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Special Article

Nursing Home-Associated Pneumonia, Part II: Etiology and Treatment



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A B S T R A C T

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This is the second of 2 parts of a narrative review of nursing home-associated pneumonia (NHAP) that deals with etiology and treatment in the nursing home. In the 1980s and 1990s, the etiology of NHAP was considered to be similar to community-acquired pneumonia (CAP). This belief was reflected in CAP guidelines until 2005 when the designation healthcare-associated pneumonia or HCAP was introduced and nursing home residents were included in the HCAP category. Patients in the HCAP group were thought to be at high risk for pneumonia because of multidrug resistant organisms and required empiric broad-spectrum antibiotic therapy much like people with hospital-acquired infection. Subsequent studies of the etiology of NHAP using sophisticated diagnostic testing found limited evidence of resistant organisms such as methicillin-resistant *Staphylococcus aureus* or resistant gram-negative organisms or atypical organisms. In terms of management of NHAP in the nursing home there are several considerations that are discussed: hospitalization decision, initial oral or parenteral therapy, timing of switch to an oral regimen if parenteral therapy is initially prescribed, duration of therapy with an emphasis on shorter courses, and follow-up during therapy including the use of the “antibiotic time out” protocol. The oral and parenteral antibiotic regimens recommended for treatment of NHAP in this report are based on limited information because there are no randomized controlled trials to define the optimum regimen. In conclusion, most residents with pneumonia can be treated successfully in the nursing home. However, there is an urgent need for a specific NHAP diagnosis and treatment guideline that will give providers guidance in the management of this infection in the nursing home.

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This is the second of 2 parts of a narrative review of nursing home-associated pneumonia (NHAP) that deals with etiology and treatment. The focus is on management in the nursing home because most episodes of NHAP are treated in that setting.¹

In the past 3 decades, there has been an evolution in the view of the etiology of NHAP from one that is similar to community-acquired pneumonia (CAP) to one in which resistant organisms predominate that has been termed health care-associated pneumonia (HCAP). However, almost all of the studies of etiology of NHAP have been in hospitalized residents and it remains to be determined if these findings are applicable to management in the nursing home. And despite remarkable advancements in nonculture methods for detecting organisms in clinical specimens, there continues to be almost total reliance on culture-based methods to identify an etiologic agent in

those suspected of having pneumonia.² This report will provide the clinician with information about etiology of NHAP and recommendations for empiric antibiotic therapy in the nursing home.

Etiology

In 1998, a review of NHAP included an evaluation of 18 studies published between 1978 and 1994 that provided information on etiology.³ Almost all of these studies utilized sputum cultures to identify etiology. However, the results of sputum cultures differed substantially depending on whether or not strict criteria (>25 polymorphonuclear leukocytes and <10 epithelial cells per 100 power field of undiluted sputum sample) were used to exclude oropharyngeal contamination of the sample. Studies that did not evaluate sputum samples for oropharyngeal contamination identified gram-negative bacilli in 3% to 55% of sputum cultures, whereas in the studies that used strict criteria 0% to 12% of cultures contained gram-negative bacilli. In the studies that utilized strict criteria, *Streptococcus pneumoniae* was isolated in 4% to 25% of sputum cultures,

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nontypeable *Hemophilus influenzae* in 0% to 22%, and *Staphylococcus aureus* in 1% to 6%; atypical organisms were rare, and only 1 study evaluated for viruses. The role of atypical organisms such as *Mycoplasma* and *Chlamydia* and viruses could not be determined due to lack of information about these pathogens in the studies available. Thus, the pattern of sputum isolates from residents with pneumonia resembled that found in hospitalized patients with CAP. The results of this review informed, in part, recommendations for treatment of NHAP in the nursing home in CAP treatment guidelines in 2000 and 2003.^{4,5}

In 2005, the American Thoracic Society (ATS), in collaboration with the Infectious Diseases Society of America (IDSA), published an update on the treatment of hospital-acquired pneumonia.⁶ Included in this guideline was a new category referred to as healthcare-associated pneumonia or HCAP. The basis for the HCAP category was the finding that resistant organisms such as methicillin-resistant *S aureus* (MRSA) and *Pseudomonas aeruginosa* were being identified more often in patients from the community with infection and this pattern of isolates was more consistent with those isolated in hospital-acquired pneumonia than CAP.^{7–10} The HCAP category consisted of a heterogeneous group of community-dwelling patients admitted to the hospital with pneumonia (Table 1). These patients had a common risk factor: frequent or recent contact with the healthcare system and/or recent antibiotic therapy. Inclusion of nursing home residence in the HCAP category was based on 2 studies of residents with severe pneumonia admitted to an intensive care unit on mechanical ventilation in whom invasive methods to identify the etiology of pneumonia were utilized.^{11,12} In these residents with presumed severe bacterial pneumonia, there was a high rate of isolation of gram-negative aerobic bacilli and MRSA. For patients with 1 or more HCAP criteria, the guideline recommended empiric broad-spectrum antibiotic therapy consisting of 3 antibiotics (2 antipseudomonal agents and 1 for MRSA) that would also be effective for other potentially multidrug-resistant gram-negative bacilli such as *K pneumoniae* and *Acinetobacter* species.⁶ The rationale for recommending this regimen was to make sure a patient received appropriate therapy initially, which was identified as an important predictor of morbidity and mortality.^{13,14}

Following publication of the ATS/IDSA guideline,⁶ a controversy developed regarding the validity of the concept that patients with pneumonia admitted to the hospital and meeting 1 or more of the HCAP criteria had a high probability of infection because of a resistant organism and required empiric broad-spectrum antibiotic therapy. Recent publications have reviewed this controversy in detail.^{15,16} The major concern was that such an approach would expose patients unnecessarily to multiple antibiotics and promote further development of resistance as well as other adverse effects such as *C difficile* infection. These reviews found evidence that the patient groups included in the HCAP category did not accurately identify the presence of resistant organisms, and hospital mortality was not increased in patients in this category after adjustment for age and comorbid disease.¹⁵ In addition, the majority of studies comparing guideline-concordant and -discordant treatment of HCAP did not demonstrate an advantage to broad-spectrum antibiotic therapy in terms of hospital mortality.^{15,16} As a result of these findings, the approach shifted from the HCAP categorization that focuses on particular clinical groups to identifying specific risk factors for the presence of resistant organisms that can be applied generally.¹⁷ Several algorithms that incorporate risk factors for resistant organisms were developed and found to perform better than HCAP criteria for identifying these organisms.¹⁷ Many of these models included residence in a nursing home as a risk factor for a resistant organism. Given all this pushback regarding the HCAP category, the updated ATS/IDSA guideline published in 2016 did not include this group and indicated that it would be part of an updated CAP guideline.¹⁸

Table 1
HSAP Inclusion Criteria⁶

Hospital admission in the past 90 days
Admission from nursing home/extended care facility
Home infusion/intravenous therapy
Chronic dialysis
Home wound care
Family member with a multidrug resistant organism

Since 2005 there have been several studies that provide information regarding the etiology of NHAP (Table 2), but none have been done in the United States or Canada. All of the studies listed in Table 2 were done in hospitalized residents and used multiple diagnostic techniques including polymerase chain reaction to identify bacteria and viruses. The size of the study populations was small except for 2 studies.^{21,23} The proportion of cases with an identified etiology varied from 12% to 72%. The most consistent finding was that *S pneumoniae* was one of the most common identified causes of NHAP in all 7 studies. *S aureus*, *Enterobacteriaceae*, and *P aeruginosa* were infrequently identified as a causative agent. Atypical organisms such as *C pneumoniae* and *M pneumoniae* as an etiology of NHAP were rare in 2 studies,^{21,22} but common in 2 Japanese studies done by the same group of investigators.^{19,20} Methods to detect viruses were used in 4 studies and 3 detected viruses^{19,20,22}; influenza virus and respiratory syncytial virus were the most common viruses identified.

One other study provides some information on etiology of NHAP that was not included in Table 2 because specific organisms were not identified in detail.²⁶ This was a prospective study of 116 nursing residents admitted to 1 hospital in Hong Kong with pneumonia from 2009 to 2010. Using methodology similar to a previous study,²² they identified an etiology for NHAP in 34 (29%) of 116 episodes. Bacteria alone were isolated in 14 episodes and viruses alone in 19 episodes. Gram-positive organisms were identified in only 2/14 bacterial episodes and gram-negative organisms in 11/14 episodes but only 3 were considered to be multidrug resistant organisms.

Based on the results of these studies,^{19–26} it appears that one should be concerned about *S pneumoniae* as the most important etiologic agent of NHAP. *S aureus* and gram-negative organisms including *P aeruginosa* as an etiology of NHAP were low overall. The role of atypical organisms as a cause of NHAP is difficult to determine because there was a distinct difference in the rate of identification of these pathogens among 4 studies, as noted above. Finally, viruses, primarily influenza, parainfluenza, and respiratory syncytial virus, have been identified in residents hospitalized with pneumonia; however, in some studies a virus was identified in conjunction with bacteria.

Treatment

There are multiple issues to consider regarding management of pneumonia in the nursing home that are discussed in this section.

Hospitalization Decision

Management of a resident in the nursing home or transfer to the hospital is an important initial decision in the treatment of NHAP. The potential adverse effects of hospitalization for the resident include drug reactions, delirium, decreased functional status, pressure ulcers, and increased mortality and cost.²⁷ Because of the adverse effects of hospitalization there have been increasing demands on nursing homes to reduce hospitalizations,²⁸ which has resulted in studies to define “potentially avoidable hospitalizations” of nursing home residents.^{27–30} Pneumonia is one of the common diagnoses associated

Table 2
Studies of Etiology of NHAP Published since 2005

Study Characteristics	Maruyama et al ¹⁹	Maruyama et al ²⁰	Pulverino et al ²¹	Ma et al ²²	Ewig et al ²³	Putot et al ²⁴	Kang et al ²⁵
Study Years	2004–2005	2004–2005	1997–2007	2006–2007	2002–2009	Jan–Jun 2013	2008–2014
Country	Japan	Japan	Spain	Japan	Germany	France	Korea
Type of study	Prospective	Prospective	Prospective	Prospective	Prospective	Prospective	Retrospective
Number of NHAP cases	75	54	150	108	518	56	105
Number of (%) cases with etiology	54 (72)	37 (69)	57 (38)	74 (69)	117 (23)	6 (12)	54 (51)
Methods to identify etiology	Sp, B, Ser, PUA, LUA	Sp, B, Ser, PUA, LUA	Sp, B, Ser, PUA, LUA	Sp, B, Ser, PUA, LUA, NPA cult and PCR	Sp, B, Ser, PUA, LUA, NPS	Sp, B, Ser, PUA, LUA, Ser, immunofluorescence or PCR for viruses	Sp, B, Ser, PUA, LUA; viruses not evaluated
<i>Organisms identified (% of cases with etiology identified)</i>							
<i>S pneumoniae</i>	46%	51%	58%	22%	33%	83%	35%
<i>S aureus</i>	6%	5%	5%	4%	10%		24%
<i>Enterobacteriaceae</i>	6%	5%	9%	4%	15%		33%
<i>P aeruginosa</i>	2%	0	4%	9%	3%		13%
<i>H influenza</i>	0	0	4%	7%	1%		NS
<i>M catarrhalis</i>	4%	5%	0	0	1%		4%
<i>C pneumoniae</i>	48%	54%	2%	4%			0
<i>C psittaci</i>				3%			
<i>M pneumoniae</i>	13%	19%	4%	8%	1%		0
<i>L pneumophila</i>	0	0	5%	0	11%	17%	0
<i>Cytomegalovirus</i>	11%	11%		0		No viruses identified	
<i>Influenza virus</i>	20%	16%		10%	8%		
<i>RSV</i>	6%	8%		18%			
<i>Parainfluenza</i>	6%	8%		20%			
<i>Adenovirus</i>				0			
<i>Metapneumovirus</i>				12%			
<i>Rhinovirus</i>				1%			
<i>Coronavirus</i>				3%			
<i>Enterovirus</i>				4%			
Additional comments	29% mixed infection; MDR in 7; 54% abx rx before admission	All ≥ 85 years old; 45% abx rx before admission; 62% mixed infection	Viruses isolated in only 3 cases	Rate of mixed infection not reported	Viruses that could be detected not reported; mixed infection rate not reported	Number with positive etiologic identification small	Polymicrobial infection 3 (6%); MDR organisms 23 (43%); 2/3 were bedridden or in wheelchair; 46% tube feeding
Treatment (denominator is all residents in study)				Only gave information about rx of those with atypical organisms isolated:			
Monotherapy:			59% BL 30% Quin 17% Carb 4%	10/11 rx'd with abx that did not cover these organisms and all survived	58%	Amox 9% Am/clav 52% 3GC 30% Pip/taz 2% Quin 4% Mac 0	33 (31%) Quin 1 Aps pcn 30 Carb 2
Combination rx:			41% BL + Quin 30% BL + Mac 11%		42%	BL + Mac 4%	72 (69%) 3GC + Mac 9 3GC + Quin 1 Aps pcn + mac 9 Aps pcn + quin 50
% Hospital mortality			NS	14.8%	NS	10.7%	11 (10.5%)
% 30-d mortality			20%	NS	27%	NS	NS

Abx, antibiotic; Am/clav, amoxicillin/clavulanate; Amox, amoxicilil; Aps pcn, antipseudomonal penicillin; B, blood culture; BL, betalactam; Carb, carbapenem; cult, culture; LUA, legionella urinary antigen; Mac, macrolide; MDR, multidrug resistant; NPA, nasopharyngeal aspirate; NPS, nasopharyngeal swab; NS, not stated; PCR, polymerase chain reaction; Pip/taz, piperacillin/tazobactam; PUA, pneumococcal urinary antigen; Quin, quinolone; RSV, respiratory syncytial virus; rx, treatment; Ser, serology; Sp, sputum culture; 3 GC, third generation cephalosporin.

Table 3
Risk Factors for Colonization with a Resistant Organism in Nursing Home Residents*

Exposure Factors	History of colonization or infection with a resistant organism Recent antibiotic therapy (<90 d) Recent hospitalization (<90 d) Dependency in activities of daily living requiring frequent contact with caregivers Dialysis
Factors that increase the risk for colonization/infection with a resistant organism	Wounds (pressure ulcers) Indwelling devices (urinary catheter, feeding tube, tracheostomy) Lung disease (COPD or bronchiectasis) (<i>Pseudomonas</i>)

*Modified from reference⁵¹.

with potentially avoidable hospitalizations of nursing home residents.³¹

Multiple factors have been identified that result in hospitalization of residents with suspected NHAP: elevated respiratory rate, after-hours evaluation, for-profit facility ownership, severity of illness, radiographic pneumonia, oxygen saturation <90%, and facility resources.^{32–36} Nonclinical factors that also influence the hospitalization decision and that need to be considered include documented advance directives, resident/family preferences, and physician preferences.

There has been only 1 randomized controlled trial of a clinical pathway to reduce hospitalization of residents with pneumonia and lower respiratory tract infection.³⁷ This was a cluster randomized controlled trial in which 22 nursing homes in Hamilton, Ontario, Canada were randomized to the clinical pathway or usual care. This study demonstrated that the clinical pathway designed to assist providers in the decision regarding location of treatment of NHAP significantly reduced hospitalizations in intervention facilities with no increase in mortality compared with control facilities. Although this clinical pathway has not been validated, it provides a reasonable basis for evaluating residents suspected of pneumonia regarding the hospitalization decision. However, it needs to be emphasized that clinical pathways do not take the place of physician/provider judgment. The decision to hospitalize a resident because of any change in status is complex and it may be difficult to determine if transfer is “avoidable” based on information available prior to transfer occurring.³⁸

Initial Treatment in the Nursing Home: Oral or Parenteral Route?

Once the determination has been made to treat NHAP in the nursing home, the next decision is what route of administration, oral

Table 4
Treatment Options for Pneumonia in the Nursing Home: Parenteral Treatment Initially

Initial regimen	Ceftriaxone 500 mg IM daily or cefotaxime 1 gm IM every 12 h for 1–3 d, then switch to an oral regimen to complete therapy*
Oral regimens	Cepodoxime 200 mg orally twice daily, or Amoxicillin/clavulanate 875 mg/125 mg orally twice daily
Alternative oral regimens (if significant contraindications to other oral agents)	Levofloxacin 750 mg orally daily or Moxifloxacin 400 mg orally daily

*Timing of switch to an oral regimen determined by monitoring for clinical stability⁴²; total duration of therapy should not exceed 7 days if clinical stability has been achieved.

Table 5
Treatment Options for Pneumonia in the Nursing Home: Oral Treatment Initially

First-line options (in no specific order)	Cepodoxime 200 mg orally BID, or Amoxicillin 1 gm orally TID, or Doxycycline 100 mg orally BID, or Amoxicillin/clavulanate 500/125 mg orally BID
Second-line options (if there are significant contraindications to first-line options)	Levofloxacin 750 mg orally daily or Moxifloxacin 400 mg orally daily

BID, twice daily; TID, 3 times per day.

or parenteral, should be used initially. There are no studies that provide a method for making a decision on the initial route of treatment of NHAP. However, there are common sense approaches to this issue that should be considered. First, if there are no swallowing problems and the resident is alert, it is appropriate to start with the oral route, which has been documented to be effective in treatment of NHAP.^{39–41} If the resident has evidence of dysphagia or it is after hours and there is concern about starting oral therapy, parenteral (intramuscular) therapy can be used for the first 2 to 3 days with reassessment for switch to an oral regimen (see next section).

Timing of Switch from the Parenteral to Oral Route

A retrospective study of NHAP in 11 nursing homes was done to develop a treatment guideline based on community practice.¹ Of 239 episodes of NHAP, 171 (72%) were treated in the nursing home. Of the 171 episodes, 66 (39%) were treated parenterally initially (intramuscular ceftriaxone or cefotaxime). The median duration of parenteral treatment was 2 days and the 75th percentile was 3 days. There was no difference in the rate of hospital transfers or 30-day mortality in those treated parenterally vs orally in the nursing home. In a study of treatment of patients hospitalized with CAP, investigators developed criteria to determine when clinical stability was achieved during parenteral therapy to assist in deciding when switch to an oral regimen was appropriate: improvement in signs/symptoms, afebrile for ≥16 hours, no acute cardiac or other significant events in the first 2 to 3 days of treatment, and able to take oral medication.⁴² If all 4 criteria are met, the patient is considered clinically stable and ready to be switched to an oral regimen. Using these criteria, by day 3 of parenteral therapy in the nursing home, 75% of residents achieved clinical stability and were switched to an oral regimen.¹ Criteria for stability are readily available to nursing home staff as the resident is monitored during the first days of treatment and can be included in an “antibiotic time-out” protocol (discussed in a later section) to assist the provider in making the “switch” decision.

Duration of Treatment

During the past 20 years clinical trials have documented that duration of antibiotic treatment for common bacterial infections can be reduced compared with traditionally longer regimens with no reduction in efficacy.^{43,44} The explanation for how antibiotic regimens evolved over time in terms of duration can be traced back to when penicillin first became available for treatment of pneumococcal pneumonia in the 1940s.⁴⁵ At that time, the appropriate dose and duration of penicillin for effective treatment was unknown. As a result, very small doses of penicillin were utilized for 1 to 4 days with excellent results. However, because of a small number of relapses (some of which were actually reinfections), longer courses of treatment (7 days or more) were recommended.

The results of the early studies of penicillin treatment of pneumococcal pneumonia informed decisions regarding treatment

duration of CAP for decades. However, because of concerns about increasing resistance with overuse of antibiotics as well as other adverse effects of antibiotics, primarily *C difficile* infection, studies of treatment of CAP as well as other common bacterial infections documented that shorter duration regimens were equally efficacious to longer regimens.^{43,44,46} However, there are no studies of short duration treatment of pneumonia that have included nursing home residents.

Despite the lack of studies regarding short-course (3–5 days) treatment of NHAP, it may be possible to shorten therapy of this infection in some residents. This could be part of a facility antibiotic stewardship program in which there is a defined time point (antibiotic time-out, for example) after treatment is initiated, during which the resident is evaluated for response to treatment. If the response meets clinical stability criteria as previously discussed, consideration should be given to limiting duration of therapy to 5 days for NHAP with careful monitoring throughout the remainder of treatment.

Treatment Regimens

No specific NHAP treatment guidelines have been published. However, there have been recommendations for the treatment of NHAP in the nursing home setting in CAP guidelines. The IDSA CAP guideline in 2000 stated “in the older patient a fluoroquinolone may be preferred.”⁴⁷ The Canadian Infectious Diseases Society CAP guideline in 2000 was the first to specifically provide a recommendation for treatment of NHAP in the nursing home: a fluoroquinolone or amoxicillin/clavulanate plus a macrolide.⁴ The ATS CAP guideline in 2001 recommended an oral betalactam, a ceftriaxone plus a macrolide or doxycycline, or a fluoroquinolone alone for treatment of pneumonia in the nursing home.⁴⁸ The revised IDSA CAP guideline published in 2003⁵ made the same recommendation as the 2000 Canadian guideline⁴ for treatment of NHAP in the nursing home. Since 2003, the IDSA CAP guideline has been revised twice: 2007⁴⁹ and 2019.⁵⁰ Neither guideline made any recommendation for the treatment of NHAP in the nursing home. The 2007 guideline recommended that nursing home residents admitted to the hospital with pneumonia be treated according to the 2005 ATS/IDSA guideline as a HCAP, but made no recommendations for treatment in the nursing home.⁶ However, the 2019 ATS/IDSA CAP guideline recommended abandoning the HCAP classification and assessing patients for risk factors to determine need for MRSA or *Pseudomonas* coverage, but made no recommendations for treatment of NHAP in the nursing home.⁵⁰ In the nursing home, there are several risk factors to consider that put a resident at risk for pneumonia due to a resistant organism (Table 3).⁵¹ The most important factors in the nursing home resident are a prior culture positive for a resistant organism, especially in the respiratory tract, and recent antibiotic therapy.

Tables 4 and 5 provide recommendations for the treatment of NHAP in the nursing home if there are no risk factors for a resistant organism. Table 4 provides recommendations if the decision is to start with a parenteral regimen followed by a switch to an oral regimen. Table 5 provides recommendations if it is decided to treat with an oral agent. There are several points to emphasize about these recommendations. First, there has been concern about using a macrolide alone because of increasing resistance of pneumococci, but there is little evidence to support the clinical relevance of this resistance.⁵² Nevertheless, the authors of the latest CAP guideline did not make a strong recommendation for the routine use of monotherapy with a macrolide for the outpatient treatment of CAP.⁵⁰ Second, an oral fluoroquinolone, such as levofloxacin or moxifloxacin, is no longer considered a first-line agent for treatment of NHAP because of multiple potential adverse effects.⁵³ Third, it is not necessary to cover for atypical organisms such as *Mycoplasma* or *Chlamydia*, although doxycycline or a fluoroquinolone provide that coverage.

In the presence of risk factors for a resistant organism (Table 3), the decision to treat in the nursing home depends on the risk factor(s) present as well as the severity of pneumonia. Since there are no studies to guide management of NHAP in this situation, the following comments represent the author’s “best guess.” If there has been recent antibiotic therapy and there is no evidence of vital sign instability, one can prescribe an antibiotic of a different class orally or parenterally. If the risk factor is recent hospitalization with no antibiotic treatment and there is clinical stability, one might opt to treat orally or parenterally as recommended in Tables 4 and 5. If there is a history of colonization/infection (especially of respiratory tract) with a resistant organism such as MRSA or *Pseudomonas aeruginosa*, these organisms are difficult to treat in the nursing home because they require parenteral therapy and it would be appropriate to transfer the resident to the hospital for management.

It is important to keep in mind the entity of aspiration pneumonia when discussing treatment of NHAP because of the evolving information regarding the bacterial etiology of this infection.^{54,55} Aspiration pneumonia is now defined as “an acute lung infection developing after a large-volume aspiration of oropharyngeal or upper gastrointestinal contents with a high enough pH (>2.5) to avoid chemical pneumonitis.”⁵⁵ Nursing home residents are at increased risk for aspiration pneumonia due to the high rate of dysphagia in this population related to dementia, Parkinson’s disease, and stroke that predisposes to large volume aspiration.^{56,57} Studies in the 1960s and 1970s indicated that anaerobes were the most common etiologic agents of aspiration pneumonia and that empiric therapy should be prescribed to cover these organisms.⁵⁵ However, more recent evaluation of aspiration pneumonia has found that anaerobes are much less likely to be identified in this infection.⁵⁵ In a study of nursing residents hospitalized with aspiration pneumonia who were intubated and on mechanical ventilation, invasive culture methods demonstrated that *S aureus* and gram-negative bacilli were more commonly isolated than anaerobes.¹² This latter finding suggested that a regimen specifically targeting anaerobes is not required when aspiration pneumonia is the diagnosis in nursing residents. However, some of the oral regimens described in Table 5 for treatment of NHAP have coverage for anaerobes.

Documentation of the “Thought Process”

A topic that is infrequently discussed is the importance of documentation by the provider of the “thought process” that resulted in the diagnosis of pneumonia in a nursing home resident. This documentation includes history, signs and symptoms, and suspected diagnosis. In addition, the provider should state the diagnostic studies to be ordered, and the plan of treatment pending work-up results. The problem for the provider is that he or she is often not in the nursing home when a resident has a change in status, and must rely on nursing staff to assess the resident and provide the information with which to base decisions. Nursing staff vary in their ability to carry out the necessary evaluation at the bedside and collect all the appropriate information before calling the provider. To deal with this variability, templates have been developed to assist nursing home staff in the evaluation of residents with a change in status and to prompt them to collect the appropriate information before calling the provider.^{58,59}

Although there has been pushback from providers regarding the use of electronic medical records (EMR), the EMR is useful for documentation especially when the provider is not on site or there is a covering provider. The “thought process” can be documented in the EMR by the resident’s usual provider or by a covering provider in the absence of a face-to-face evaluation. This documentation will be useful for follow-up (discussed in the next section) of the resident as the infection is treated.

Follow-Up during Treatment and Antibiotic Time-Out Protocol

Nursing home providers need to be mindful that when any infection is being treated in the nursing home there should be follow-up during treatment to verify response, check on any laboratory tests that have been ordered, determine if changes in treatment are required, and decide on duration of therapy. Because of the importance of follow-up, nursing home antibiotic stewardship programs should consider incorporating a “time-out” protocol in a follow-up procedure.⁶⁰ The “time-out” protocol consists of an evaluation of the resident by staff and provider on day 2 to 3 of treatment to assess response to treatment and determine if the regimen should be changed or continued. In addition, at the same time, a determination of the duration of treatment can be made. For example, if clinical stability has been achieved as discussed in a previous section, consideration should be given to complete treatment on day 5. “Time-out” decisions should be documented in the medical record. If the resident is responding to therapy, it is not necessary to repeat laboratory tests or a chest radiogram.

Implications for Practice, Policy, and/or Research

There have been no studies of the etiology of NHAP in the nursing home setting, mainly because it is difficult to obtain reliable respiratory specimens for culture in this population and the yield of blood cultures is too low to recommend it routinely. Future research may be able to utilize molecular testing to define the etiology of NHAP, but the practicality of this approach in the “real world” setting is unclear given the cost of this testing and the need to have testing done at an off-site laboratory. Given the rarity of identifying the etiology of NHAP in the nursing home setting, treatment is almost always empiric. However, the optimum regimen(s) for the treatment of NHAP (including duration of therapy) in the nursing home has not been defined. For example, is there any additional improvement in outcome with the addition of a macrolide to a beta-lactam or cephalosporin in treatment of NHAP? A concern is the role of resistant organisms such as MRSA and *Pseudomonas aeruginosa* as the etiology of NHAP. Clinicians practicing nursing need to be aware of the risk factors for colonization with a resistant organism (Table 3) and adjust empiric therapy accordingly. The most important risk factor for colonization with a resistant organism is respiratory colonization with MRSA or *Pseudomonas aeruginosa* or recent antibiotic therapy. As discussed in a previous section, studies of the duration of treatment of CAP have documented that 3 to 5 days is equivalent to 7 to 10 days of therapy in terms of efficacy. However, these studies have excluded nursing home residents. Therefore, studies of the duration of NHAP in the nursing home setting should be considered, as this might impact on antibiotic resistance levels as well as other adverse events such as *C difficile* infection.

Finally, there is an urgent need for a specific NHAP diagnosis and treatment guideline that will give nursing home providers guidance in the management of this infection. This guideline should take into consideration the hospital transfer decision; risk factors for infection due to resistant organisms; nursing home capability to provide recommended regimens, especially parenteral therapy; and follow-up during treatment. Other issues to be considered for inclusion in a guideline that were not covered in this report include prevention strategies such as vaccination and dealing with penicillin allergy.

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