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Antimicrobial Use in Long-Term—Care Facilities •

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SHEA Position Paper

Antimicrobial Use in Long-Term–Care Facilities

Lindsay E. Nicolle, MD; David W. Bentley, MD; Richard Garibaldi, MD; Ellen G. Neuhaus, MD; Philip W. Smith, MD; the SHEA Long-Term–Care Committee

ABSTRACT

There is intense antimicrobial use in long-term–care facilities (LTCFs), and studies repeatedly document that much of this use is inappropriate. The current crisis in antimicrobial resistance, which encompasses the LTCF, heightens concerns of antimicrobial use. Attempts to improve antimicrobial use in the LTCF are complicated by characteristics of the patient population, limited availability of diagnostic tests, and the virtual absence of relevant clinical trials. This position paper recommends approaches to management of common infections in LTCF patients and proposes minimal standards for an antimicrobial review program. In developing these recommendations, the position paper acknowledges the unique aspects of provision of care in the LTCF (*Infect Control Hosp Epidemiol* 2000;21:537-545).

This position paper outlines concerns regarding, and adverse consequences of, inappropriate antimicrobial use in long-term–care facilities (LTCFs) and recommends approaches to promote the rational use and limit the potential adverse effects of antimicrobials in this high-risk setting. This paper updates the guideline previously published in 1996.[1]

STATEMENT OF THE PROBLEM

Intensive Use of Antimicrobials in LTCFs

Antimicrobials are among the most frequently prescribed pharmaceutical agents in LTCFs, accounting for approximately 40% of all systemic drugs prescribed.[2,3] The point prevalence of systemic antibiotic use in LTCFs is approximately 8%,[4,5] with a likelihood of 50% to 70% that a resident will receive at least one course of a systemic antimicrobial agent during a 1-year period.[4,6] In addition, topical antimicrobial drugs also are frequently prescribed in LTCFs, although the extent of use of these agents has been less well studied.[6]

Inappropriate Use of Antimicrobials in LTCFs

A substantial proportion of the antimicrobial use in LTCFs is considered inappropriate. Recent reports indicate that 25% to 75% of systemic antimicrobials[4,5,7-9] and up to 60% of topical antimicrobials[8] are prescribed inappropriately. Although inappropriateness of antimicrobial use is a problem in all settings,[10] the intensity of antimicrobial use and the additional concerns noted below warrant careful attention toward improving prescribing practices in LTCFs.

Adverse Consequences of Inappropriate Antimicrobial Use

Because infections occur frequently in LTCFs,[11-15] residents often are exposed to antimicrobial agents. These agents carry with them a risk of adverse consequences even when they are prescribed optimally. Elderly nursing home (NH) residents are at increased risk of drug-related adverse effects by virtue of the physiological effects of aging on kidney, liver, and cerebral function, the presence of comorbid medical illnesses, and the concurrent use of other drugs to treat these diseases. Probably the most important adverse outcome of inappropriate antimicrobial use in LTCFs is the promotion of antimicrobial resistance in this high-risk population and the increased opportunities for transmission of resistant organisms to other patients in the LTCF.[16] Because residents of LTCFs frequently are treated with multiple drugs,[2,6] the addition of antimicrobials increases the potential for harmful drug interactions in addition to the adverse drug effects directly associated with the antimicrobials prescribed. In addition, the

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increased use of antimicrobials contributes substantially to costs. Excess costs associated with inappropriate antimicrobial use cannot be sustained in the current climate of cost containment and rationing of resources.

Problems in Optimizing Use of Antimicrobials in LTCFs

There are many difficulties in promoting the optimal use of antimicrobials in LTCFs. First, the clinical diagnosis of infection frequently is imprecise. Hearing and cognition often are impaired in residents of LTCFs, and symptoms may not be expressed or interpreted correctly. Chronic comorbid clinical conditions may obscure the signs or symptoms of infection. Infectious illnesses may not present with classic clinical findings.[17] The febrile response may be relatively impaired, and there is an increased frequency of afebrile infection.[18,19] Alternatively, fever with no clearly identified source is frequent.[11-14,20] Illness may present with vague systemic symptoms such as confusion, diminished appetite, or low-grade fever rather than localizing findings. There are limitations in resources to support physician (or other health professional) clinical assessment. Clinical criteria for the diagnosis of infections have been identified primarily for younger populations with limited comorbidities, and in most cases their validity in the LTCF population has not been assessed.[21] The uncertainties in clinical diagnosis contribute to inappropriate use of empirical antimicrobials.

Limited use of laboratory and radiological tests also contributes to less than optimal use of antimicrobials. Few LTCFs have on-site laboratory or radiological facilities. Thus, standard diagnostic tests frequently are not obtained.[4,5,8,9] Obtaining appropriate specimens for microbiological studies also may be problematic. Residents with productive coughs may not be able to cooperate to expectorate sputa; clean-catch or midstream urine specimens may be impossible to obtain from incontinent residents. When culture data are available, they may be difficult to interpret. For instance, many elderly residents of LTCFs have oropharyngeal colonization with aerobic gram-negative bacilli.[22,23] When sputum specimens are obtained, they frequently are contaminated with these organisms, complicating the identification of the causative agent of pneumonia. For more disabled residents in LTCFs, the prevalence of bacteriuria is over 30%[24] even in noncatheterized patients. In catheterized patients, the prevalence of bacteriuria approaches 100%.[25] Therefore, a positive urine culture is of limited value in identifying whether fever or other symptoms are due to urinary infection.

The patient mix among LTCFs is heterogeneous, ranging from healthy elderly in assisted living complexes to debilitated, chronically ill patients in NHs. The population of many NHs now includes more acutely and subacutely ill patients who, in the past, may have been treated in hospitals. Specific population groups, such as human immunodeficiency virus (HIV) patients, may have unique problems. There is an increasing use of invasive devices and procedures including central lines, tracheostomy and chronic respiratory therapy, percutaneous feeding tubes, and peritoneal dialysis and hemodialysis. All of this increases the frequency of infection in residents. Many LTCFs now offer intravenous antibiotics, making it possible for physicians to prescribe the array of broad-spectrum agents available for hospitalized patients. This may promote the induction of antimicrobial-resistant infections in the LTCF.

Finally, a substantial problem in providing guidelines for the optimal use of antimicrobials in LTCFs is the absence of relevant comparative clinical trials to define the most effective management of residents with probable or documented infections. The difficulties in clinical and microbiological diagnosis complicate the performance of these trials. Restrictive entry criteria, such as requiring a sputum specimen, limit the generalizability of studies.

Thus, recommendations regarding the use of antimicrobials in LTCFs are limited, because they are based on clinical criteria targeted for younger populations with less complex medical problems, drug selection must be made with limited assistance from diagnostic tests, and virtually no data are available from relevant clinical trials to define optimal treatment regimens.

Use of Quinolones in LTCFs

Ciprofloxacin initially was introduced to North America in 1987. Since its release, it has been widely used in NHs,[7] as have subsequent quinolones. These agents are used because they allow oral therapy with an agent with good bioavailability, are easily administered by once- or twice-daily dosing, are perceived to be safe, and have a wide spectrum of activity. There are, however, limited indications for a quinolone as first-line therapy in the LTCF. These include infections caused by an organism resistant to other oral antimicrobials or use in individuals unable to tolerate other oral therapies. In one study describing the use of ciprofloxacin in an academic NH setting, the agent was appropriately prescribed only 25% of the time.[7] Even where it was appropriately prescribed, the duration or dose frequently was not correct.

With the intense quinolone use in many LTCFs, quinolone resistance of organisms has increased.[26,27] Quinolone resistance complicates management of infections by requiring parenteral therapy for organisms resistant to oral agents, as well as increasing the burden of resistant organisms. Relevant clinical trials of quinolones with other therapeutic regimens are necessary to clarify the appropriate role of quinolones in LTCFs and the risks and benefits of use. Until such trials are available, quinolone use in LTCFs should be approached cautiously, and if possible these agents should be avoided as first-line empirical therapy.

Antimicrobials and Comfort Care

The use of antimicrobials in infected elderly institutionalized patients is potentially life-sustaining. It is accepted that, for selected patients in LTCFs, it is ethically appropriate not to offer therapy with antimicrobials.[28] Subjective criteria have been proposed to assist physicians in making decisions with respect to nontreatment of life-threatening infec-

TABLE 1
DIAGNOSTIC ASSESSMENT AND EMPIRICAL ANTIMICROBIAL THERAPY FOR COMMON INFECTION

Clinical Syndrome	Minimal Diagnostic Tests	Empirical Antimicrobial
Upper respiratory infection		
Coryza/common cold	None	None
Pharyngitis	Throat swab	None; treat only if group A streptococcus
Sinus infection	CT (refractory only)	TMP-SMX+amoxicillin, cefuroxime axetil, macrolide; second line: amoxicillin-clavulanic acid, quinolone
Lower respiratory infection		
Acute bronchitis	None	Most cases viral, no antibiotics indicated
Acute exacerbation of chronic bronchitis	Sputum culture	Amoxicillin, TMP-SMX, doxycycline
Pneumonia	Sputum gram stain and culture,* chest radiograph,* respiratory viral tests (for outbreak only)	TMP-SMX, amoxicillin, cefuroxime axetil, macrolide, doxycycline; second line: amoxicillin-clavulanic acid, quinolone, clindamycin (aspiration pneumonia)
Urinary tract infection	Symptom assessment, urinalysis, urine culture, blood culture (only if ↑ temperature)	TMP-SMX, quinolone, aminoglycoside (parenteral)
Skin/soft-tissue infection		
Cellulitis	None	Dicloxacillin; second line: cephalexin, clindamycin
Infected pressure ulcer†	Culture of drainage	Metronidazole or clindamycin *and* TMP-SMX or quinolone; amoxicillin-clavulanic acid
Candidiasis	Fungal cultures	Topical antifungal
Diarrhea		
Clostridium difficile	Stool toxin assay	Metronidazole
Salmonella, Shigella species	Stool C and S	TMP-SMX, quinolone
E coli O157:H7	Stool C and S	None

Abbreviations: C and S, culture and sensitivity; CT, computerized tomographic; TMP-SMX, trimethoprim-sulfamethoxazole; ↑, increased.
* May not be available.
† May require surgical debridement; if severe systemic symptoms, initial parenteral therapy should be considered.

tions.[29,30] In addition, some hospitals and NHs currently have policies that address the ethical issues of antibiotic use for patients with life-threatening infections, and advance directives frequently list antimicrobial therapy among life-sustaining treatments such as transfusions and ventilators.

PROMOTING OPTIMAL ANTIMICROBIAL USE IN LTCFs

Scientific evidence on which to base definitive recommendations for antimicrobial use in LTCFs is lacking; thus, the subsequent sections of this position paper outline the opinions of the working group. First, guidelines are offered for appropriate empirical management, including choice of antimicrobials for infectious syndromes that are common in LTCFs. Second, recommendations for the structure and content of an antimicrobial utilization review program are proposed. Institutions may wish to use these recommendations as a framework to develop antimicrobial programs appropriate for their own facility.

EMPIRICAL ANTIMICROBIAL THERAPY

Background

The LTCF clinician frequently must initiate therapy with empirical antibiotics in the absence of cultures or while awaiting culture results.[31] This section provides recommendations for empirical antimicrobial therapy for the most frequent types of infections in NH residents: upper and lower respiratory tract infections, urinary tract infection, skin and soft-tissue infections, diarrhea, and fever of unknown origin (Table 1). The discussion for each syndrome includes a brief description of clinical issues, most frequent bacterial pathogens, appropriate pretreatment investigation, and choices for empirical antibiotic therapy.

An empirical antimicrobial should be active against the most likely pathogens and be able to achieve the desired therapeutic concentration at the suspected site of infection. Thus, it is important to evaluate the patient thoroughly to identify the source of infection and to select drugs and routes of administration appropriate for the clinical problem.[32] The use of empirical antimicrobial therapy does not eliminate the need to establish a specific diagnosis and identify the causative etiologic agent whenever possible. Drug toxicity, costs, and the induction of resistance are more likely to be clinically significant issues when the duration of empirical therapy exceeds 3 to 4 days.[16]

The extent to which laboratory assessment is obtained will vary among institutions. In the LTCF, culture results may not be available or may be delayed, often for several days. If cultures are available, the results are difficult to interpret, due in part to the poor quality of the culture specimen submitted. When culture and sensitivity tests are available, empirical therapy should be reassessed. The

TABLE 2
CLASSIFICATION OF THE STRENGTH AND QUALITY OF EVIDENCE OF EACH RECOMMENDATION*

Category	Definition
Categories reflecting the strength of recommendation	
A	Good evidence to support the recommendation.
B	Moderate evidence to support the recommendation.
C	Poor evidence to support the recommendation.
Categories reflecting the quality of evidence for the recommendation	
I	Evidence from at least one properly randomized, controlled trial.
II	Evidence from at least one well-designed clinical trial without randomization, from cohort or case-controlled analytic studies (preferably from more than one center), from multiple time-series studies, or from dramatic results in uncontrolled experiments.
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

* Modified from reference 33 by deleting previously used categories D ("moderate evidence . . . against") and E ("good evidence . . . against") and requiring all recommendations to be phrased so that category A, B, or C is applicable. This modified classification scheme has been used for SHEA position papers since 1994.

choice for definitive antimicrobial treatment should have as narrow a spectrum as possible, achieve therapeutic concentrations at the site of infection, be well tolerated, have low toxicity, and be the least expensive therapeutic option.

The choice of a specific empirical antimicrobial is influenced by the severity of the patient's illness, the nature of underlying diseases, prior exposures to antimicrobials, prior infections with resistant organisms, and history of drug allergies. The environment of the NH also can influence the choice of empirical antimicrobials. Institutions frequently have specific patterns of antibiotic resistance that are unique to their setting or patient population.[15] Thus, the recommendations for empirical or definitive antimicrobial therapy that are suggested in this position paper should not be considered as defining drugs of choice or even optimal treatment in all institutions; they should be used as broad guidelines by the clinicians in LTCFs who must integrate epidemiological, clinical, and available laboratory data to provide the best possible care for the patient. Consistent with the previous discussion of the lack of useful therapeutic studies in this population, all recommendations for assessment or empirical therapy for specific infections would be considered category B, III (Table 2).

Upper Respiratory Tract Infection

Etiology. The most frequent infections of the upper respiratory tract are the common cold, pharyngitis, and sinus infections. Upper respiratory infections in NH patients usually are caused by viral pathogens; however, the β-hemolytic group A streptococcus is an occasional cause of pharyngitis in the elderly. *Streptococcus pneumoniae* and *Haemophilus influenzae* are the most common causes of bacterial sinusitis. Prolonged, recurrent sinus infections frequently are caused by other organisms, including gram-negative bacilli and anaerobic bacteria.

Patient assessment. The minimal evaluation of a patient with pharyngitis should include visualization of the throat and obtaining a pharyngeal swab for a diagnostic test for group A streptococcus. For patients with earache, an otoscopic examination should be performed. Bacterial sinusitis should be considered in patients with fever, nasal discharge, and facial pain or headache. Generally, no additional diagnostic or microbiological evaluation is needed. However, refractory cases that do not respond to initial empirical therapy may require sinus radiographic or computerized tomographic examination of the sinuses or mastoids. Rarely, surgical aspiration of middle ear fluid or an occluded sinus may be needed to identify a definitive causative agent.

Empirical therapy. Empirical therapy for pharyngitis seldom is necessary; penicillin should be prescribed only if a throat culture or a reliable streptococcal screening test documents the presence of group A streptococci. For acute sinusitis, antimicrobials such as trimethoprim-sulfamethoxazole, amoxicillin, or cefuroxime axetil are appropriate. Macrolide antibiotics such as clarithromycin or azithromycin often are used for empirical therapy, but the effectiveness of clarithromycin against *H influenzae* has been questioned. Amoxicillin-clavulanic acid should be reserved for patients who respond poorly to treatment with more narrow-spectrum antibiotics. Quinolones rarely are indicated for infections at these sites.

Lower Respiratory Tract Infection

Etiology. *S pneumoniae* remains the most common bacterial cause of pneumonia in elderly LTCF patients.[34-36] However, in this population, a broad array of other bacterial and nonbacterial pathogens also may cause pneumonia.[37,38] Gram-negative bacilli frequently are grown in culture from patients previously treated with antimicrobials or from residents in NHs where intense antimicrobial use occurs,[39] but these organisms are relatively infrequent causes of pneumonia. Patients with preexisting chronic lung disease are at risk for infection with *H influenzae;* those with diseases that predispose to aspiration frequently have

mixed aerobic and anaerobic pulmonary infections.[37] Anaerobic infection occurs most commonly in patients with dental caries and infrequently in edentulous patients.

Patients with bacterial pneumonia usually have productive coughs, although some patients are unable to expectorate respiratory secretions. Patients with dry hacking coughs may be infected with atypical pathogens, including *Chlamydia pneumoniae,* which is a common pathogen,[38,40] or *Legionella pneumophila* or *Mycoplasma pneumoniae,* which are relatively uncommon in LTCF patients.[37,40]

Patient assessment and investigation. Many NH patients have preexisting underlying lung diseases, making it difficult to distinguish chronic symptoms from acute lower respiratory infection. The diagnosis of pneumonia frequently is made on the basis of new onset of fever and increased cough, increased sputum production, and change in sputum character without the benefit of chest radiograph confirmation.[21] A respiratory rate of over 25 breaths per minute has been reported to be a reliable clinical indicator of pneumonia.[41]

The minimum workup of patients suspected of having pneumonia should include assessment of the respiratory rate and auscultation of the lungs. Patients without classic pulmonary findings of bacterial pneumonia on physical examination may have bacterial bronchitis or infection with an atypical agent. Ideally, the evaluation of patients with suspected pneumonia should include a chest radiograph obtained before or immediately after empirical therapy has been started. Pulse oximetry may be helpful, if available.

Efforts should be made to obtain a sputum specimen for Gram stain and culture from patients with suspected pneumonia. This frequently is impossible, however, due to patient dehydration or inability to cooperate. If a sputum specimen is obtained, the quality of the specimen, determined by the presence of large numbers of polymorphonuclear leukocytes and relative paucity of epithelial cells, should be assessed by direct Gram stain before culture.[42] The Gram stain also is useful to identify the pneumococcus, as this organism may not be isolated in culture because it may not survive during refrigeration and transportation to the laboratory.

Sputum or serological tests to identify unusual pathogens, such as *Legionella, Mycoplasma,* or pertussis, should be obtained only in highly selected cases. Laboratory tests for specific viral etiologies are rarely indicated, but may be useful in outbreak situations where a diagnosis would assist in development of optimal infection control strategies. If reactivation tuberculosis is considered, smears for acid-fast bacilli and sputum for *Mycobacterium tuberculosis* culture should be obtained. Blood cultures are not usually indicated, but should be obtained from patients ill enough to warrant hospitalization. In this situation, they may be positive in up to 20% of cases.

Empirical therapy. There are several appropriate antimicrobial options for the empirical therapy of pneumonia in LTCF patients.[43] Trimethoprim-sulfamethoxazole, doxycycline, amoxicillin, cefuroxime axetil, or a macrolide such as erythromycin, clarithromycin, or azithromycin generally are considered to be appropriate agents. Quinolones, broad-spectrum cephalosporins or penicillins, and aminoglycoside antibiotics usually should not be prescribed as agents of first choice for empirical therapy of pneumonia in NH patients. Where penicillin-resistant pneumococci are suspected, a quinolone may be considered, but there are increasing concerns about quinolone resistance in these strains. Clindamycin should be used for patients with suspected anaerobic pneumonia following aspiration and may be combined with trimethoprim-sulfamethoxazole if mixed aerobic-anaerobic infection is considered. Intramuscular ceftriaxone may be used in patients who require parenteral therapy.[44]

Urinary Tract Infection

Urinary tract infections are the most commonly diagnosed and treated infections in residents of LTCFs.[5,9,45] More than 30% of noncatheterized residents in LTCFs and almost all chronically catheterized patients have asymptomatic bacteriuria.[24,25,46] Many treatment courses are given, inappropriately, for asymptomatic bacteriuria.[46] Treatment of asymptomatic bacteriuria does not decrease the occurrence of symptomatic infection, alter chronic genitourinary symptoms such as incontinence, or alter mortality.[47] Inappropriate treatment of asymptomatic bacteriuria exposes the patient to the risk of adverse drug effects and may cause the patient to become colonized or infected with increasingly resistant organisms.[48,49]

Etiology. The most likely cause of urinary infection in both catheterized and noncatheterized NH residents is *Escherichia coli.*[25,46] Other members of the *Enterobacteriaceae,* such as *Proteus* species, *Klebsiella* species, *Providencia* species, or *Enterobacter* species, as well as enterococci and *Pseudomonas aeruginosa,* are frequently isolated, usually from patients previously treated with antimicrobials.[25,34,45,46] In men with recurrent urinary infection, bacterial prostatitis is a likely source. Chronically catheterized patients have polymicrobial bacteriuria with a variety of organisms that change spontaneously regardless of antibiotic pressure.[25]

Patient assessment and investigation. The minimal workup of patients with signs and symptoms suggestive of urinary tract infection should include a urinalysis and urine culture; urine cultures should not be collected from asymptomatic patients. A clean-catch or midstream urine specimen should be obtained. This often is difficult in nursing home residents who may not be able to cooperate. Straight catheterization may be needed to obtain a satisfactory specimen. Patients with indwelling urethral catheters should have a urine specimen obtained for culture through a freshly placed catheter[50] or by aspiration of the catheter tubing lumen; specimens should not be collected from the drainage bag. Urine specimens may be obtained from freshly applied external (condom) catheters in men if standardized collection methods that limit contamination are used.[51,52] All urine specimens should be refrigerated prior to and during transport to the microbiology laboratory to prevent overgrowth of contaminating organisms. Ideally, blood cultures should be

obtained from any patient with rigors or with temperature greater than 102°F (38.5°C) or less than 96°F (36°C). Positive blood cultures may identify a specific etiologic pathogen for patients with polymicrobic bacteriuria.[34]

Empirical therapy. Empirical therapy should be initiated only if symptoms are present and of sufficient intensity that a delay of 2 to 3 days awaiting culture results would not be appropriate. Results of previous urine cultures and sensitivity tests should be reviewed to identify patterns of possible antimicrobial resistance that might guide the choice of empirical therapy. The usually preferred empirical therapy for symptomatic urinary tract infection is trimethoprim-sulfamethoxazole. Quinolone antibiotics are excellent drugs when infection with antibiotic-resistant gram-negative bacilli is anticipated; amoxicillin is the drug of choice for enterococcal infections. Initial parenteral therapy with a single daily dose of an aminoglycoside may be appropriate for some patients. Most symptomatic lower urinary tract infections in women in the NH are treated with 3- to 7-day courses of antimicrobials[24]; 10 to 14 days of therapy may be appropriate for patients with signs or symptoms suggestive of pyelonephritis or with genitourinary tract complications, or in men. Chronic prostatic infections sometimes require 2 or more weeks of therapy. Agents such as trimethoprim-sulfamethoxazole or a quinolone, which penetrate into the prostate gland, should be used in this setting.

Skin and Soft-Tissue Infection

Two major types of skin and soft-tissue infection occur frequently in NH residents, infected pressure ulcers and cellulitis.

Etiology. The bacteriology of infected pressure ulcers invariably is polymicrobial. The most common isolates are *Staphylococcus aureus* and enteric bacteria such as *Proteus* species, and *E coli.* Occasionally, anaerobic bacteria and *P aeruginosa* are recovered from these infected sites.[34,53] This same array of organisms can be isolated as surface contaminants from noninfected pressure ulcers. The most common bacterial causes of cellulitis are streptococci, particularly groups A and B β-hemolytic streptococci, and *S aureus.* These organisms are the most frequent pathogens recovered in blood cultures from patients with cellulitis.[34,53] Occasionally, gram-negative bacilli will cause superficial soft-tissue infections or cellulitis in NH patients.

Patient assessment and investigation. Determining whether an ulcer is infected or colonized is problematic, because sites of skin breakdown often are coated with exudative material and colonized with bacteria. Swabs of exudate for culture are not helpful in diagnosing the presence of infection; they generally reveal multiple bacterial species. The diagnosis of infection of a pressure ulcer requires clinical judgement.[21] In the lower extremities, it sometimes is difficult to distinguish bacterial cellulitis from stasis changes or other diseases of the venous or arterial circulation. The diagnosis of superficial cellulitis rarely is confirmed by culture. Erythema around percutaneous feeding tubes or tracheostomy sites is common and frequently not due to infection.[54]

The workup of a patient with a suspected skin or soft-tissue infection must include a careful examination of the area to identify signs of local inflammation such as erythema, warmth, tenderness, and swelling. The area around pressure ulcers should be palpated to identify crepitus, a clue to a deep subcutaneous tissue infection. Evaluation of foot infections should include an assessment of vascular sufficiency. Cultures of purulent material should be obtained for both aerobic and anaerobic bacteria. In patients with systemic symptoms in which a definitive bacterial diagnosis is needed, needle aspiration of purulent material from a deep decubitus ulcer infection may be helpful. Radiological studies should be obtained to identify gas or bone involvement. Blood cultures should be drawn from patients with fever, rigors, acute confusion, or other clinical presentations that suggest sepsis.

Empirical antimicrobials. Therapy for infected pressure ulcers must be of broad spectrum, to cover both aerobic gram-positive and gram-negative bacilli and anaerobic pathogens. Amoxicillin-clavulanic acid as a single agent meets these criteria. Other possibly effective antimicrobial combinations include trimethoprim-sulfamethoxazole or a quinolone such as ciprofloxacin or levofloxacin for gram-negative organisms, together with metronidazole or clindamycin for anaerobic coverage. In treating infected pressure ulcers, definitive therapy must include aggressive debridement or drainage of the wound infection, as well as antibiotics. This may require hospitalization.

The usual agents selected to treat cellulitis are dicloxacillin or cephalexin, although other drugs such as trimethoprim-sulfamethoxazole or amoxicillin-clavulanic acid also may be used. In facilities with a high prevalence of methicillin-resistant *S aureus,* vancomycin therapy may be considered for patients with substantial systemic signs or symptoms. In most cases, local care and observation are sufficient for erythema around feeding tubes and tracheostomy sites. Antimicrobial therapy should be initiated only if the area of concern is worsening or if there are systemic symptoms thought to be due to local infection of these sites.

Diarrhea

Etiology. Occasional episodes of diarrhea are common in NH patients. Most of these episodes are noninfectious due to food intolerance or other gastrointestinal pathology.[55] Outbreaks of infectious diarrhea in NH residents may be caused by viral agents, foodborne enterotoxigenic pathogens such as *S aureus, Clostridium perfringens,* or *Bacillus cereus,* or invasive pathogens such as *Salmonella* species, *Shigella* species, *Campylobacter jejuni,* or *E coli* O157:H7. NH residents who are being treated or have recently been treated with antibiotics also are at increased risk for *Clostridium difficile*-associated diarrhea.[56]

Patient assessment and investigation. Establishing the diagnosis of infectious diarrhea in an NH patient is difficult and costly.[21] An infectious agent should be suspected when a patient develops an acute change from usual bowel habits. Depending on the pathogen, fever may or may not be present. Patients with severe symptoms,

such as fever, abdominal cramps, or bloody diarrhea should have stool cultures sent for identification of invasive enteric pathogens, and blood cultures should be obtained. Patients who develop diarrhea during, or within 4 weeks after, antibiotic therapy should have stool specimens sent for identification of *C difficile* toxin. Generally, no specific workup is needed for the afebrile patient with new-onset diarrhea without major clinical alterations; observation and appropriate hydration are sufficient.

Empirical therapy. Most patients have self-limited episodes of diarrhea, and empirical therapy is not warranted. Appropriate oral replacement of fluid and electrolytes is the mainstay of treatment in these patients.[55] Nonetheless, if symptoms are severe, the patient appears toxic, and infection with *Salmonella* species or *Shigella* species is a concern, agents such as trimethoprim-sulfamethoxazole or a quinolone antibiotic should be prescribed. Antimicrobials should not be given for *E coli* O157:H7 infection. In all of these patients, antimotility agents may be hazardous. If *C difficile* colitis is identified by toxin assay, metronidazole should be used for definitive treatment; oral vancomycin should not be used as a first-line agent for this illness because of the expense and the possibility of selecting for vancomycin-resistant enterococci in intestinal flora.

Fever of Unknown Origin

Fever of unknown origin (FUO) is a common occurrence among NH residents. This observation reflects the difficulties in establishing the specific etiology of febrile illnesses in elderly NH patients. Strictly speaking, the diagnosis of FUO is restricted to patients with fever of greater than 101°F (38°C) for 2 weeks or longer that is undiagnosed after a thorough review of the clinical record, repeated physical examinations, and usual laboratory tests to identify focal infections.

Etiology. The causes of FUO in NH residents are similar to those in the general population. Infections (36%); cancer, especially lymphomas (24%); connective tissue diseases, especially giant cell arteritis (26%); and drug reactions are frequent causes of FUO in the elderly.[57] The more common infectious causes of FUO in the elderly include intra-abdominal abscesses, infective endocarditis, and disseminated tuberculosis.

Assessment and investigation. The minimal workup of a patient with FUO should include repeated histories and physical examinations, complete blood cell count and differential, erythrocyte sedimentation rate, and urinalysis. A stool specimen may be obtained to test for occult blood if anemia is present. The chemistry profile should include liver function tests. Blood cultures, chest radiograph, and an intermediate-strength intradermal tuberculin skin test should be obtained. If a diagnosis is not suggested by these tests, further workup should be considered. This may require hospitalization for imaging studies including computerized tomographic scans or nuclear medicine surveys. Biopsy of the bone marrow, liver, lymph node, or temporal artery may be needed to establish a definitive diagnosis.

Empirical therapy. Empirical therapy of a patient with FUO should be avoided. Every effort should be made to establish a definitive diagnosis. Antimicrobials and other empirical drugs should not be administered until a specific etiologic cause is identified for the fever.

ANTIMICROBIAL UTILIZATION REVIEW

Background

Infection control programs have become a standard measure for quality improvement in LTCFs.[58] Surveillance and control activities are the major foci of these programs. Antimicrobial utilization is logically within the purview of the infection control program. While infection control programs traditionally have advocated education, isolation techniques, and hand washing to control nosocomial infections, they now are beginning to address problems of antimicrobial use. A recent survey found 52% of LTCFs had an antimicrobial utilization program.[59] There is little precedent, however, to guide the LTCF in developing standards for an antimicrobial utilization review program or to evaluate the program's efficacy in improving patient care or controlling the spread of infections.

Inferences may be drawn from reports of hospital-based antimicrobial control programs. Guidelines from the Infectious Diseases Society of America outline several steps to limit antibiotic over-use in the hospital, including antibiotic order forms, automatic stop orders, limited antimicrobial susceptibility reporting, the development of antimicrobial-use criteria, regulation of promotional efforts by pharmaceutical representatives, and specific monitors of antimicrobial use.[60] They suggest that a multidisciplinary team carry out these efforts. A number of studies from acute-care hospitals have noted some benefit from implementation of an antibiotic order form,[61] individual continuing education,[62] and a computerized antibiotic consultant.[63] Many of these programs are labor-intensive and expensive, and may be applicable only in selected university teaching hospitals. Moreover, there are few data confirming the long-term value of such interventions. In fact, a number of studies suggest that some measures, such as formulary restriction,[64] a physician prescribing handbook,[65] providing peer comparative data to physicians,[66] and physician education on antimicrobials in general,[67] are either ineffective or of limited short-term benefit. Enforced compliance with institutional antimicrobial prescribing guidelines is more effective than voluntary compliance in decreasing antimicrobial use.[68]

The extent to which such measures are either possible or effective in the LTCF has not been assessed. Few antimicrobial utilization standards are available, especially standards applicable to the LTCF. Criteria developed by Delphi methods for utilization of drugs have, however, been attempted for LTCF residents.[69] In developing an antimicrobial utilization review program for an LTCF, the limitations of resources and absence of reports that evaluate effectiveness of different components must be acknowledged. With this in mind, minimal standards of antibiotic review of all LTCFs are recommended, with further suggestions for expanded programs for selected facilities with special concerns, interest, and resources.

RECOMMENDATIONS

1. Infection control programs in LTCFs should be encouraged to include a component of antimicrobial utilization review. The purpose of this activity should be to promote the rational use of antimicrobial agents and, potentially, to limit the extent of antimicrobial-resistant pathogens in the LTCF. The process of antimicrobial utilization review falls most appropriately into the domain of the infection control program; inappropriate antimicrobial prescribing practices have an impact on the success or failure of infection control efforts. This program must, however, be multidisciplinary, with input and cooperation from the infection control practitioner, the medical director, nursing staff, practicing physicians, and the pharmacy. *Category BIII.*

a. The antimicrobial review program should monitor antibiotics that are prescribed in the LTCF. Surveillance data should be reviewed on a regular basis, monthly, quarterly, or semiannually, depending on the size of the institution and quantity of antibiotics prescribed. The program should list the specific types of antibiotics used in the LTCF and record the number of doses or days of treatment, as well as costs. Whenever possible, these data should be linked with surveillance data of infections caused by resistant pathogens. This information should be reviewed by the infection control committee and forwarded to prescribing physicians. *Category BIII.*

b. The antimicrobial review program should develop and promote programs to optimize judicious antibiotic use. This would include ensuring information regarding the rationale for use of antimicrobials for symptomatic infections is included in the patient's medical records as part of the treatment plan. Whenever possible, the use of antibiotics, particularly broad-spectrum antibiotics, should be minimized. *Category BIII.*

c. Guidelines should be developed for the use of antimicrobials for patients for whom comfort measures only are being provided. *Category BIII.*

2. In selected LTCFs, a more intensive antimicrobial utilization review program may be developed, including review of antibiotic appropriateness. Such a program may be warranted because of an identified or potential problem in antimicrobial use, because of concerns with antibiotic resistance in the facility, or where there is a special research interest to improve antibiotic use. The audit program in these LTCFs should be focused on the collection and review of data that are relevant to antimicrobial use in the context of the goals or needs of the institution. Components of this program may include a review of antimicrobial prescribing practices, evaluation of the appropriateness of drug prescriptions, more intense surveillance of antibiotic resistance, or the identification of adverse effects of antimicrobial drugs. The purposes of these audits include measurement of the extent to which antimicrobial use meets accepted practice standards, identification of patterns of use that may adversely affect patient outcome, documentation of costs of care, and collection of information to link antimicrobial use and bacterial antimicrobial resistance patterns in the institution.

Specific guidelines should be developed to define the information to be collected, the methods of analysis and dissemination of that data, and the circumstances under which interventions might be undertaken. Criteria for appropriateness should be developed based on published guidelines,[5,70] including this position paper, reviews, or clinical studies. The input of clinicians is mandatory to ensure that the program is clinically relevant and accepted in the LTCF. A selection of topics for audit should be based on resource utilization and the frequency of observed inconsistencies in practice. Reviews should include consideration of topical, as well as systemic, antimicrobial agents. *No categorization.*

LTCFs that implement intensive programs should report their findings to both the infection control committee and the medical staff. Where a high rate of inappropriate use is identified, a plan to improve usage should be developed. Although several mechanisms to improve antibiotic usage have been reported, none has been critically evaluated in the LTCF setting. These methods include physician education, the development of a restricted LTCF formulary, antibiotic prescribing guidelines, feedback to individual physicians of monitored data, or recommendations for mandatory infectious disease consultation. Restrictive programs may be warranted when serious problems have been identified, such as outbreaks of antibiotic-resistant infections or consistent misuse of antimicrobial agents. Any intervention program should include a component of assessment to document its impact with regard to efficacy and cost.

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