Misdiagnosis of Pneumonia in Patients Needing Mechanical Respiration

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During a prospective study of tracheostomy and mechanical ventilation, it was found that the primary physicians made a clinical diagnosis of pneumonia in 60 of 111 patients. The primary indications for assisted ventilation included multiple trauma and ventilatory failure after major operations. Only 18 patients had supportive evidence for a diagnosis of pneumonia. Evaluation of the pulmonary processes indicated a diagnosis of atelectasis or postthoracotomy changes in 20 patients while pneumonia could not be differentiated from atelectasis in eight. Atypical pulmonary edema was misinterpreted as pneumonia in five patients and two had uremic infiltrates. The diagnosis was based on fever and positive tracheal cultures in seven patients without physical or roentgenographic findings.

Previous emphasis on infection in respiratory patients, coupled with misinterpretation of tracheal cultures and x-ray films of the chest made with a standard portable unit may result in overdiagnosis of pneumonia.

The hazard of respiratory infection in patients who require tracheostomy and mechanical ventilation is well recognized. While the incidence of tracheobronchial and pulmonary infection has varied in several reported series, major emphasis has been placed on the frequency of colonization with hospital-acquired, antibiotic-resistant microorganisms. A recent study in this medical center, however, suggested that not enough attention has been directed at distinguishing simple colonization from respiratory infection. It was further noted that a diagnosis of pneumonia was often made on the basis of inconclusive clinical or roentgenographic evidence.

Patients who require assisted ventilation after major operations or trauma often develop transient pulmonary lesions which may be confused with pneumonitis at first examination. Included are atelectasis, pulmonary edema of several types, pleural effusion, and pulmonary emboli. The presence of chronic Airways' disease or emphysema may complicate the difficulty with diagnosis. An inappropriate use of antibiotics for these patients may result in antibiotic-resistant infections, and may increase the frequency of resistant organisms in the hospital environment. The purpose of this report is to direct attention to the misdiagnosis of pneumonia in respiratory patients, and to illustrate the circumstances of its occurrence.

Materials and Methods

Patients included in this report were admitted to a surgical intensive care unit between March 1970 and December 1971. After exclusion of those patients with evidence of pneumonia before tracheostomy and mechanical ventilation were instituted, 111 patients were available for study. The 73 men and 38 women had a mean age of 49.2 years with an age range of 15 to 73 years. The duration of tracheostomy varied from 4 to 48 days with a mean of 17.6 days. Mechanical ventilation was required for 3 to 42 days with a mean of 13.2 days. The primary indications for ventilatory support are shown in the Table.

Tracheal cultures were obtained at one- to three-day intervals by an aseptic aspiration technique. Roentgenograms of the chest were made at frequent intervals with a standard portable unit (300 ma, 100 kv, maximum). Patients were raised to the upright position for all x-ray films, and a tube distance of approximately 6 feet was used. Roentgenograms of the chest were generally reviewed by the residents responsible for individual patients within a few hours after they were taken.

A clinical diagnosis of pneumonia was made by the primary physicians in 60 of the 111 patients. The interval between institution of mechanical ventilation and the first diagnosis of pneumonia varied from 1 to 15 days. The Table shows the distribution of the 60 patients according to the primary indication for ventilatory support. Forty of the 60 patients were receiving systemic antibiotics when pneumonia was first considered.

Because the patients included in this report were part of a larger study of infection associated with tracheal intubation, it was possible to review each case serially during hospitalization. This included examination of the patient as well as review of the chest x-ray films and the laboratory data.

Results

Only 18 of the 60 patients had conclusive evidence of pneumonia based on physical findings, laboratory data, clinical course, and serial roentgenographic changes. For seven of the remaining 42 patients, the diagnosis was based on the presence of fever and mild leukocytosis (11,500 to 18,200 white blood cells per cubic millimeter) with tracheal cultures positive for potential pathogens. None of these
seven patients developed either physical findings or chest x-ray film evidence of pneumonitis. Three patients subsequently had positive urine cultures and one had an infected thoracic incision.

The presence of transient physical findings and roentgenographic changes contributed to the clinical diagnosis of pneumonia in the other 35 patients. All but two had one or more tracheal cultures positive for potential pathogens, and the majority of patients had mild fever (less than 38.8°C [102°F]). In 14 patients, several patterns of partial pulmonary collapse or atelectasis were initially misinterpreted as pulmonary infiltrates compatible with pneumonitis. The correct diagnosis was indicated by a rapid clearing of physical findings and roentgenographic changes in response to intensified chest physiotherapy (Fig 1 and 2). Similar roentgenographic changes coupled with purulent tracheobronchial secretions prompted the diagnosis of pneumonia in six patients who were recovering from blunt chest injuries or thoracic operations. Most of the latter patients had neither fever nor leukocytosis and subsequent review of the roentgenograms suggested that lateral views of the chest would have helped to exclude pneumonitis in the beginning.

There were five patients who were considered to have pneumonia for several days before it was recognized that the infiltrates shown in the chest x-ray films actually represented pulmonary edema (Fig 3 and 4). Three patients had other evidence of congestive heart failure, while two were found to have markedly positive water balance, beginning with the surgical procedure. Three of the five had unilateral pulmonary edema, and one had an asymmetrical distribution. All three with unilateral edema had chronic airways' disease. Restriction of fluids and intravenous administration of diuretics resulted in resolution of the pulmonary edema in less than 48 hours in all five patients. Two additional patients with severe azotemia due to renal failure developed patchy pulmonary infiltrates associated with fever. Although it was considered possible that the lesions represented uremic infiltrates, the patients received additional antibiotics. The lesions cleared quickly with dialysis and tracheal cultures showed organisms that were not sensitive to the added antibiotics.

For eight of the 60 patients it was not possible to differentiate pneumonia from atelectasis. Although serial roentgenograms of the chest showed features suggestive of regional and segmental collapse, the clinical course was suggestive of pneumonia. The interpretation was complicated by other causes for fever and leukocytosis in four patients.

Potential pathogens had been isolated from the tracheal cultures of all but two of the 60 patients when the initial diagnosis of pneumonia was made. The organisms isolated and their frequency in the 60 patients were as follows: *Pseudomonas aeruginosa* (15), *Klebsiella pneumoniae* (10), *Escherichia coli* (9), *Aerobacter aerogenes* (9), *Proteus* (6), *Diplococcus pneumoniae* (4).
(4), Staphylococcus aureus (2), Ser-
ratia marcescens (1), Candida albi-
cans (2), and "normal flora" (2). Forty
patients were already receiving sys-
temic antibiotics, but only 28 had or-
ganisms that were sensitive. Thirty-
two patients received a second or
third antibiotic, and 37 became colo-
nized with either gram-negative bac-
teria or with Candida. Nine patients
subsequently developed unilateral or
bilateral pneumonia, including three
who were in the group with definite
pneumonia earlier. Five of the re-
main ing six patients died with pro-
gressive pneumonia due to antibiotic-
resistant, gram-negative organisms
which were the second or third colon-
zers after previous antibiotic ther-
apy.

Comment

This study has shown that signifi-
cant overdiagnosis of pneumonia may
occur in patients receiving mecha-
nical ventilation. The factors which ap-
pear responsible are as follows: (1)
previous emphasis on the hazard of
respiratory infection in respirator pa-
tients; (2) immobilization of patients
with a tendency toward retained se-
cretions and atelectasis; (3) early colo-
nization of the tracheobronchial tree
with potential pathogens after tra-
cheostomy; (4) inadequate roentgen-
ographic examination of the chest by
portable technique; and (5) mis-
interpretation of chest x-ray films.
For the patients included in this re-
view, the last three factors seemed
most influential in causing the pri-
mary physicians to consider a diag-
nosis of pneumonia.

Perhaps too often, the isolation of a
potential pathogen cultured from tra-
cheal specimens is equated with sig-
nificant respiratory infection. In ad-
dition to contamination of the culture
specimen, the isolated organism may
represent simple colonization of the
trachea and bronchi, or it may be as-
associated with tracheobronchitis of
varying severity. If quantitative col-
ony counts could be obtained rou-
tinely on tracheal cultures, errors in
interpretation might be reduced. Un-
fortunately, little information is avai-
lar in this area. For seven of the 60
patients in this study, the pre-
sumptive diagnosis of pneumonia was
based on the presence of fever and
the isolation of potential pathogens
from tracheal cultures. Although this
appears completely unwarranted in
retrospect, it is understandable if one
considers the difficulties with exami-
nation of some respirator patients
and the limitations of a single chest
x-ray film made from a portable ma-
chine.

The largest group of patients with
an initial misdiagnosis of pneumonia
were those with segmental or patchy
atelectasis. When atelectasis was
complete, the roentgenographic pat-
tern was generally recognized with-
out difficulty. This was not true for
partial degrees of pulmonary collapse,
and most often the initial film was
compatible with single or multiple
pulmonary infiltrates. Unfortunately,
this often prompted a presumptive
diagnosis of bronchopneumonia and
resulted in either a change of anti-
biotics or the addition of another
agent. For most patients, simulta-
aneous intensification of physical ther-
y to the chest, including the use of
a mucuslytic agent, resulted in de-
aring of the roentgenographic abnor-
mality in 24 to 48 hours. Since the ma-
ajority of the patients did not appear
to be critically ill, one can speculate
that no harm would have resulted
from a delay in alteration of anti-
biotic therapy with greater effort at
precise diagnosis.

Especially noteworthy was the
small group of patients in whom uni-
ilateral or bilaterally pulmonary
edema was confused with pneumoni-
tis. All five patients were quite ill, but
the correct diagnosis was suggested
by the radiologists or by cardiology
consultants after serial review of the
films. Bahl and his associates have
recently emphasized the occurrence of
unilateral pulmonary edema in pa-
tients with left ventricular failure.
These authors suggest that the roent-
genographic presentation of unilat-
eral edema is not as unusual as gen-
erally believed. Hublitz and Shapiro®
have described several atypcal pul-
monary patterns of congestive heart
failure in patients with chronic lung
disease.

A review of our own cases sug-
gested that several of those patients
who were considered to have multiple
areas of partial collapse may have had
interstitial pulmonary edema. As
pointed out by Sladen and his asso-
ciates, left ventricular failure may not
be a prerequisite of pulmonary edema
in patients receiving mechanical ven-
tilation. Those authors reported a
positive water balance and roentgen-
ographic evidence of interstitial pul-
mmonary edema in 19 of 100 patients
receiving prolonged mechanical ven-
tilation. For some years we have
noted that discontinuation of me-
chanical ventilation is often associ-
ated with a spontaneous diuresis.
While a relative fluid overload may be
a common feature in these patients,
the underlying cause of their water
retention has not been identified.

The consequences of overdiagnosis
of pneumonia in respirator patients
are serious. First, the patient may
receive antibiotics that result in coloni-
zation and subsequent infection with
resistant organisms. Second, the in-
creased frequency of antibiotic-re-
sistant organisms in the intensive
care unit environment represents a
hazard to all patients admitted to the
unit.

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