Antibiotic Timing and Diagnostic Uncertainty in Medicare Patients With Pneumonia*

Is it Reasonable to Expect All Patients to Receive Antibiotics Within 4 Hours?

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Background: **Many organizations, including the Centers for Medicare & Medicaid Services, measure the percentage of patients hospitalized with pneumonia who receive antibiotics within 4 h of presentation. Because the diagnosis of pneumonia can be delayed in patients with an atypical presentation, there are concerns that attempts to achieve a performance target of 100% may encourage inappropriate antibiotic usage and the diversion of limited resources from seriously ill patients. This study was performed to determine how frequently Medicare patients with a hospital discharge diagnosis of pneumonia present in a manner that could potentially lead to diagnostic uncertainty and a resulting appropriate delay in antibiotic administration.**

Methods: **Randomly selected charts of hospitalized Medicare patients who have received diagnoses of pneumonia were reviewed independently by three reviewers to determine whether there was a potential reason for a delay of antibiotic administration other than quality of care. Antibiotic administration timing, patient demographic, and clinical characteristics were also abstracted.**

Results: **Nineteen of 86 patients (22%; 95% confidence interval, 13.7 to 32.2) presented in a manner that had the potential to result in delayed antibiotic treatment due to diagnostic uncertainty. Diagnostic uncertainty was significantly associated with the lack of rales, normal pulse oximetry findings, and lack of an infiltrate seen on the chest radiograph. There was a nonsignificant trend toward a longer time until antibiotic treatment in patients with diagnostic uncertainty.**

Conclusions: **Many Medicare patients in whom pneumonia has been diagnosed present in an atypical manner. Delivering antibiotic treatment within 4 h for all patients would necessitate the treatment of many patients before a firm diagnosis can be made.** ***(CHEST 2006; 130:16–21)***

Key words: antibiotics; health care; pneumonia; quality indicators

Abbreviation: ED = emergency department

The Centers for Medicare & Medicaid Services conducts a multipronged program to encourage improvements in quality of care for Medicare beneficiaries. The timing of antibiotic therapy for patients who have been admitted to the hospital with pneumonia has been an audited performance measure for pneumonia for many years,[1] as reports have demonstrated improved outcomes among patients who received antibiotics within 4 h of presentation.[2,3]

With the recent trend of using this and other performance measures as the basis for public reporting and pay-for-performance programs, there is increasing pressure for hospitals and physicians to drive their performance rates as high as possible.[4–6] The only way to ensure not being outperformed by another institution in the competition for reimbursement (in many pay-for-performance programs) or for patients (in the case of publicly reported quality measures) is to achieve 100% adherence.[4]

It is well-known that many elderly patients with

pneumonia present with atypical signs and symptoms.[7,8] Thus, in order to achieve 100% performance, physicians may be compelled to administer antibiotics before a firm diagnosis can be established,[4–6] a practice that has been described as "shoot first and ask questions later."[6] Inappropriate antibiotic use could induce increases in antibiotic resistance and the number of antibiotic-related adverse events, and may decrease the yield of subsequently required diagnostic tests.[4–6] Another commonly voiced concern is that the increased focus on patients with pneumonia may delay care that should be given to other acutely ill patients.[4,6,9]

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It has been suggested that one way of reducing the likelihood of these negative consequences is to determine the percentage of patients who present in a manner in which the treating physician could reasonably be expected to diagnose pneumonia and deliver antibiotic therapy within 4 h.[4,5] Then, the performance goal could be set at that percentage, and any hospital reaching that goal could be reported as having achieved the goal, without reporting the actual percentage achieved.[4] In this way, there would be no incentive for hospitals to strive for ever higher performance rates. This study was performed in order to determine how frequently Medicare patients with pneumonia present in a manner that is likely to allow diagnosis and antibiotic treatment within 4 h. A secondary aim of this study was to determine what patient characteristics predict a delay in the diagnosis of pneumonia or in delivering antibiotic therapy.

Materials and Methods

Randomly selected charts of Medicare patients with a hospital discharge diagnosis of pneumonia fulfilling the criteria for inclusion in Medicare pneumonia reporting were made available to the investigators. The criteria for inclusion in the Medicare reporting have been described in detail previously.[10] A key inclusion criterion for the antibiotic timing measure was that pneumonia had to be among the diagnoses being considered at the time of hospital admission. A confirmatory chest radiograph was not required. Patients with documented antibiotic treatment within 24 h prior to presentation were excluded. A sample size of 80 to 100 patients was planned, due to investigator time and resource constraints, as this was an unfunded study. With this sample size, an analysis prior to commencing the study revealed an acceptable predicted 95% confidence interval based on an anticipated prevalence of diagnostic uncertainty of at least 15%.

Three clinicians from varied backgrounds were recruited to perform the chart reviews. One was a clinical academic pulmonologist at a suburban university hospital in Connecticut, one was an emergency department (ED) physician practicing at a large urban non-medical school-affiliated teaching hospital in Delaware, and one was a community-based family practitioner at a nonteaching hospital in Pennsylvania.

Each reviewer was supplied with any available prehospital records (*ie*, transfer notes and emergency services records) and ED records, including the results of diagnostic studies that would normally be available during the ED stay. These generally included blood chemistry measurements, CBC count, initial radiographic study findings, and occasionally a CT scan or urinalysis finding. Other than the official finding of the chest radiograph performed in the ED, no records that would have been unavailable to the ED physician were provided to the reviewers. In order to avoid bias related to knowledge of the actual timing of antibiotic administration, the timing of events occurring during the patient's ED stay was redacted from the chart. Since patients who were admitted directly to the hospital ward are included in reporting for the Medicare performance indicators, they were also included in this study. For these patients, any data sent to the hospital with the patient, as well as the hospital admission history and physical examination and hospital admission laboratory results, were provided to the reviewers.

Each chart was reviewed independently by the reviewers, who were asked one key question, as follows: was there a potential reason for a delay of antibiotic administration other than quality of care? It was anticipated that such cases in which the answer was "yes" would generally be due to diagnostic uncertainty such that the diagnosis of pneumonia would likely not have been made soon enough to deliver antibiotics within 4 h. Inherent in this designation was acceptance of the premise that in the absence of diagnostic uncertainty or an unusual patient-related circumstance that prevented the timely delivery of antibiotics, a delay in antibiotic treatment represented a lapse in quality.

After a pilot study of 10 charts, it became clear that there were patients in whom a diagnosis of pneumonia was unlikely to have been made within 4 h, but in whom a need for therapy with antibiotics would have been clear within 4 h (*ie*, a patient who was more likely to have had a purulent exacerbation of chronic

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