are active against penicillin-resistant S. pneumoniae and Legionella species and, when used as single agents in hospitalized patients, produce outcomes comparable to those with standard cephalosporin/erythromycin combinations [30]. Quinolone agents (including levofloxacin, sparfloxacin, grepafloxacin, trovafloxacin, or other fluoroquinolones with enhanced pneumococcal activity) can be part of the initial management strategy for both outpatient pneumonia (alone) or inpatient pneumonia (combination) in elderly patients. In addition, new information suggests that a switch or step-down in therapy after a short period or intravenous therapy may be accomplished even in elderly residents of chronic care facilities [31]. Enhanced bioavailability of newly available antibiotics may facilitate home management with oral agents throughout the course of treatment.

Preventive Strategies

Even though vaccination with currently available preparations may produce an incomplete antibody response in the frail elderly, efficacy of both pneumococcal and influenza vaccination is estimated to be at least 50% [32–34]. Recent studies have documented that influenza vaccination reduced the overall number of hospitalizations. Admission for pneumonia and congestive heart failure was also decreased [32–35]. Use of the 23-valent pneumococcal vaccine has been demonstrated to enhance prevention of pneumonia, in comparison with the effect of influenza vaccination alone [35]. Despite these encouraging statistics, in 1995 compliance with current recommendations was <60% for influenza [36] and <40% for pneumococcal vaccination [35]. Because of the minimal side effects and waning immunity, the CDC has recommended that this vaccine be administered every 5 years rather than as a single lifetime dose as previously advised. The application of molecular biology to vaccine technology may improve the activity of vaccines currently available [37].

Summary

The importance of pneumonia in the elderly is rising and increases both the clinical challenges as well as the potential for creative solutions. The dramatic increase in frail elderly persons and consequent requirement for dependent care creates a new clinical context for pneumonia in that it is more difficult to both recognize and treat, thus consuming more resources in the process. Solutions will have to improve access to and compliance with currently available preventive and therapeutic regimens while permitting more treatment at home. New technologies should permit better outcomes through more effective diagnosis and better-focused treatment, thereby eliminating the current empirical approach with attendant increased duration of therapy and microbial resistance. Immune modulation by enhancers like granulocyte colony stimulating factor and modulators like anticytokines may even permit dramatic reductions in the duration of therapy, with better outcomes. The coming decade will see us demographically challenged. We expect our therapeutic initiatives will keep pace.

References